Project Management Development – Practice and Perspectives
8th International Scientific Conference on Project Management in the Baltic Countries

CONFERENCE PROCEEDINGS

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Research Institute of the Project Management
of the Faculty of Business, Management and Economics,
University of Latvia
Professional Association of Project Managers

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Conference is organized by the **Research Institute of the Project Management**
of the Faculty of Business, Management and Economics,
University of Latvia in cooperation with the **Professional Association of Project Managers**

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Project coordinators:

PhD.cand. **MSc.proj.mgmt. Silvija Bruņa** and **PhD.cand. MSc.proj.mgmt. Emīls Pūlmanis**

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PREFACE
Importance of Professional Project Management

The current global economy and growing digitalization require ever new solutions for cooperation between economy and society. In these terms, project management serves as a key discipline ensuring technically innovative and fast satisfaction of clients' demands. The classical project management methods are faced with certain changes in such circumstances. The new factors of success are agile and hybrid project management, as well as social competence and interactivity. The time of choosing between agile and traditional project management has already passed. Today, the tools to use for project management combine both agile and traditional elements.

That is why this conference features experts who will share with you their experience with the use of agile methods, techniques, and formats in project development. They will review the agile project management practice in IT, real estate, consulting, construction, and other projects. The new formats additionally concentrate on the development of their standards of use and the problems arising in their practical application.

An increasing number of jobs are focussing on project approach, with growing demand for qualified project managers. Michael J. Littman emphasizes in his research that, according to the PMI data for 2010-2020, the USA have created 6.2 million jobs for project managers, noting that certified project managers earn up to 20% more than uncertified ones. It gives a particular importance to review the opportunities for obtaining education in project management. Several of the conference expert reports are devoted to analysing the academic project management programmes on offer, and the state of certification in the academic context - notably, the masters' programme (level 7) by Carsten Wolf, which has been implemented and available in multiple countries for several years, and Michael J. Littman's analysis of project management programmes.

Communication, ethics, and leadership, as well as emotional intelligence are critical success factors in project management, and several reports will analyse them. Good project culture works toward success in a project, but not every culture is good for every project. Projects are implemented within the framework of multiple cultures, which must be integrated.

The conference sections and results will elaborate on the practice and the new solutions and visions that project manager's face when commencing the changes.
I would like to wish all participants of the 8th International Scientific conference on Project Management in the Baltic Countries - Project Management Development - Practice and Perspectives many interesting conversations, good contacts, and inspiration for new valuable ideas.

Prof. (emer.) Dr. oec. Žaneta Ilmete

CONTENTS

MANAGING RISK OF REFINERY MEGAPROJECT BASED ON ISO 31000 AND PMBOK

Arie Wisianto, PMP, PMI-RMP, CMRP,CRP, PT. PERTAMINA (Persero)

Abstract

In order to improve national energy security and the competitiveness of the refinery industry, PT Pertamina (Persero) implements the Refinery Development Master Plan (RDMP), which is revamping 4 units of existing refineries and building 2 units of new grass root refinery. In this paper we will discuss risk management for the RDMP project based PMBOK and ISO 31000 RDMP.

RDMP Project management is divided into two stages, namely project development and project execution, risk management has been implemented since the project initiation until commissioning startup. The process of risk management referring to PMBOK are plan risk management, identify risks, qualitative risk analysis, quantitative risk analysis, plan risk responses, implement risk responses and monitor risks. We determined risk limit for project 5% of investment costs, while the ongoing stage is 5% of the current year's budget, those number represented Pertamina's risk appetite. Furthermore, the risk identification stage followed by qualitative risk analysis obtained 170 risk events with 46% in the categories of strategy & planning aspect, 2% compliance aspect and the remaining 22% operations / infrastructure aspect. This is in line with the theory that stated at the project development stage having higher risk than at the execution stage, and the top risk category is related to business strategy risk, namely the business scheme (tolling or merchant), getting the right partner, project financing, land acquisition, most of the top risk are risk owned by Project Development Department.

The quantitative risk analysis (QRA) stage has two tasks, namely numerical simulation of project economics and numerical simulation of cost & schedule. Once of the overall project risks can be seen from the QRA results, probability of completed project duration P80 for RDMP Balikpapan project is 58 months while P50 is 57 months and P90 is 59 months.

To assess the effectiveness of risk management and project management, a maturity assessment has been carried out with results of level 2.65 of scale 5 for project management and 3.3 of scale 5 for project risk management.

When implementing project risk management, we use for both PMBOK and also ISO 31000 frame work, this feels very complementary. As an example the need for risk maturity as a review of risk management implementation, mandate & commitment and the existence of a Risk Management Policy, the principles and risk management framework of ISO 31000 are very beneficial. On the other hand, emphasizing positive and negative risks, links with the knowledge areas and other process groups by PMBOK are very helpful in integrating project risk. When conducting risk management Pertamina equipped with web-based Enterprise Risk Management System (ERMS) to facilitate data and communication processes.

From the discussion it can be concluded that ISO 31000 and PMBOK complement each other in carrying out project risk management, quantitative risk analysis can describe overall risk of the project, maturity assessment helps measuring the effectiveness of risk management and gap analysis, risk management information system is very necessary in carrying out risk management

Introduction

Refinery and Petrochemical Megaproject PT Pertamina (Persero) aims to increase refinery capacity from 1 million barrels per day to 2 million barrels per day, the project consists of revamping Cilacap refinery, Balikpapan refinery, Balongan refinery, Dumai refinery and building of new refineries in Tuban and Bontang. Project risk management is carried out since the initial stage of project development to the end of project execution. As a reference for project risk management generally refers to the PMBOK framework, but this has limitations where risk management starts after the project charter, while our megaprojects have been exposed risk since pre project stage.

The project development stage (before project charter) and early work scope of megaproject have been exposed to major risks including business decisions risk, project financing risk, establishment of subsidiaries risk, land acquisition and site preparation risk. It takes 2 to 3 years before the EPC contract starts where hundreds of millions of dollars have been spent for pre project work. Our experience with reference to the ISO 31000 standard and the combination with the PMBOK standard as a reference for risk management provides complementary benefits so that project risks before and after the charter project can be managed according to standards.

In this paper I will explain how Pertamina takes a combination of principles, frameworks and process from ISO 31000 combine with process taken from PMBOK that can complement each other so that megaproject risk management can be carried out effectively and efficiently.

Risk Management at Pertamina

PT Pertamina (Persero) is an integrated oil and gas state-owned company from the upstream, downstream and midstream sectors, we have 11 directorates one of them is the directorate of refinery and petrochemical megaprojects. As an integrated corporation we use the basis of ISO 31000 standards as a reference for implementing risk management for companies and subsidiaries and specifically for the megaproject directorate because using PMBOK as a reference for project management implementation, our project risk management also refers to the risk management came from PMBOK risk management framework.

Refinery & Petrochemical Megaproject Risk Management Process

The business process of Refinery and Petrochemical megaproject is described in figure 1 below, the scope of risk management starts from the initiation of the project to the start-up and commissioning. Project charter is created after the approval of Final Investment Decision (FID) and in accordance with the PMBOK the project lifecycle starts after the pre-project work is completed as depicted from figure 2. As seen from figure 1 we have actually carried out risk management since Pre-Feasibility Study (Pre-FS) work, it was not like the project PMBOK lifecycle stated where risk management is done after the project charter. By adopting ISO 31000 we have a reference when implementing the risk management at project development stage. For refinery and petrochemical megaprojects, during project development phase there has been a high risk exposure. For example, we have spent around US $ 500 million in the project development stage while FID is not approved yet, the development stage can take 2 to 3 years' duration. During project development stage or pre project work our risk exposure is high that's why requirement of doing risk management is mandatory, here is the role of ISO 31000 work. We carry out risk management with scope of strategic risk regarding project proposals and with the context as a state owned company obeyed to the minister of state owned enterprise

regulation No.PER-01 / MBU / 2011 regarding the Implementation of Good Corporate Governance in State Owned Enterprises (scope, context, ISO 31000 risk management process criteria).
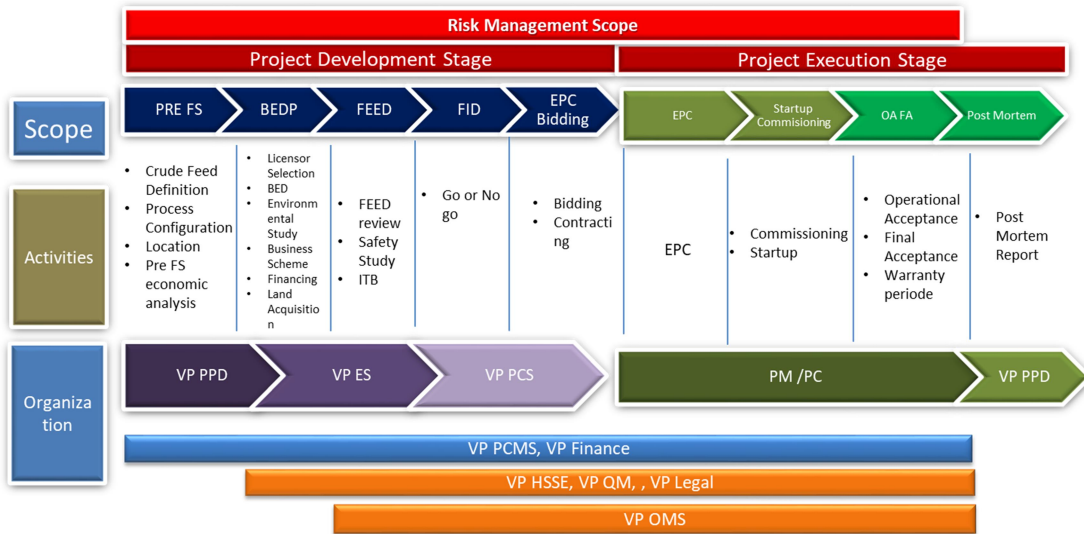
Fig. 1 **Megaproject business process**
Source: Author construction
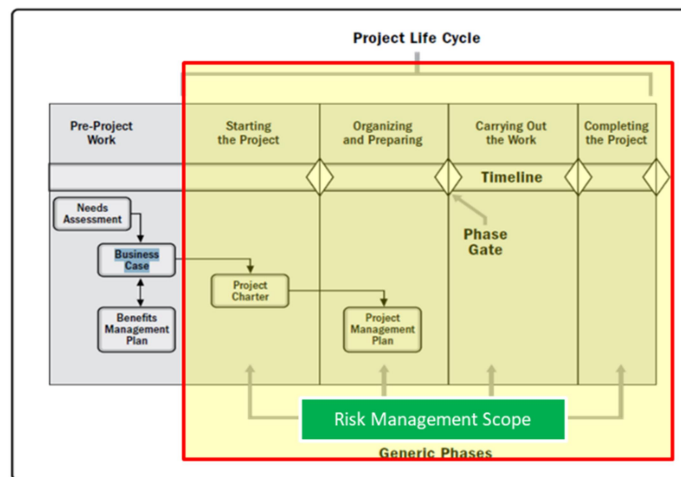
Fig. 2 **Project Life Cycle ref PMBOK 6th edition**
Source: Author construction

ISO 31000 and PMBOK a complementary perspective

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According our experience of how the two standards above complement each other for more details can be seen in figure 3 below.

Table 1

Risk for Megaproject, ISO 31000 and PMBOK

	Proses	Activities	PMBOK	ISO 31000
PRE PROJECT WORK		Established Risk Management Policy		Leadership & commitment 5.2
		Project Risk Organization (assignment letter)		Leadership & commitment 5.2
		determine Risk Tolerance		Scope, context, criteria
		Pre Feasibility Study (risk register with scope high level risk and overall project risk)	Project Management Business Document High Level Risk Register Overall Project Risk	
		Quantitative risk analysis (economic analysis)		
		Determine contingency and management reserve	Known unknown risk and unkwon unknown risk	NA
		Final Investment Decision (FID)	Project Success Measures (targeted NPV, IRR, PBP)	
PROJECT LIFECYCLE	INITIATING	High level Project risk for Project Charter	Project Charter	NA
	PLANNING	Risk Management Plan (appetite, risk criteria, risk tolerance included)	Plan Risk Management	Scope, context, criteria
		Road Map Risk Management		Leadership & commitment 5.2
		Risk register	Identify Risk	Risk identification
		Qualitative risk analysis	Qualitative risk analysis	Risk analysis
		Schedule & Cost Quantitative Risk Analysis	Quantitative risk analysis	Risk analysis
		Risk ranking, risk strategies, risk owner	Plan risk responses (strategy for threat & strategy for opportunities, escalate)	Risk evaluation (Strategy for negative risk)
			Fallback plan & contingency plan	NA
	EXECUTING	Execute risk responses/risk treatment by PIC Risk	Implement Risk Responses	Risk Treatment
	MONITORING & CONTROLLING	Weekly meeting, Project Risk Forum, monthly report	Monitor Risk	Recording & Reporting
			Reserve analysis	NA
		Risk Maturity Assessment	Risk Audit	Monitoring & review

Source: Author construction

The principles, framework and process at ISO 31000 are very useful in managing project risk management, this can be said that the risk management process in PMBOK can also be done effectively with the support from of ISO 31000 principles & framework as illustrated in figure 3. From table 1 the first step in our risk management process is to establish policy, organization, risk tolerance, those are the realization of the ISO 31000 framework where PMBOK does not state it. Furthermore, determining the list of high-level risks for overall project risk, risk and reserves is the realization of the PMBOK project risk management in which ISO 31000 does not mention. Then creating the risk management plan, road map, cost & schedule risk, risk ranking, determination of the risk owner and risk response strategies, are a realization from ISO 31000 and PMBOK even though in different terms. To measure the effectiveness of risk management we have carried out risk maturity assessment, the basis of its implementation refers to the clauses of PMBOK and ISO 31000 as in table 1 above. And of course what is not in ISO 31000 but in the PMBOK risk management framework stated is the relationship between project risk management knowledge area and other knowledge area from project management.
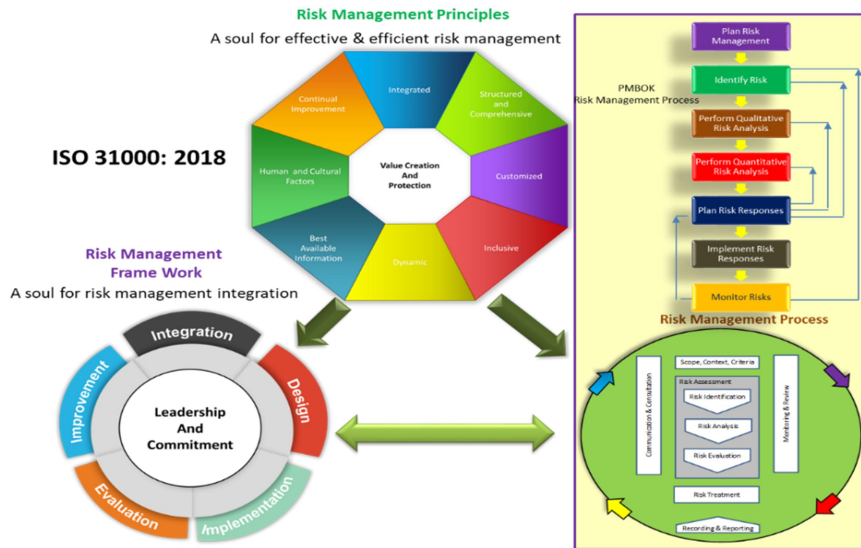
Fig. 3. **A Complementary Risk Management between ISO 31000 and PMBOK**
Source: Author construction

Result

As a result, we present the results of the 2019 risk assessment with a risk tolerance of 5% for the current year budget. The risk identification stage was followed by a qualitative risk analysis obtained 170 risk events with composition of risk 46% in the category of strategy & planning aspect, 2% compliance / infrastructure aspect as depicted at figure 4 and table 2.
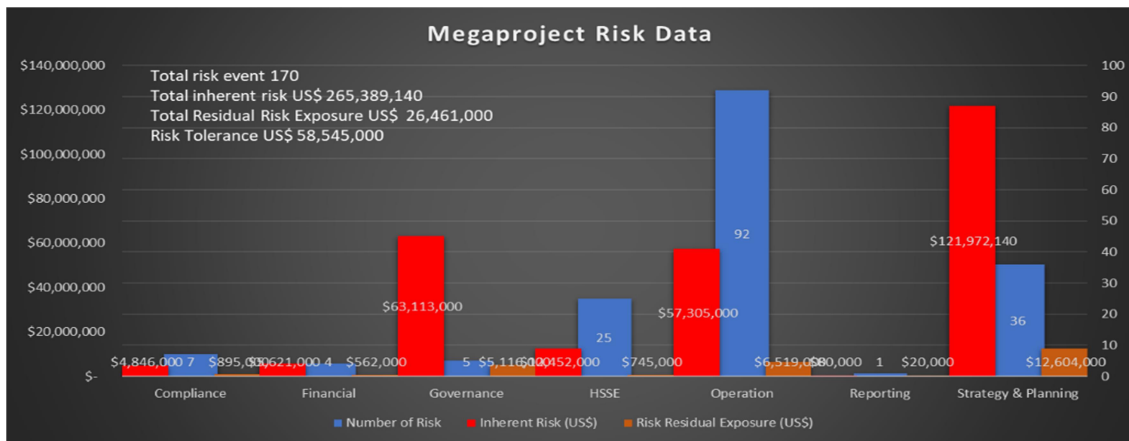
Fig. 4. **Risk Register Data of Pertamina Megaproject**
Source: Author construction

Table 2.

Risk Register Summary

Risk Type	Number of Risk	% Number	Inherent Risk (US$)	inherent %	RRE (US$)	RRE %
Compliance	7	4%	$ 4,846,000	2%	$ 895,000	3%
Financial	4	2%	$ 5,621,000	2%	$ 562,000	2%
Governance	5	3%	$ 63,113,000	24%	$ 5,116,000	19%
HSSE	25	15%	$ 12,452,000	5%	$ 745,000	3%
Operation	92	54%	$ 57,305,000	22%	$ 6,519,000	25%
Reporting	1	1%	$ 80,000	0%	$ 20,000	0%
Strategy & Planning	36	21%	$ 121,972,140	46%	$ 12,604,000	48%
Total	170		$ 265,389,140	100%	$ 26,461,000	100%

Note : RRE = Risk Residual Exposure
Source: Author construction

Strategic & Planning risk is the dominant contributor to the risk register even though the number of risk events is only 21% of the total number of risk events but the inherent risk value is 46% of the value of total inherent risk. This is consistent with the theory that when the project development stage has a higher risk or uncertainty than when project execution, by carrying out risk management since the pre-project or project development stage where having higher risk, so the overall risk of the project can be managed accordingly and ISO 31000 can be used to complement those requirements.

One of the tools and techniques mentioned in PMBOK is the project information system (clause 11.6), where in implementing the risk response will greatly assist by the availability of the application system. Pertamina uses application namely Enterprise Risk Management System (ERMS) to input data, process data, generate risk report and integrate with other application systems.
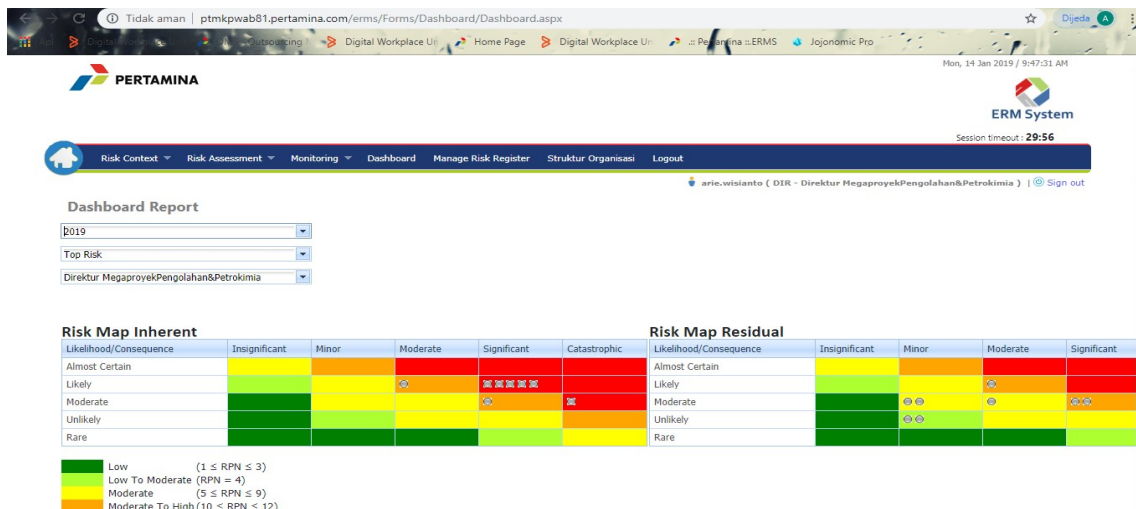
Fig. 5. **Pertamina Enterprise Risk Management System** (**ERMS**)
Source: Author construction

As said both by ISO31000 and PMBOK conducting an evaluation of the effectiveness of risk management is necessary, in this case we have done the risk management maturity assessment. In PMBOK stated on Monitoring & Control about risk audit while in ISO 31000 stated in monitoring and review clause Maturity assessment is done by one on one interview for the vice president level and higher while the manager level and below through online surveys (figure 6). The final results of our maturity assessment are at level 3.3 (defined) as depicted on table 3, namely the level at which an organization recognizes the importance of project risk management, and evidence of recognition is reflected in awareness and organizational culture, the existence of a process to apply, and the experience and leadership style in managing project risk.

Table 3

Hasil Maturity Assessment

MATURITY LEVEL				
LEVEL 1 INITIAL	LEVEL 2 REPEATABLE	LEVEL 3 DEFINED	LEVEL 4 MANAGED	LEVEL 5 OPTIMIZING

ATTRIBUTES
PROCESS
CULTURE
EXPERIENCE
APPLICATION
LEADERSHIP

	AREA	SCORE	LEVEL
1	PROCESS	3.45	DEFINED
2	CULTURE	3.34	DEFINED
3	EXPERIENCE	3.18	DEFINED
4	IMPLEMENTATION	3.00	DEFINED
5	LEADERSHIP	3.52	DEFINED
	MATURITY LEVEL	3.30	DEFINED

Source: Author construction
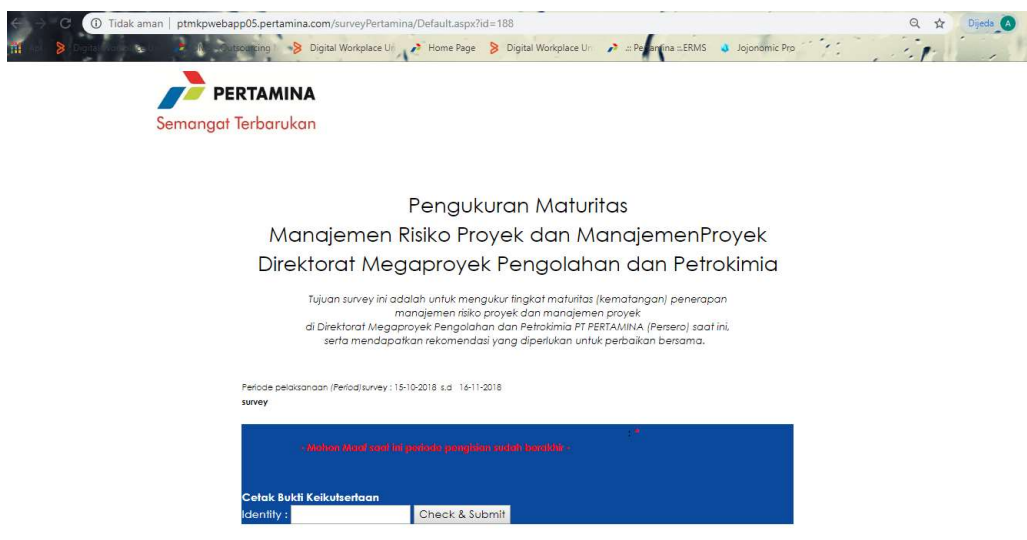
Fig. 6. **Pertamina Online Project Risk Maturity Assessment**
Source: Author construction

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Conclusions

The refinery and petrochemical megaprojects of PT. Pertamina has a high risk process, especially during the project development stage, in this pre-project stage the PMBOK project risk has not been able to be used as a reference for carrying out risk management while the risk level for this stage has been high.

Implementing the PMBOK-based project risk management process is not enough to become the basis and reference in the day-to-day process, the 2018 edition of ISO 31000 can complement these shortcomings so that the risk management process can be more perfectly implemented

The existence of the principles concept and framework in ISO 31000 can encourage the risk management process in both ISO 31000 and PMBOK more effectively and efficiently

The summary of the risk register shows that risk type of risk strategy and planning is the biggest contributor to the risk of the Megaproject Directorate, this also indicates that at the initial stage of the project (pre project / project development) have a higher risk. Risk management should have been carried out since the initial stages of the project

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IMPROVISATION IN PROJECT MANAGEMENT: LESSONS FROM JAZZ

Arvi Kuura, University of Tartu, Pärnu College
Iñaki Sandoval, University of Tartu, Viljandi Culture Academy

Abstract

During this century, a seemingly strengthening trend can be observed in business research – several subfields, including project management, have been 'jazzed'. It can be noticed that music and orchestras, particularly jazz, are common metaphors in project, as well as in general and other business fields studies. Another proliferating trend is linking different, ostensibly separated subfields in business research. These initial observations lead to the question: what have the 'jazzed' subfields in common, what have they learned and can still learn from jazz (or more broadly, from music), and what can different subfields of business learn from each other? Jazz music approach is a very inclusive, democratic, horizontal, leadership and team-group balanced discipline, using 'improvisation' as the main vehicle for problem solving and development of new strategies. In this paper we carry out a literature review, examining what, how, etc. has been 'jazzed' so far, concentrating on general organization and project management studies. Next, we analyse the main findings and juxtapose the findings from jazz (or music) with counterparts in project management. In the discussion part we reveal possible developments and possibilities for fostering mutual learning and enrichment and provide suggestions for further advancement.

Key words: *project management, business, jazz, improvisation, music*.
JEL codes: L82, M1

Introduction

Since the beginning of this century, a seemingly strengthening trend can be observed in the field of business research – several subfields, including project management, have been 'jazzed'. It can be noticed that music and orchestras, particularly jazz, are common metaphors in project, as well as in general business studies. Another proliferating trend is linking different, ostensibly separated subfields in business research. These initial observations lead to the question: what have the 'jazzed' subfields in common, what have they learned and can still learn from jazz (or more broadly, from music), and what can different subfields of business learn from each other?

The aforesaid is an initial observation, leading to the question: why has project management, as well as several subfields in business studies, been 'jazzed'? A possible explanation is that they have learned and/or possibly can still learn something from jazz, and more broadly, from music. As some subfields in business research have been 'jazzed', they probably have something in common and have learned and/or taken over something from each other. And, it can be assumed that there are still (partly) unused possibilities for even more mutual learning and enrichment.

This article elaborates on these questions and will provide insights for subsequent learning and enrichment between jazz and project management, as well as other still apparently

separated subfields in business research. The following sections present an overview of existing literature about 'jazzing' in general and in project management, using a loosely structured historical method for studying routines / practices, starting with keyword searches in academic databases.

A question to be clarified at the beginning is – why jazz? The answer is improvisation, the main element of jazz music (c.f. Crook, 1999). According to Sandoval (2013), improvisation is a natural and organic element in all human beings (also animals) and occurs throughout everyday life, as we talk, move, respond, etc. Although theoretically possible, our actions and interactions do not happen in the same manner every time. Improvisation requires the adaptation and use of learned elements into a situation that occurs in a particular setting at a particular time. We feel different every day and the external conditions differ, and this obligates us to use different tools or techniques for a similar problem, or the same tactic for a similar problem. Improvisation could be also defined as a "problem solving" action, which in music also implies creativity and innovation, and in most situations implies group work and interaction. Varied study fields – for one, business, medicine, etc. include improvisation-related courses in their curricula, in order to prepare future professionals for a constant changing environment, with new needs and problems to be solved. Leadership and teamwork skills that have always been necessary for jazz musicians, become more and more important for all other professionals (c.f. Bourn, 2018). This is also an important plea of jazz. To be noted that improvisation in music is not exclusive of the jazz styles. Before the late XIX and XX centuries, improvisation was a normal practice among what we call today "classical" composers. Musicians such as Johann Sebastian Bach, Wolfgang Amadeus Mozart, or Franz Liszt, among several others, were great improvisers, performing their own compositions and making "variations" as a normal practice in their interpretations. Later in the XX century, music institutions (i.e. European Conservatoires) focused almost entirely on performance and composition, leaving improvisation apart. Nowadays, musical styles such as jazz, folk/world, and popular, are regularly included in higher education curricula, in fact, they are gaining terrain together with the use of technology, and so it reflects the music industry, where "non-classical" genres have taken over.

Jazzing and improvisation in organizations: general literature review

Jazz metaphor in project management seems to be rather traditional, thus it is difficult to figure out, by whom and when it was introduced. However, considering that the main feature of jazz is improvisation, leads to the liable influencer – the concept of organizational improvisation or improvisation in organizational theory. The musical process (Copland, 1939), seen in a wider sense, implies the activation of several simultaneous processes which would lead to a better strategic and anticipated thinking, directly related with how music evokes emotions (Huron, 2006), which would eventually lead to a better product design and organizational management.

According to Cunha, Cunha, and Kamoche (1999) this research stream formed in the 1990-s and embraces three stages of theory development and two generations of authors. They (*ibid*.) provided a proper review of the existing literature at this time (1999). Not deepening into details, some strains can be pointed out. First, this stream emerged quite gustily: virtually all influential publications are dated in the 1990-s, just a few in (late) the 1980-s. Second, during a decade of development, it proliferated into a wide range of areas in organizational theory, from general and strategic management to narrow specific topics (such as crisis management, risk mitigation, etc.). This situation naturally caused a multitude of definitions and understandings.

And importantly, among other springs of organizational improvisation, jazz seems to be the most influential.

An important landmark in 'jazzing' of organization theory seems to be a symposium "Jazz as a Metaphor for Organizing in the 21st Century" at the Academy of Management Conference in 1995, followed by a special issue of Organization Science in the autumn 1998. This symposium included 'normal' scholarly presentations (by Mary Jo Hatch, Bill Pasmore and Karl Weick) but also a demonstration and discussion of jazz improvisation by Frank Barrett (both scholar and pianist) and Ken Peplowski (an avowed saxophonist and clarinettist), accompanied by two more musicians (on bass and on drums). The symposium attracted over 500 people, it was great fun but also generated a prolonged intellectual discussion (Meyer, Frost, & Weick, 1998). Barrett and Peplowski (1998[1]) performed and analysed there a jazz 'standard' "All of Me".

Why did the organization scientist turn to improvisation and jazz, is explicated by Weick (1998) in the introductory essay for the mentioned special issue – dominant emphasis on order and control causes disability to understand creativity and innovation. As organizations embody "*… orderly arrangements for cooperation, it is not surprising that mechanisms for rearranging these orders in the interest of adaptation, have not been developed as fully.*" (ibid.: 543). Hence, organizational improvisation is seen as a possibility for coping this shortage and jazz as a source of orienting ideas. The introductory essay brings out several parallels between improvisation in organizations and jazz (music) and educes practical implications, particularly 13 characteristics of groups with a high capability for improvisation, as well as limitations to improvisation. Among the highlighted aspects, the most important seems to be the proportion of success and mistakes. As jazz could be depicted as "*moments of rare beauty intermixed with technical mistakes and aimless passages*", it can teach organizational scientists that "*… that there is life beyond routines, formalization, and success. To see the beauty in failures …*" (*ibid.*: 554). Making mistakes, it is also commonly accepted in jazz music, and in music in general (Westney, 2003), as one of the most effective approaches to develop new ideas and to problem solving, and as a way to unfold the mind and creative thinking.

The afore-mentioned special issue contained several articles, discussing different aspects in relating organizational and jazz improvisation. For one, Mirvis (1998) asserted that improvising is essential in various expressive mediums, such as sports, theatre, military, psychotherapy, etc.; and called to assess how different practitioners improvise and what could be learned from them. This special issue of an academic journal is uncommon also because it contains articles written by non-academic persons – like a jazz musician Ken Peplowski. In his article Peplowski (1998) discussed the process of jazz improvisation and performing of jazz music. He pointed out several useful parallels with organization and what the managers can learn or take over from musicians – for instance, the importance of listening, and sharing and shifting leadership – who takes a solo, takes also leadership and when finishing, gives it over to a follower. Nevertheless, the cited article looks odd: there are no references in the text and no literature listed. If somebody submitted this article to a regular issue, it was certainly rejected but this was a 'very special' issue.

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[1] The article has remarkable heading "*Minimal Structures Within a Song: An Analysis of "All of Me'*". All of Me is a popular song, probably familiar for most listeners, written by Gerald Marks and Seymour Simons. Recommended performance by Ella Fitzgerald, "Ella Swings Gently with Nelson" (1962, Verve).

A remarkable conceptual contribution in this special issue was made by Frank Barrett, who is both researcher and jazz musician. Such a rare combination of competences was probably the enabler, solely organization scientist or musician was not able to do such interdisciplinary work. In his article Barret (1998) declares that Drucker's view of contemporary leaders as orchestra conductors "*... connoting pre-scripted musical scores, single conductor as leader — is limited, given the ambiguity and high turbulence that many managers experience*" (*ibid.*: 605). Thus, he turns to Weick's suggestion, seeing jazz band and jazz improvisation as models of contemporary organizations, maximizing innovation and learning. The main contribution of this ('coda') article was pointing out seven characteristics of jazz improvisation and exploring their applicability in "non-jazz contexts" – that is, in management of (business and other) organizations.

Alongside with the Organization Science 1998 special issue, another significant conceptual contribution appeared. Moorman and Miner (1998) provided a comprehensive overview of the notion of improvisation in different perspectives (organizational, musical, theatre, therapy, and teaching), related to a multitude of domains (from wide and general, such as management and music, to narrow and specific, such as firefighting management). The novelty of their approach was distinguishing the levels of improvisation – from slight modifications of a 'standard' theme to "free jazz" (the jazz metaphor used before considered traditional (mainstream) jazz, which is somewhere in between). Their main contribution was relating organizational improvisation to organizational memory and showing possibilities for the development of higher-level competency in improvisation.

The afore-cited works concerned improvisation in organizations under (more or less) stable conditions yet targeting on provoking innovation. However, even decades ago the environment was changing, and this forced organizations to change (or innovate) more often and extensively. Under these circumstances a subdiscipline – change management emerged. Not surprisingly, in change management there is also place for improvisation, as was shown by Orlikowski and Hoffman (1997). They noted that traditional change management models did not work well in unprecedented, open-ended, and context-specific situations. Thus, they proposed an alternative, improvisational model, adapting iterative experimentation, use, and learning over time.

The afore-cited work was somehow continued afterward by Kamoche and Cunha (2001). They examined side by side social and technical structures and jazz improvisation and synthesized an improvisational model for new product development. It contrasted the existing well-planned approaches of product innovation, adhering clear structures, dominating in rational-functionalist paradigm of that time. A focal keyword in this article (standing also in the heading) is "minimal structures" that allow merging composition and performance in jazz. The cited article showed their usefulness also in product innovation in turbulent and competitive business environments.

The noteworthy special issue of Organization Science was published already more than 20 years ago, and the symposium took place already in 1995. Thus, it might be a bit surprising that their core messages sound even more actual nowadays – but this is already a matter for later discussion. Looking at the developments following during the past two decades, several mile-stones can be picked out. One of these is a (2002) book "Organizational Improvisation". As the editors (Kamoche, Cunha, & Cunha, 2002) noted in the introductory overview, organizational improvisation was a recent (at this time!) theoretical development, starting to deserve attention of theorists and practitioners. This was because of its ability of coping with increasing complexities in turbulent environments and detecting new sources of competitive advantage.

These properties placed organizational improvisation aside other modern (at this time!) conceptual developments, including transaction cost and institutional theories.

A year later Kamoche, Cunha, and Cunha (2003) published an effort towards the theory of organizational improvisation. They scrutinized other improvisational phenomena and discerned possibilities for complementing the insights from jazz. Also, they claimed that theorizing guided by a 'one-best-metaphor' approach is possibly dangerous and called the researchers to go beyond the jazz metaphor, prevailing at this time. Yet, at that they recognized the important contribution of jazz and prevised its continuation in the future.

Looking at later developments, it is worth to bring out a work by Tsoukas and Chia (2002). Their main message was that treating organizational change as exceptional rather than natural is outdated approach and suggested to "*treat change as the normal condition of organizational life*" (*ibid*.: 567). This article was eloquent for further legitimatizing of 'jazzing' in organization theory. Even more: they stated that "*... the view of change suggested here helps us to better understand the process of jazz improvisation discussed by Barrett (1998), ...*" (*ibid*.: 576).

Already during the first decade of substantial development of organizational improvisation it tended to relate to organizational learning. This was pointed out also in some afore-cited works, such as Moorman and Miner (1998) and Orlikowski and Hoffman (1997). Nevertheless, as stated by Vendelø (2009), works investigating learning and improvisation in organizations were missing at this time. Vendelø's article took stock of existed research on relationships between learning and improvisation in organizations and addressed challenges. Furthermore, a step forward in this vein was made by Bernstein and Barrett (2011), relating organizational improvisation to dynamic capabilities. Creation of dynamic capabilities was gaining popularity in the literature, as a feasible response to the problem of organizational inertia. Drawing upon the two notions, they show that dynamic capabilities can be enhanced by strengthening practices observed in jazz improvisation.

A notable work by Oakes (2009) discussed the empowerment as jazz metaphor, considering possibilities for mutual learning between marketers (managers and empowered direct contact staff) and jazz improvisers, in the light of two polarized concepts – freedom and constraints. The main message is that both jazz musicians and empowered service providers are not fully free, they must consider certain constraints. This work is notable also because it targeted on a specific field – service, stating that improvisation allows to create impression of a more personalized service encounter. In the same vein is a work of Cunha, Rego, and Kamoche (2009), designating the eventual role of improvisation in service recovery. Yet, at that they underline that improvisation without clear rules and boundaries may result in unwanted service variation, and poor improvisation can be costly for service organizations.

Even though the 'conductor' (of symphony orchestra) approach has been criticized by the 'jazzmen' (c.f. Barret, 1998), it seems to be place for a little 'intermezzo' here. Koivunen and Wennes (2011) remind that (even according to several gurus, like Drucker, Mintzberg, etc.) the conductor is proliferated as a symbolic metaphor of good management of leadership, yet this is very little reflected in research. Intending to fill the gap, they draw on organizational aesthetics and aesthetic leadership and develop three dimensions of the leadership of conductors: relational listening, aesthetic judgment and kinaesthetic empathy. It should be noted that several afforded elements are relevant also for players in jazz combos.

During the past decade of development in organizational improvisation, two streams can be discerned: general and field-specific. First, looking at progress in the general stream, Barrett

(2012) authored a book where he noted metaphorically that improvising in organizations will say 'yes to the mess', a novel pattern for leading and collaborating in organizations. This needs guided autonomy – that is, setting minimal structures and routines but not eliminating them totally. This will give freedom to experiment and respond to intuitive impulses that foster innovation. In 2014 another special issue on organizational improvisation appeared. In the introduction to the special issue, the editors (Leybourne, Lynn, & Vendelø, 2014) recognize increasing attention from both academics and practitioners, and point out the main headwords in organizational improvisation – creativity, adaptation and innovation. Thus, it was appropriate that this special issue appeared in (Wiley's) journal *Creativity and Innovation Management*. A notable contribution in this special issue (Cunha, Clegg, Rego, & Neves, 2014) asserts that "improvisational" labels very different processes – from impromptu reactions to organizational choreographies in set terms. Their main contribution is discerning forms of organizational improvisation (ad-hoc, covert, provocative and managed) and relating them to streams in organization theory.

A consolidating review of organizational improvisation literature by Hadida, Tarvainen and Rose (2015) states that organizational improvisation is increasingly recognized in management research. However, 15 years after the (probably first) literature review by Cunha *et al*. (1999), the cumulativeness of research remains low and a consolidating framework is still missing. Because this is a potential threat to the future of the field, they introduced a new, degree / level framework. The framework figures a 3x3 matrix, organizing the contributions to organizational improvisation across two core dimensions. First, the level: from single actors to (small) teams and organizations, labelled proportionately 'individual', 'interpersonal' and 'organizational' improvisation. Second, the degree of improvisation: that is, performing an existing task in a different manner, improvising a different task toward the same outcome, or a different task toward a new outcome – labelled respectively 'minor', 'bounded', and 'structural' improvisation. Also, they indicate potential areas for future research across areas, organizational settings and industries.

The presented before overview may seem as an apologia for organizational improvisation. However, wrong usage of something what is normally useful may cause serious damage and this is valid also for organizational improvisation. So Giustiniano, Cunha and Clegg (2016) elucidated the 'dark side' of organizational improvisation, analysing the notorious Costa Concordia disaster[2].

In order to round up more positively, it can be claimed that development in organizational improvisation goes on, new publications appear steadily. Just some examples are recent works of Fisher and Barrett (2018), scrutinizing improvisation from a process perspective; and a case study of a musical intervention in a Finnish professional sport (ice-hockey) team by Sorsa, Merkkiniemi, Endrissat and Islam (2018). As they (*ibid*.: 373) state, "*Once the analogy between musical and team coordination has been established, a variety of different parameters of coordination are opened up, creating a field for both empirical research and applied initiatives.*". The message of these 'golden' words, as well as of the presented overview is that the analogies between business and music, particularly jazz, are promising. In order to use that potential, quite a lot has been done but the potential is not yet depleted, especially in terms of empirical research and elaboration of applications, useful for practitioners.

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[2] On January 13, 2012, the captain of cruise ship Costa Concordia decided to 'improvise', causing sinking the ship.

Jazzing of projects or improvisation in temporary organisations: targeted literature review

The above-presented overview of organizational improvisation disserted the phenomenon in permanent organizations. All organizations have life cycles, no one is permanent. It means that a permanent organization is a construct, used in project literature in order to differentiate from project organizations that are supposed to be temporary – that is, terminated when the project (as a set of tasks, activities, etc.) is completed and/or the deadline is over. This approach was coined by Lundin and Söderholm (1995) in a seminal work, outlining a theory of temporary organization. It should be noted that some publications, referred in the previous section, mentioned also projects; the best examples are Hadida *et al*. (2015), Cunha *et al*. (2014), and some others. They mention projects for just a single reason – projects enable more improvisation, compared to regulated and institutionalized permanent organizational settings. Yet, the mentioned ones are rare examples, projects do not deserve much attention in the mainstream organizational improvisation literature.

Against this background, it is good to denote that jazzing of projects – or in other words, improvisation in temporary organizations – has deserved attention from some project researchers. An early attempt of jazzing project management is a paper by Wikström and Rehn (2002). They compared overall characteristics of projects and jazz and pointed out five most important linkages: (1) plans are enabling, not constricting; (2) aberrations are normal; (3) work with what happens; (4) order is emergent, not pre-defined; and (5) disorder is not chaotic. These are fairly in line with general implications from the organizational improvisation.

In succeeding developments in jazzing of project management, several contributions are made by Stephen Leybourne, alone and with different co-authors. Leybourne and Sadler-Smith (2006) discussed the role of intuition and improvisation in project management and provided empirical evidence. They showed that statistically significant positive relationships exist between: (1) the use of intuitive judgements and improvisation; (2) experience and improvisation; (3) the use of intuitive judgements and experience; and (4) the use of intuitive judgements is related to external project outcomes (customer satisfaction). His next contribution (Leybourne, 2009) compared two emerging trends – improvisational working and agile project management (APM), that were not much recognized by the practitioner bodies (such as PMI, IPMA, etc.), nor the mainstream literature. Reviewing the extant literature on improvisational working and APM and comparing the findings led to several commonalities. Now, about a decade later, his conclusion "*... it is likely that both improvisational working, and the early manifestations of APM, will have something to offer the project practitioner that can assist in more effective execution of project tasks and a higher quality of project deliverables*" (*ibid.*: 532) appears far-sighted and tenable. Further, Leybourne, Warburton, and Kanabar (2014) discussed a more fundamental question "*Is project management the new management 2.0?*" and paid much attention to the role of improvisation, relating it with several aspects in changing paradigms, such as decline of organizational hierarchies, values of the Y-generation, and effectuation. Leybourne and Kennedy (2015) scrutinized the links between knowledge management and improvisation, introducing this subtopic in the project domain. One of their key points is that agile (iterative) approach will support better learning in projects, as well as improved management in contemporary contexts.

Another contribution by Leybourne and Cook (2015) explores the relationships between improvisation in organisation and in music across various musical genres, particularly orchestral, jazz, and rock music. In this work, they argue that rock music is the best metaphor

for the business in the 21st century. At that, they concede that their divisions are blurred, as jazz varies from very structured to almost free. His latest article (Leybourne, 2017) takes stock of developments in both project management and organizational improvisation. As he notes, the paradigm that dominated during some decades, characterized as '*plan, then execute with minimum deviation*' has utterly changed. Nowadays most projects are uncertain, complex, and ambiguous, and this has caused significant changes in project management. This contribution focuses on a specific component of improvisation – adaptation, showing its usefulness in coping with ambiguity and uncertainty, and in avoiding additional risks arising from novelty of activities. Even jazz is mentioned very seldom, developed (and visualised) model for adaption is in line with the 'jazzing' approach.

Inquiring into other parallel developments in 'jazzing' of project management brings out a trend what was alluded also in afore-referred works. Several works by Leybourne (and co-authors) speak in favour of flexible and iterative project management methods, labelled generally as agile (c.f. Salameh, 2014). This development was resounded in a work by Suscheck and Ford (2008), arguing that just the jazz metaphor elucidates the organizational culture, required for supporting an agile software development processes, especially Scrum[3]. For one, the jazz or improvisation metaphor alludes that a general plan is reasonable, whereas dictating the details is unreasonable. This, as well as several other parallels are drawn upon Barrett's (1998) seven characteristics of jazz improvisation, especially working as teams with minimal structures for maximum flexibility.

Agile methods started to spread at the beginning of the 21st century, albeit in the beginning they were not widely recognized in the mainstreaming project management literature. Therefore, it should be mentioned that jazz and improvisation appeared also in the mainstreaming literature. For instance, Geraldi, Lee-Kelley, and Kutsch (2010) recognized the role of improvisation (and bricolage) in explaining the responses of project managers to unexpected events. Jerbrant and Karrbom Gustavsson (2013) examined project portfolio management practices and suggested that both project or portfolio management need "action spaces" allowing improvisation, not fixing the mind on planned, structured work. Klein, Biesenthal and Dehlin (2015) proposed a praxeological framework for resilient project management where improvisation has a crucial role. It assumes that the more knowledge (e.g. schools of project management thought) a project manager has, the more he/she can use and apply his/her knowledge in different situations, and at times improvising, the more prepared and resilient his/her project-management practices will be. Their framework combines two aspects: knowledge of instrument(s) and degree of improvisation; and discerns four types of project management: linear (rigid), bricolage, pluralist, and pure improvisation.

To end this overview just some more significant publications. Biesenthal, Sankaran, Pitsis, and Clegg (2015) examined contributions of project management literature to discussions of temporal issues in general management and organization literature. They emphasize the ability to improvise, as linear assumptions confront the complexities and point out the analogy with jazz. And finally, a book by Sivaraman and Wilson (2016) with expressive heading "*Making projects sing: a musical perspective of project management*". Discussing properly the relations of project management and music, they show numerous possibilities for mutual learning. This book is about music in general, not just jazz, yet pays copious attention to jazz and improvisation. Appearance of such proper work obviously signs the potential of jazzing and

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[3] Scrum is "… *a simple framework for effective team collaboration on complex products*" (source: www.scrum.org). This agile management method was first adopted in IT but now it is proliferating into a variety of fields.

more widely music in project management. As project management is an essential part of general management in contemporary organizations, most implications should be extendable to management and organization in general. In other words, the next step could be "making sing" the whole business and organizations.

Discussion of the main findings

The first deduction from the review of general 'jazzing' (i.e. organizational improvisation) literature is that the jazz (and more widely music) metaphor has been fruitful, perhaps even more fruitful than its introducers expected some decades ago. The trigger for 'jazzing' was an emerging need to refract the orientation on order and control, hence enabling more creativity and innovation (Weick, 1998). Considering almost two decades history of 'jazzing' organizations, we may ask – are the organizations in current societies already enough 'jazzed'? The answer is probably not, as nowadays most organizations need 'jazzing' more than ever. This comes from the paradigmatic changes, labelled as VUCA, standing for a combination of **V**olatility, **U**ncertainty, **C**omplexity, and **A**mbiguity (Bennett & Lemoine, 2014). To cope with volatility and ambiguity, organizations need correspondingly (more) agility and experimentation (*ibid*.) Our analysis of literature brought out that the jazz metaphor propounds both agility (Leybourne, 2009; 2017) and experimentation (Orlikowski & Hoffman, 1997; Barrett, 2012). Regarding experimentation Bennett and Lemoine (2014) emphasize that it must be 'intelligent' – not just doing some (futile) things but rely on something – experience, knowledge, etc. The same is in jazz – a widely cited dictum from Charles Mingus uttered "*You can't improvise on nothing; you've gotta improvise on something*". All the mentioned, particularly agility and experimentation, relate to an important notion deriving from jazz – "minimal structures".

Jazz musicians may be classified as entrepreneurs, building a jazz music career in the same approach as a start-up company. A jazz musician normally wants to bring in a new style and artistic conception into the music business industry by introducing a fresh approach to performance and improvisation, and in many cases, composition, arranging and production as well. This "fresh new approach" is only possible through a deep knowledge of the jazz tradition, its language, and techniques (Reeves, 1995). Truly free jazz improvisation, not in terms of the "free jazz" style, but referring to develop a performance technique with full freedom to recreate and improvise, it can only be achieved after a comprehensive understanding and mastering of the jazz fundamentals and its roots. The jazz approach may be understood as an open view to a concrete circumstance and environment, which requires specific action(s) to accomplish the goal (i.e. performance of a new/old song within a group situation), in the same way that a project manager would deal with problem solving. Developing a new voice or personal style as a jazz musician requires both deep knowledge of the jazz tradition but also, and most important, an artistic vision which leads musical and aesthetic components into an original new proposal as an artist. Jazz artists need to be able to adapt to a constant changing multi-cultural and technological environment, intrinsically connected with the music industry, market, and audience demands.

In jazz, minimal structures allow improvisation – simultaneous creation and performance; in organizations they enable working (especially in creative teams) with optimal flexibility. Both jazz musicians and workers must follow their minimal structures – in jazz the harmony, rhythm, etc.; in business the routines, rules, etc.; not eliminating them totally. If a group of jazz players will not agree upon the theme, tonality, tempo, etc. and just start to play, the result will

probably be not admissible for the listeners. Similarly, if a product or service design team will not have any agreement between themselves or a task given by the higher-level management and just start to develop something, they probably develop something useless, unfeasible and unprofitable. Such result in business means not only useless result but also wasted resources – manpower and even money. Thus, everywhere must be some structures, but they should be as minimal as possible.

A question that has not yet enough been addressed in the organizational improvisation literature is the level of minimalism. Our proposition is that the optimal level varies, and we use jazz music metaphor to scrutinize the idea. First, the case described by Barrett and Peplowski (1998), how they analysed and performed a jazz 'standard' "All of Me". They performed with two more musicians (on bass and on drums) and obviously they had previously agreed the theme (song) and tonality (on a figure in this article it is in C), probably also the rhythm and tempo (or it was forced by the drummer). How they performed, is not described in the article but we assume that it was quite traditional – one of them (clarinettist, as a melodic instrument), played once the theme (melody), while the piano provided harmonic support, and then they played alternately several improvisational solos. (Bass and drums are usually accompanying instruments but sometimes they also take solos, did this happen at this performance is not known.) We realize that this example might be not easy to understand for non-musicians, but it describes the "structures" they had and needed for this performance. These structures were minimal, that is, optimal in this case. Yet, the same 'standard' "All of Me" has been performed by big bands[4] and in this case more structures are needed. If several instruments play together without orchestrated and notated (written) scores, the result will be total cacophony (that is, dissonance). Although musicians in big bands play improvisational solos, such actions cannot be spontaneous, they are premeditated by the arranger and/or conductor. Big band music is balanced between written and improvised sections, depending on the nature of the style and composer. Moreover, this jazz 'standard' has been performed also by symphony orchestras, whereat the structures are more rigid.

Jazz, as well as other music genres, are sometimes performed by single musicians, yet most music performances are collective actions, involving several people – from duets and trios and small (ca 4-6 musicians) combos to big bands, orchestras and choirs with 20-40 musicians, and in specific occasions[5] up to thousands. Thus, performing music, particularly jazz, is collective and social phenomenon. Music collectives are different, varying from small, informal or semi-formal (jazz) combos to bigger and more formal organizations, like most (symphony) orchestras. Moreover, the music collectives vary in terms of their desired life cycles: some (usually smaller and less formal) are temporary, formed for a single performance (or recording, etc.) whilst bigger orchestras are often desired to be permanent. As mentioned before, no organization is permanent, yet some music collectives[6] have very solid history, comparable to solid businesses. Just in jazz, there is other extremity, called 'jam session' where musicians (mostly instrumentalists, possibly even strangers) improvise on tunes or just chord progressions.

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[4] Big band is the most characteristic instrumental big ensemble in jazz history, originated in the early 1940s during the "Swing Era". Traditional instrumental setting includes saxophones (5), trombones (4/5), trumpets (4), and rhythm section (4: piano/guitar, bass, drums), with a total number of around 16-18 musicians, which may vary depending of the size of the band and the specific program. Occasionally, a singer is added, and in contemporary settings, strings and electronic instruments are widely used as well. It is very typical that big bands feature top level soloists performing a specific program of just as regular member of the band.
[5] Like Baltic song and dance celebrations, see https://ich.unesco.org/en/RL/baltic-song-and-dance-celebrations-00087
[6] A good example is world-famous *Die Wiener Philharmoniker*, established in 1842 and still performing.

In this process, they form bands – temporary organizations with very short life cycles – from some minutes to some hours.

Analysis of the general organizational improvisation literature brought out that projects are considered, yet chiefly because temporary organizational settings are more improvisation-friendly than institutionalized and regulated permanent counterparts. This is probably true in most cases; however, the situation may be not so bright there. As Lundin (2007) stated, there is also a dilemma of "the beauty and the beast", epitomizing respectively creativity and innovativeness, and project management. Order and control, prescribed by traditional project management approaches, tends to kill creativity and innovativeness. Perception of this dilemma was probably the main trigger for 'jazzing' of projects. As the seminal paper by Wikström and Rehn (2002) pointed out, plans should be enabling, not constricting, aberrations are normal, order is emergent, not pre-defined, and disorder is not chaotic. All these principles are somehow reflected in an alternative approach of project management, labelled agile. Our main conclusion is that all the journey of 'jazzing' of project management has explicit parallels with overall developments towards agility.

After all, we want to emphasize that agility is not a 'silver bullet' that could kill any enemy. According to some recent findings (c.f. Cooper & Sommer, 2016), agile approaches have several advantages, but they do not suit everywhere, traditional approaches are quite good in some cases. For instance, agile approaches appear more suitable when (project) teams consist of experienced members, are relatively small and changes during the task (project) are probable. In opposite cases, when (project) teams are larger, unexperienced members dominate and the requirements are fixed, traditional (or plan-driven) approaches probably work better.

Considering aforesaid, the prospective future might be hybrid approaches, combining both agile and traditional in a suitable way. In this vein, it is possible to claim that the possibilities for learning from jazz are bigger than ever before. In our opinion, the nature of jazz is corresponding just the hybrid approach, setting minimal structures, allowing freedom to improvise when this is suitable and establishing enough order when this is needed.

Conclusions

This conceptual paper takes a fresh stock of existing research in 'jazzing' of organizations, giving special attention to temporary organizational settings. Review of literature and discussion of findings brings forward increasing importance of organizational improvisation as a powerful enabler of creativity and innovativeness. In the contemporary (VUCA) world, most organizations should forget about stability and seek for new possibilities and solutions. Jazz (also music) has been a fruitful metaphor and source of learning so far, however, the possibilities are not depleted yet. Even the main derivative from jazz – the principle of "minimal structures" – was accentuated nearly two decades ago, the developments tend to bound on the conceptual level, empirical work is still rare and importantly, tools for practical application in organizations are virtually absent.

Scrutinizing the history of 'jazzing' and developments in project management brings out a substantial trend towards agility. Although agility appeared in project management, this notion is swiftly proliferating in other fields. Thus, there is a need for more and deeper research, especially empirical, covering also other fields, such as services, process management, entrepreneurship, and others.

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ARCHAELOGICAL PROJECT MANAGEMENT

Bożena Błaszczyk, Sebastian Kania

VERUM Advisory & Management, Katowice, Poland,
University of Economics in Katowice, Faculty of Informatics and Communication,
Katowice, Poland

Abstract

In recent years, one could get more information on the projects being implemented, which may be related to obtaining other types of funding. Achieving success in project management requires extensive knowledge and its applications.

Projects can be made according to very different criteria (Oliński M., 2016): because of the size of the project (employees, duration, financial outlays); because of purpose for destiny (internal, external); place of implementation (in enterprises, public administration, schools, local government units, hospitals, etc.); type of project (innovative, investment, development, research, teaching, etc.); source of financing (from domestic, foreign, mixed funds); on the expected profitability (modernization, introduction of a new product, higher productivity, etc.); as well as by projects typical for the computer industry.

Due to the type of the project, archaeological projects can be distinguished, which on the one hand can be designed by scientists. The main stages of the project implementation are as follows: 1) planning, 2) data collection, 3) analysis, reports, transfer of sources and documentation, 4) long-term storage. (EAC Guidelines 1).

The article will present the specificity of archaeological project management, based on the example of the project entitled: "Pafos-Agora and infrastructure and economic activity of the Hellenistic capital and Roman Cyprus on the basis of interdisciplinary investigations" carried out at the Institute of Archaeology of the Jagiellonian University.

The research is carried out on the basis of literature analysis, field observations, research and project management and members of the archaeological expedition.

Key words: *project management, international project, archaeological project.*
JEL code: M10, M12

Introduction

Archaeology (from Greek: archaios - old, logos - speech, story) –is a word meaning speaking, inquiring about the past, about old things. There are many definitions of archaeology. Most of them describe it as a science exploring ancient human history based on the material remains of its activity. The most important of the tasks of archaeology is the desire to recreate in the most complete way the manner and conditions of old people's lives. The purpose of archaeology is also to preserve the world's cultural heritage and its protect it from destruction or robbery. As the subject of archaeology is a man, it is assumed that it "begins" with the appearance of the first objects considered by our ancestors and "lasts" properly to modern times, because the object thrown away by us in the trash is becoming part of the just created future cultural heritage. (Ławecka, 2011).

The document that created the legal basis for a specific cultural policy of the European Union was the Treaty on European Union, the so-called the Maastricht Treaty, which entered into force on November 1, 1993. In art. 128 of the Treaty, Member States have defined the purpose, competence and scope of Community action in the field of culture. In art. 128 paragraph 1 The Community has set as its goal, the contribution to the cultures flourishing of the cultures of the Member States, respecting their national and regional diversity while at the same time emphasizing the common cultural heritage. This meant the legitimacy of the role and importance of cultural diversity of the Member States of the Community in the integration project, while granting the Community the competence to take action to promote a common heritage. In art. 128 paragraph 2 The Community clearly defined the scope of its activities in the field of culture and subordinated them to the principles of complementarity and subsidiarity. Community action was aimed at encouraging cooperation between Member States and, if necessary, supporting and supplementing their activities in listed areas. They consist of the following:

- increasing the level of knowledge and popularizing the culture and history of European nations,
- preservation and protection of cultural heritage of European significance,
- non-commercial cultural exchange,
- literary and artistic works, including audiovisual items.

(Jurkiewicz-Eckert D., 2015).

The purpose of this article is to presentation the specificity of archaeological project management. The article was inspired by the project entitled "Pafos-Agora and the infrastructure and economic activity of the Hellenistic capital and Roman Cyprus on the basis of interdisciplinary research" carried out at the Institute of Archaeology of the Jagiellonian University in Poland.

Introduction to project management

The system approach to project management assumes that the project should be perceived as a form of conversion of a given form of effort into a result (Maylor H., 1996).
The concept of project, both in theory and practice, takes on a variety of forms and meanings (Drobniak A., 2005).
Quoting Kerznera, the project should be considered every series of tasks that characterize (Kerzner H., 1998):
- a specific goal, necessary from the point of view of specific technical parameters,
- dates, which is the start and end time,
- financial constraints,
- the use of resources such as people, equipment, money.

According to Young, the term design should specify a set of combined activities, organized in a structured way, with a clearly defined start and end date, to achieve specific results that will meet the organization's needs resulting from its current business plans and the overall development concept (Young T.L., 1996).
According to Rosenau, the project has four characteristics that differentiate it from other planned and managed activities, these are: three-dimensional goals, uniqueness, use of resources, implementation within the organization (Rozenau M.D., 1992).
Based on the literature recognition and practice, we can identify common features of the project, which graphical presentation includes Fig. 1.
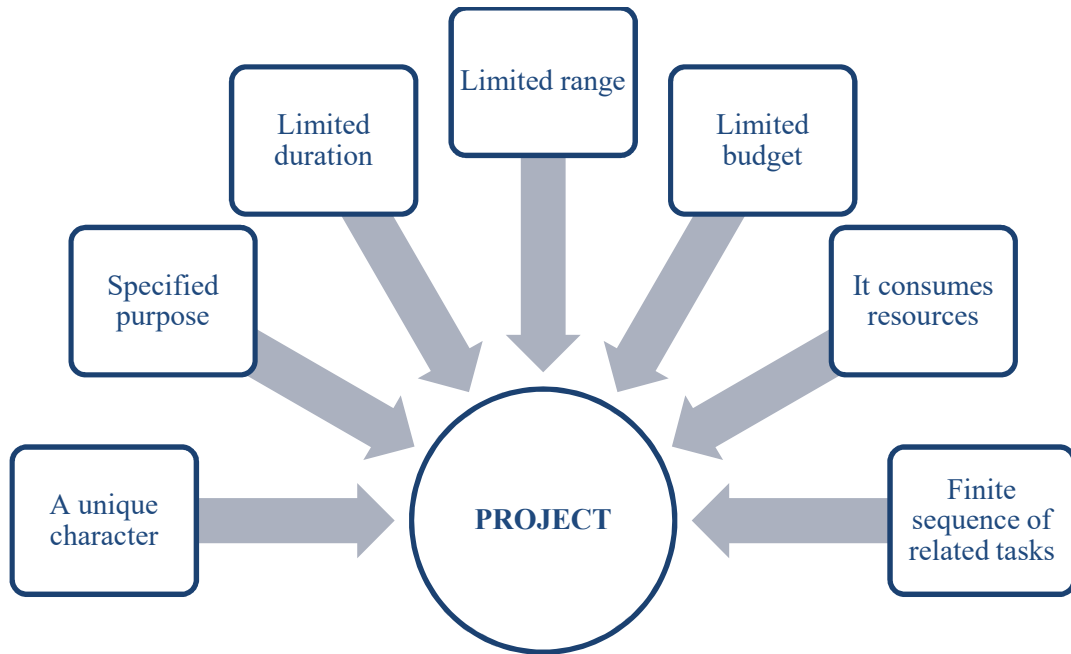
Source: Authors' own work

Fig. 1. **Features of the project**

The concept of project management can be understood as the process of making decisions necessary for the proper implementation of project tasks and their implementation (Pawlak M., 2006).

Project management is also a team of managerial activities related to the implementation of projects and a set of principles, methods and measures used in these activities (Trocki M., 2003).

Haberfellner by project management understands all activities related to the preparation and implementation of decisions related to the implementation of projects, with a view primarily to managing the problem solving process (Haberfellner R., 1992).

There are three main problem areas of project management (Trocki M., 2009):

- Functional project management:
  − What is the subject of the project?
  − What goals are to be achieved and what tasks should be performed and in what order?
  − What resources do you need to commit to the project and these tasks?
- Institutional project management:
  − How should tasks, competences and responsibilities be assigned to the project?
  − How should the implementation of the project be included in the organizational structure of the enterprise?
  − What should be the flow of information between elements of this structure?
- Personnel project management:
  − What are the main values, management styles or behavioral patterns that are necessary during the project implementation?

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- What tasks related to motivation or staff training should be implemented?
- What requirements for knowledge or skills of employees are necessary from the point of view of the project and who can meet them?

Archaeological project management

To understand the specificity of an archaeological project, it is necessary to clarify such terms as archaeological sources and archaeological sites.

We call archaeological sources all material traces of people's activities from the earth or water in the past, enabling the reconstruction of various areas of their lives.

Archaeological sources can be divided into movable and immovable, as shown in Fig. 2

Archaeological sources

movable

excavated from the ground during excavations, for example: ceramics, bones, flint tools, metal decorations

immovable

residues of various objects such as: residential houses, amphitheatres, granaries, mine shafts, tombs
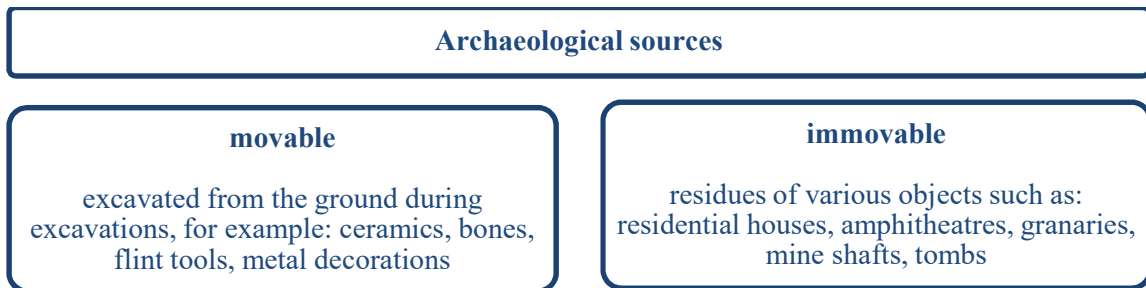
Source: Authors' own work (Ławecka D., 2011, p. 81)

Fig. 2. **Archaeological sources according to the static criterion**

The category of archaeological sources includes residues produced by man and by nature, as shown in Fig. 3.

Archaeological sources

man-made monuments

residues related to the natural environment

artifacts

any movable finds produced or adapted for human use

objects

immovable finds, various types of constructions

ecofacts

organic residues and inorganic residues from the natural environment
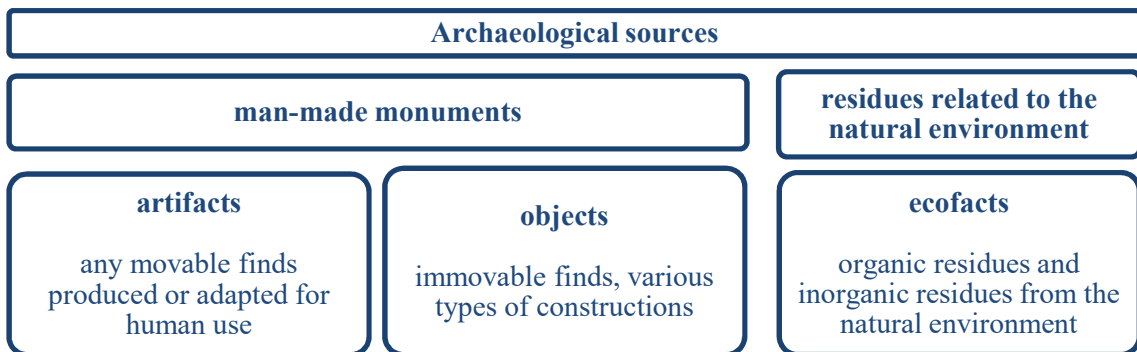
Source: Authors' own work (Ławecka D., 2011, pp. 81-82)

Fig. 3. **Archaeological sources according to the origin criterion**

According to Mazurowski, the position is called a section of area, in which archaeological sources are grouped together with the context explaining them, having the property that it is

separated from other similar spaces in which there are no archaeological sources, and thus constitutes a compact area from the point of view of research methodology field.

Ławecka reports that the archaeological site is every material trace of human activity in the past. In the case of most positions, it will be true to say that it is a spatially compact area where artifacts, ecofacts and objects co-exist. (Ławecka D., 2011).

The division of archaeological sites can be made according to various criteria, for example visible on the surface and below ground level, or simple and complex. The division of archaeological sites is important because of the functions they performed in the past. Exemplary types of archaeological sites, due to their functions in the past, are presented in Fig. 4.
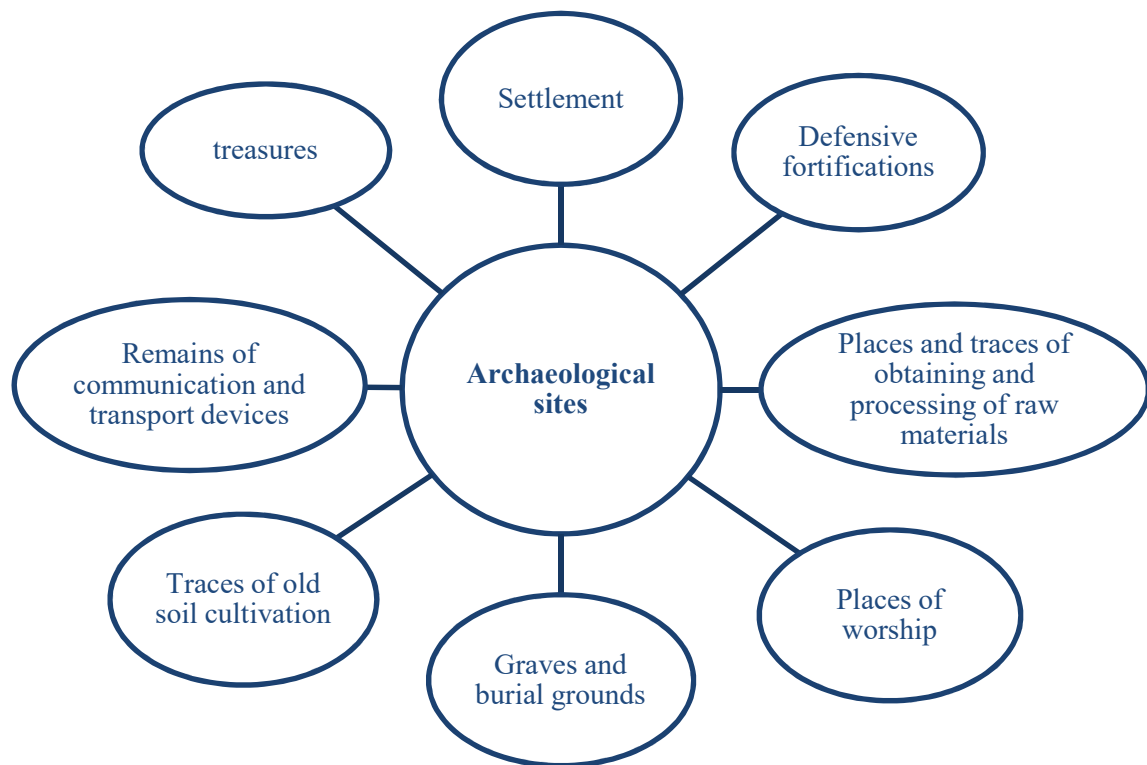
Source: Authors' own work (Ławecka D., 2011, pp. 83-84)

Fig. 4. **Types of archaeological sites, due to the functions they performed in the past**

The term 'archaeological project' or 'project' will be used to describe any piece of archaeological activity that results in an archive.

A project is understood generally to be a temporary piece of work undertaken to meet stated goals and objectives which will operate to a timetable and an end date, deliver a product, and

have defined scope and resources. It will usually have a project manager and be undertaken by one or more persons brought together for that particular activity. (EAC Guidelines 1).

An archaeological project is any programme of work that involves the collection and/or production of information about an archaeological site, assemblage or object in any environment, including in the field, under water, at a desk or in a laboratory. Examples of an archaeological project include: intrusive projects such as excavation, field evaluation, watching brief, surface recovery and the destructive analysis of objects; non-intrusive projects such as landscape or building survey, aerial survey, remote sensing, off-site research such as desk-based assessment and the recording of objects or object assemblages. The re-investigation of archives in curatorial care also constitutes an archaeological project. (EAC Guidelines 1).

EAC Guidelines 1, identifies the stages of the archaeological project (the first three are the main stages):
1) Planning,
2) Data Gathering,
3) Analysis, Reporting and Archive Transfer.
4) Care and Curation (long-term storage).

Planning. The start up or initiation stage, a time when: documents such as project outlines and/or designs, tenders, work specifications and methodologies, will be written; research aims and objectives identified; project scope, stages, products and tasks described; a project team identified, specialists consulted and resources allocated; temporary care and long term curation procedures and repositories identified; project review schedules agreed and communication, disaster management and health and safety plans devised. This is the stage where archive creation and compilation begins.

Data Gathering. In archaeology this stage is often applied to fieldwork but for the purposes of the Guide, data gathering means the execution stage of a project, when archaeological data and/or materials (finds) are collected. Whether the archaeologist is undertaking original research in the field, the office, laboratories or stores, this is the stage where factual data is recorded with minimal interpretation.

Analysis, Reporting and Archive Transfer. This stage is commonly called post-excavation, however not all archaeological projects will involve excavation, as for example in building recording, survey or finds analysis and this stage has been renamed to reflect modern archaeological practice. Analysis involves fuller, targeted recording and interpretation, whether that is of the field records, a finds assemblage or the results of a geophysical survey. The resulting records, such as data and images, will be included in the archive. This stage will normally end with a final report. Different types of analysis may result in the creation of several reports, some of which will be included in the final project report. The acceptance of those reports into the project archive is an important element of creating an accessible resource. Once analysis and reporting have been completed, it is expected that the project will no longer generate new records, materials (finds) or samples and the project archive will be compiled and prepared for transfer to a repository for long term curation.

Care and Curation (long-term storag). Curation is the process of ensuring that archive materials remain stable, secure and accessible in the long term. It is an ongoing process that ensures the integrity of an archaeological archive after the project has been completed but the care of all archive components is a process that should start at the beginning of a project, from the point any documentation is created or material objects (finds) are collected. Any archaeological materials or documentation created or collected from the planning stage onwards

will require temporary care until transfer to a repository for long term curation. Care of the components selected for archiving is an activity which forms a thread running throughout an archaeological project and will involve both temporary care and long term curation of the documentary and material (finds) archive.
(EAC Guidelines 1).

Information on the Project

The ancient town of Nea (New) Paphos was founded by the end of 4th or the beginnings of 3rd century BC and after some time took on significance by becoming the capital of the island in the Hellenistic and Roman times. It replaced the Old Paphos (Palaepaphos, today Kouklia village) in its economic and administrative functions. However, Old Paphos remained the main centre of the Aphrodite's cult on the island. The monuments of Nea Paphos uncovered, starting from the 60s of the 20th century by Cypriot archaeologists and numerous foreign missions, have been inscribed in the UNESCO World Cultural Heritage list. (Papuci-Władyka E., 2016).

In 2011, a license granted by the Department of Antiquities in Nicosia allowed to commence archaeological research of the Agora in the ancient town of Nea Paphos in Cyprus. The Paphos Agora Project (PAP) is headed by the Department of Classical Archaeology of the Jagiellonian University (JU) Institute of Archaeology. The project aims to investigate the history and development of the city's central part – the main market place, the Agora. The research goes also beyond the Agora itself, and aims to answer open questions concerning the economic infrastructure and trade activity of Nea Paphos during Hellenistic and Roman times. (Papuci-Władyka E., 2016).

The Paphos Agora Project (PAP) had modest beginnings – first team consisted of only 20 people. By the 2015 season, mission had grown to 70 members, consisting primarily of employees, doctoral and undergraduate students from the JU Institute of Archaeology. However, mission also benefitted from volunteers – both students from JU and other Polish universities (Poznań, Toruń, Łódź and Warsaw) and from abroad, as well as, freelancers and archaeology enthusiasts from Czech Republic, Croatia, Cyprus, Greece, Germany, UK, USA, Italy and Slovakia. (Papuci-Władyka E., 2016).

Investigations of the Paphos Agora during the first phase of the project (2011–2014), which were financed from the OPUS grant of the National Science Centre (NSC, no. 2011/01/B/HS3/01282), aimed to answer many questions. The main question was whether the Hellenistic Agora was situated in the same place, under the Roman one. Other questions related to when the excavated area had started to be the Agora; what it had looked like at the beginning and later on, during the changes and rebuilding caused by, among others, the frequent earthquakes in Cyprus; how it had functioned as a public space. (Papuci-Władyka E., 2016).

The second phase of research began in 2015, financed by the new NSC grant MAESTRO (no. 2014/14/A/HS 3/00283), which aims to continue research in the Agora itself and to search for the remains of other material infrastructure related to the economy and trade (e.g. other market places, harbours, warehouses, workshops) outside the Agora, based on non-destructive investigations. (Papuci-Władyka E., 2016).

The Paphos Agora Project is an interdisciplinary research effort with expertise in specialized areas of archaeology, architecture, geodesy, geophysics, 3D laser scanning, photogrammetry, aerial photography and preservation. A variety of research, prospection, and

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documentation techniques were applied. Researchers created a Digital Terrain Model (DTM), which is the representation of land surface point elevations of the investigated area. All processed data have been stored in a GIS environment (on-going process). Consequently, it will be possible to depict the excavated site virtually on a computer screen. This modern system, named the Archaeological and Archaeometric Information System for PAP (AAISforPAP), a database specifically for documenting excavations, is slowly being implemented since 2013. It will provide easy access to all excavation data for project participants and – in the future – for other scientists.

Excavated portions of the Agora (500m2) only account for 5% of the entire Agora.

Many architectural remains were excavated including: small shops (Lat. tabernae) from the Roman period located in the eastern portico next to the Agora's entrance and on a street directed towards the theatre, many walls, floors, and hydro-technical devices (e.g. channels, terracotta pipelines for the city's water supply, basins, wells, and cisterns for water collection). Huge amounts of portable objects also excavated include: numerous pottery sherds, olive oil lamps, coins, metal objects, terracottae, glass vessels and objects, stone artefacts, roof tiles, and animal bones. After working in Paphos for 211 days, project discovered thousands of ceramic sherds and non-ceramic objects, additionally 13,000 roof tile fragments. 1747 special finds were registered and almost 19,000 photographs were taken. The findings presented in this volume are only a small sample of what members of the expedition have excavated to date. (Papuci-Władyka E., 2016).

Conclusions

It can be observed that the stages of the archaeological project are visible in The Paphos Agora Project.

At the beginning, the former prospection was carried out before archaeological excavations, which involved the use of methods for searching and locating positions, and methods for detailed identification of sites already located.

Proper work related to data gathering was carried out in annual cycles, as shown in Fig. 5.

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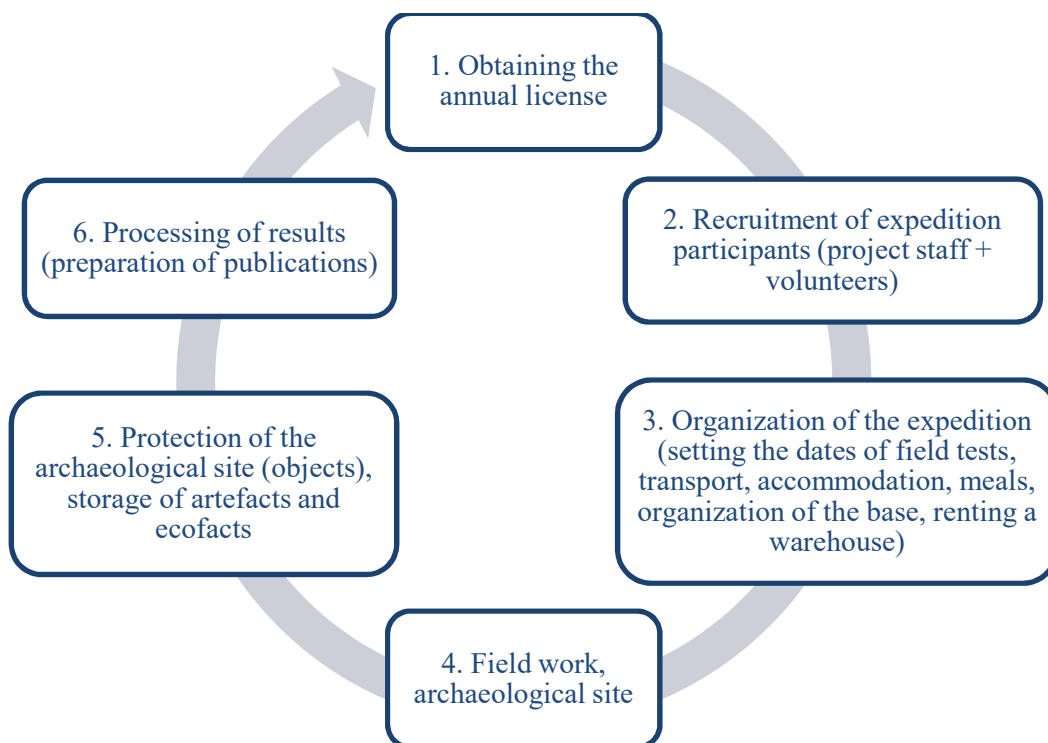
Source: Authors' own work

Fig. 5. **The annual cycle of the data collection stage on the basis
of The Paphos Agora Project**

The basis for conducting archaeological research is to obtain an annual license, issued to the head of the archaeological expedition. In addition to specialists involved in the implementation of the project: archaeologists and specialists developing specific types of discovered monuments (archaeologists studying ceramics, numismatists, etc.), but also architect, surveyors, geophysicists, laser scanning specialists, aerial photography, photogrammetry and conservator, a large group of participants of the expedition were volunteers. The logistic and organizational activities in the project were very important. Proper field work was carried out in the spring and summer months, in Cyprus, outside the seat of the Jagiellonian University. All archaeological sources were kept on record, photographed, and after cleaning and maintenance, stored in a designated local warehouse. The prepared documentation enabled the development of results, preparation of scientific publications.

The completion of the archaeological project involves the necessity of transferring archaeological sources - to the museum, to the warehouse, or making it available to visitors in the archaeological park.

A simplified model of the archaeological project stages is shown in Fig. 6

OPUS Grant of NSC   MAESTRO Grant of NSC
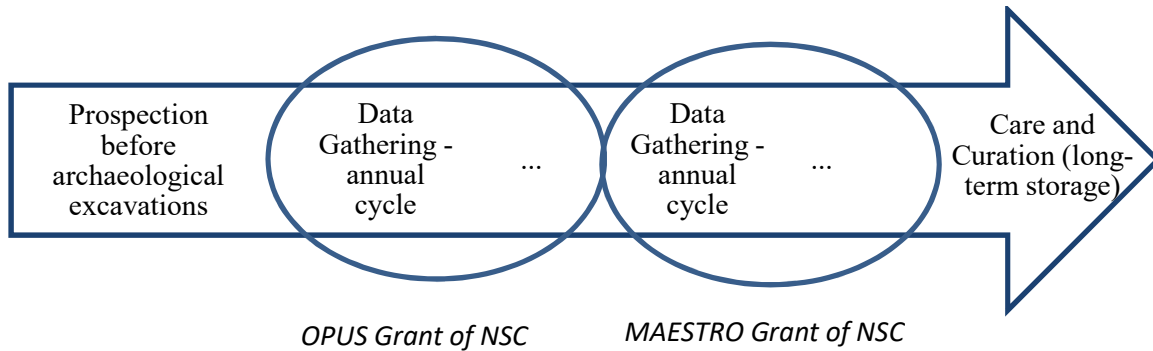
Source: Authors' own work

Fig. 6. **Stages of the archaeological project based on The Paphos Agora Project**

On the example of The Paphos Agora Project, the following main problem areas of archaeological project management can be distinguished:

- Functional project management:
    - Search and location of positions.
    - Detailed recognition of sites already located.
    - What is the subject of the project?
    - What will be the sources of financing the archaeological project?
    - Obtaining a concession.
    - What goals are to be achieved and what tasks should be performed and in what order?
    - What resources do you need to commit to the project and these tasks?

- Logistic project management:
    - Organization of the archaeological sites (securing the site, providing a social place for eating and short rest, toilet, Internet access).
    - Organization of the base near the archaeological sites (place of work of specialists with basic equipment, secured warehouse, utility room, social room, toilet, water, Internet access).
    - Organization of accommodation for expedition members.
    - Organization of food and drinks for members of the expedition, taking into account specific preferences (eg for health reasons).
    - Organization of tools and materials necessary during excavation (transport of own equipment, purchase or rental on site).
    - Providing software for collecting data on archaeological sources and IT devices for data collection.
    - Organization of transport during field research.

- Institutional project management:
    - How should tasks, competences and responsibilities be assigned to the project?
    - How should the implementation of the project be included in the organizational structure of the university?

- – What should be the flow of information between elements of this structure?
- – During fieldwork, decisions are made on-site without the University's support.
- – During fieldwork, the necessary shopping is carried out on site without the University's support.

- Personnel project management:
  - – What requirements for knowledge or skills of employees are necessary from the point of view of the project and who can meet them?
  - – What requirements for volunteers are necessary from the point of view of the project and who can meet them?
  - – Proper recruitment of members of the archaeological expedition, determination of predisposition to archaeological works.
  - – Ability to manage an interdisciplinary team.
  - – Ability to manage a multicultural team, where members of the expedition come from different countries.
  - – Ability to build a team and resolve conflicts.
  - – Strength for physical, monotonous work, resistance to high temperatures and high humidity, acceptance of field conditions.

Archaeological projects are scientific projects, because a team of researchers is undertaking work to achieve the progress of scientific knowledge.

Archaeological projects have certain features of logistics projects because efficient management of logistics processes during data gathering is necessary to achieve the project's success.

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ORGANIZATIONAL DNA OF THE MASTER'S PROGRAMME EUROMPM

Carsten Wolff

Dortmund University of Applied Sciences and Arts, Germany

Abstract

Organizational DNA (or corporate DNA) is proposed to phrase and codify the philosophy, structure, believes and capabilities of an organization. It forms a description of an organization which can be used for communication, strategy development and as a tool for management. The application of the concept of organizational DNA to a Master's programme in Project Management (as the European Master in Project Management - EuroMPM) follows the idea to view Master's programmes as a kind of learning or self-optimizing organization. Considering the concept of the DNA can lead to a new analysis of the capabilities and therefore of the goal of academic Master's programmes in a very practical domain like project management. It can help to answer the question: what can we achieve with a Master's programme in project management? Furthermore, it can be a tool to analyse and plan the development options for such study programmes: how can we develop the capabilities? How can it be more effective and more efficient? Finally, forming a consensus on the DNA of the EuroMPM can be a common ground for the members of the EuroMPM consortium.

Keywords: Organizational DNA, European Master in Project Management
JEL code: O22

Introduction

The European Master in Project Management (EuroMPM) is a study programme which was initially conducted at the University of the Basque Country (UPV), Bilbao, Spain, the NTNU Trondheim, Norway, and the Dortmund University of Applied Sciences and Arts (FH Dortmund), Germany. It is based on a joint curriculum and didactic model. The programme is taught in 3 or 4 semesters with two "teaching semesters" which deliver a set of modules and one or two "project semesters" which are devoted to projects and Master's thesis.

Semester	Module	ECTS	Delivery
1	Project Management Core Module 1	6	Theory Teaching & homework
	Project Management Core Module 2	6	Block workshop
	Technical Skills Module 1	6	Tool Training
	Leadership and Team Module 1	6	Workshop
	Scientific Methodology & Research	6	Seminar
2	Project Context Management 1	6	Theory Teaching & homework
	Technical Skills Module 2	6	Professional Certificate Training
	Leadership and Team Module 2	6	International workshop
	Project Case Study	6	Summer School
	Elective 1	6	
3	Elective 2 (Specialisation)	6	
	Elective 3 (e.g. research seminar)	6	Publication for student conference
	Research Project (thesis)	18	Own research
4	Master Thesis	30	Own research

Fig 1: **EuroMPM model – curriculum design**
Source: Wolff, C.; Otegi, J.R.; Bushuyev, S.; Sachenko, A.; Ciutene, R.; Hussein, B.; Torvatn, T.A.; Arras, P.; Reimann, C.; Dechange, A.; Toledo, N.; Nuseibeh, A.; Mikhieieva, O., 2017.

Meanwhile, the EuroMPM has expanded to a consortium of eight European universities (in addition to the initial three partners: KTU Kaunas, KU Leuven, TNEU Ternopil, KNUCA Kiev and ZNTU Zaporizhia). This opens unique options for cooperation, joint research and curriculum development and for exchange of lecturers and students in various educational formats. The cooperation of the programmes in a virtual, cross-border Master School (Wolff, C.; Mikhieieva, O.; Dechange, A, 2017) has become a core concept of the education in project management.
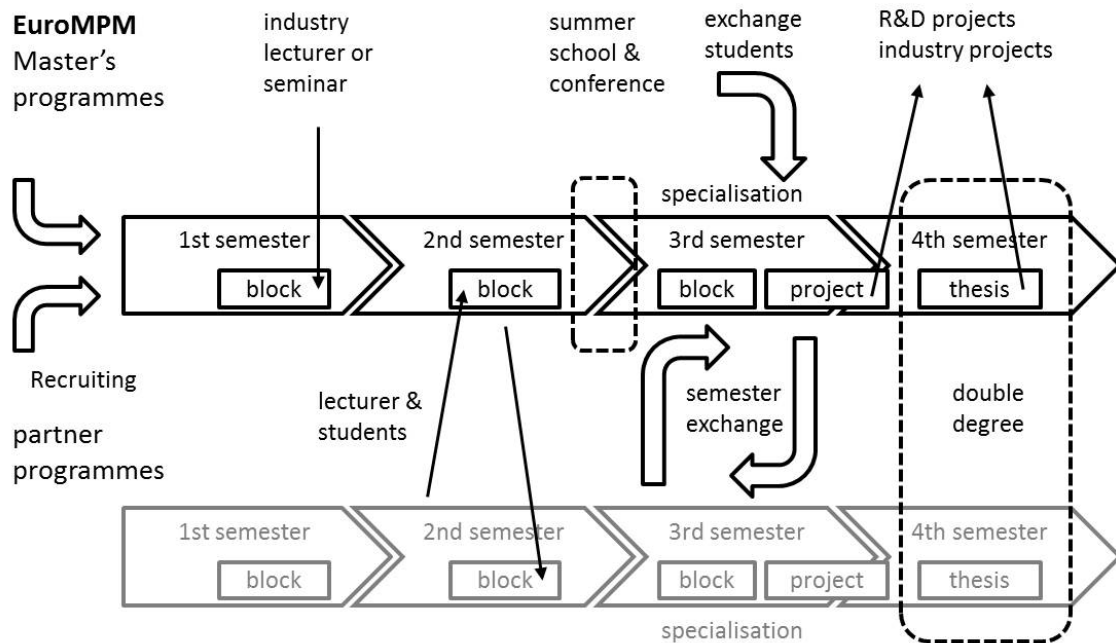
Fig. 2 **EuroMPM model – exchange concept.**

Source: Wolff, C.; Otegi, J.R.; Bushuyev, S.; Sachenko, A.; Ciutene, R.; Hussein, B.; Torvatn, T.A.; Arras, P.; Reimann, C.; Dechange, A.; Toledo, N.; Nuseibeh, A.; Mikhieieva, O.,2017.

The EuroMPM and the joint efforts of the consortium are a major contributor with a high impact in the European project management community. The activities form a cumulating point for researchers, practitioners, lecturers and students. The graduates from the cooperating Master's programmes (150-200 p.a.) are driving the community.

Master's education in project management is facing a dilemma. Project management (PM) is rather perceived as a practical skillset (even a soft skill) than a science. Students expect to be trained for DOING project management while academic programmes educate for REASONING about project management. Project managers are trained in projects, not necessarily in academia. Such project managers do projects. They rather do not research about projects and the underlying scientific aspects. The PM community believes in life-long development of PM competencies (Mikhieieva, O.V, 2016) with contributions from various elements like training, education and project experience. In this competence development path the area and scope of Master's programme in project management can only form a certain part (Wolff, C.; Otegi, J.R.; Bushuyev, S.; Sachenko, A.; Ciutene, R.; Hussein, B.; Torvatn, T.A.; Arras, P.; Reimann, C.; Dechange, A.; Toledo, N.; Nuseibeh, A.; Mikhieieva, O,2017).

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The EuroMPM consortium believes in the benefit of Master's education in project management. The goal is the combination of three aspects:

- Students should learn the necessary knowledge about processes, methods and tools for project management. They learn about relevant side aspects like leadership, business administration and IT. This knowledge is at the edge of the advancement of the body of knowledge in project management. It comes from the latest research in project management.
- Students are using and practicing processes, tools and methods as much as possible during the semesters. By doing this and by being trained and coached they develop the required skills. Therefore, they are exposed to project situations. This is only possible to a certain extent since academia cannot provide a full real world project scenario. Nevertheless, providing as many real world project management experiences as possible is an important goal in EuroMPM. The international classroom, the industry cooperation and the projectized didactic approach support this goal.
- Students and researchers jointly work on analysing, interpreting and discussing the observations during the participation in the EuroMPM programmes. Students are introduced to scientific methodology and ongoing research. By doing so, they develop the attitude and ability to perform a scientific reflection of project management and to develop new scientific findings. Graduates from the Master's programmes can continue the scientific working into doing a Doctorate at several of the partner universities.

Therefore, Master's education in project management is filling a very relevant gap in the development of excellent project management experts. It bridges the gap between practitioners and researchers, between industry and academia, and between scientific theory and practical application. It defines a focal point connecting the two parallel paths of doing project management and reasoning about project management.

For the EuroMPM consortium, it is very important to understand and to find a consensus on what is the role within the international project management community. It is important to understand the role of Master's programmes in project management and to know the capabilities of such programmes. We need to know what we can do and what we cannot do. Apart from the work in project management research and education the consortium wants to find answers to the following questions:

- What is a Master's programme in project management? What competencies can be delivered by conducting it? Why Master's?
- Why should we do Master's education in project management? Where does it help?
- How can it contribute to better project management? What can be achieved in education? What can be achieved in research?
- What are the capabilities of the programmes and of the consortium?
- Which outputs can be delivered? Which outcomes can be achieved? And what impact does it have?
- What other things can be delivered apart from educating students? How can it contribute to the body of knowledge?

Answering these questions leads to the core questions: What are the capabilities of the EuroMPM consortium? How does it work? What can be achieved by the consortium? How is it organized? It is the question for the organizational DNA of the EuroMPM.

Organizational DNA
The concept of the organizational (or corporate) DNA was developed to find a description (or a coding/phrasing) of the core characteristics, capabilities, behaviours, structures and motivations of an organisation. The idea of the DNA is to separate what an organisation is learning (like a brain) and what is already inherent or embedded into an organisation (like a gene or DNA).

Neilson, Pasternack & Mendes came up with the concept of an organizational DNA which is using four bases: structure, decision rights, motivating factors, and information (Neilson, G.; Pasternack, B. A.; Mendes, D, 2003).
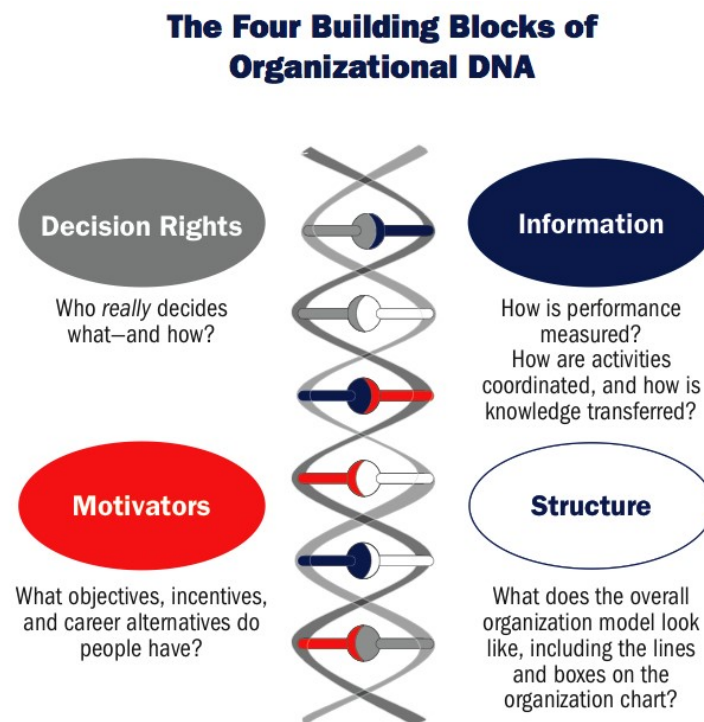
Fig. 3: **Model published by Booz & Company**

Source: Neilson, G.; Pasternack, B. A.; Mendes, D., 2003

The idea is to describe the basic processes and principles embedded into an organization by grouping them into four areas which describe a stable core causing the behaviour and capabilities of the organization. In addition to the four "formal" bases (building blocks of the DNA) the four "informal" bases are added: norms, commitments, mindsets and networks. They correspond to the "formal" bases in pairs: decision rights – norms, motivators – commitments, information – mindsets, and structures – networks.

This forms a comprehensive model describing the underlying cause-and-effect mechanisms embedded into an organisation.

- Denervaud & Chatin re-phrased the four organizational bases for innovative organizations (Denervaud, I.; Chatin, O, 2011). The initial concept of Neilson, Pasternack & Mendes did not reflect the dynamics of an innovative company since it was focussed on stable and longer-lasting aspects. For the innovative company, the four organizational bases are:
- Actors are the people involved in the innovation process in an innovative company.
- Ideation is the process of idea generation and communication.
- Emotion is a broader concept than the motivators proposed by Neilson, Pasternack & Mendes.
- Collaboration describes how people work together in the innovation process.

Denervaud & Chatin added factors that may mutate organizational DNA (innovation as change):

- Discontinuity is a very important driver for new ideas since really new ideas describe the end of a continuous development process and the start of a new process.
- Traditional (or historic) playing fields are the environment where the organizational DNA is developed and coded.
- New lands describe the factor of disruption by defining horizons which introduce completely new findings. Reaching a horizon opens the path for something innovative.
- Finally, individuals may alter the organizational DNA by bringing in their own, new DNA.

Neilson, Pasternack & Mendes as well as Denervaud & Chatin focus in companies as a specific type of organisations. Nevertheless, some of the aspects apply to other organizations, too. Christensen & Eyring used the concept of organizational DNA to characterize innovative universities (Christensen, C.M.; Eyring, H.J, 2011). The description helped them to understand and to communicate how two American universities developed themselves into very successful higher education institutions by leveraging on the strength incorporated into their DNA. By understanding the competitive advantage coming from their past organizational development, the two universities where able to develop their own profile and to position themselves as successful players within the higher education system.

The European Qualification Framework - EQF describes the competencies and qualifications connected to eight standardized competence levels. With the description of competencies based on knowledge, skills, abilities and attitudes, the EQF provides a code for competence profiles. A competence profile on a certain EQF level can be considered as a part of the DNA of the respective person. The DNA of a higher education institution (HEI) has to reflect the

competence profiles of the people which are educated. The DNA of a Master's programme has to be aligned with the DNA of the graduate (in terms of competence profile).

Competencies are a big topic within project management education. They form foundations of the respective PM standards and they are the basis of PM certifications and study programme accreditations. The competencies connected to the EuroMPM have been a research topic for the consortium for many years (Wolff, C.; Otegi, J.R.; Bushuyev, S.; Sachenko, A.; Ciutene, R.; Hussein, B.; Torvatn, T.A.; Arras, P.; Reimann, C.; Dechange, A.; Toledo, N.; Nuseibeh, A.; Mikhieieva, O, 2017). Therefore, the competence profiles are based on a consensus of the consortium and form a part of the DNA of the EuroMPM.

In the context of accreditation and re-accreditation of the Master's programmes of the EuroMPM consortium and in connection with funding applications (e.g. Erasmus+), the effectivity and efficiency of the programmes and the work of the consortium is researched and analysed. The analysis considers the direct outputs delivered by conducting the Master's programmes (e.g. modules which are evaluated with surveys amongst students), the outcomes of the completed programmes (e.g. graduate point of view) and the impact of Master's education in project management for industry and society. Connected with the input to the programmes (e.g. teaching hours) in cause-and-effect chains, this forms a result-oriented monitoring (RoM) based on the iooi method (input-output-outcome-impact) (Wolff, C.; Mikhieieva, O.; Dechange, A, 2017). Reviewing the iooi of the EuroMPM gives further information for the description of the DNA of the EuroMPM.

Proposing the EuroMPM DNA

Thinking about the DNA of EuroMPM means to develop a conceptual model for the DNA of a Master's programme in project management and to apply it to EuroMPM.

The starting point should be the definition of the "bases" of the DNA. These are the categories with which the EuroMPM can be described or defined. A proposal inspired by the different existing models could be the following:

1. **Educate & Teach PM:** The core motivation of the Master's programmes of the EuroMPM is to educate students to become competent and successful graduates according to the requirements of EQF level 7. Graduates should have some of the competencies defined in the different PM standards in order to do project management. In addition, they should be competent to use scientific methods to reason about project management and to develop new scientific findings. Apart from the students (and graduates), the actors of the EuroMPM are the teachers and scientists. The way how and what we teach and how and what we learn is part of the DNA of EuroMPM. The didactic model and the learning and teaching formats are part of the DNA, too. New lecturers, scientists and students (but also new industry lecturers, visitors, etc.) are the individuals which innovate and develop the DNA of EuroMPM. The people who learn and teach are committed to the programme and community. They share the vision and values of EuroMPM.

2. **Research about PM:** the scientific work in the field of project management is an important part of EuroMPM. The consortium members intend to contribute significantly to the

development of the scientific body of knowledge which forms the basis of their teaching and education. To offer students access to scientific work, they need to get involved into scientific work. Furthermore, in addition to the Master's students and as a path for continuation, the work of the PhD students of the EuroMPM consortium is an integral part of the overall concept and the DNA. The research activities form the link and information flow about project management within the community. The joint work forms the common mindset about project management and how Master's education in project management has to be delivered. This forms the ideation process of the EuroMPM consortium. New lands are (for example) discovered by researching about the impact of the digital transformation, sustainability or new PM paradigms like agility. The ability for own scientific work is a distinguishing factor for EuroMPM compared to the efforts of associa¬tions, professional bodies, training centres and industry practitioners. EuroMPM contributes to the world-wide PM community by bridging the gap between science and application.

3. **Build a PM expert community (internal view):** The EuroMPM consortium with its lecturers, scientists (including PhD students), students, graduates and industry practitioners forms a large and influential expert community. The model of the virtual, cross-border Master School with the exchange of students and lecturers, the education and collaboration formats, and the intensive interaction due to the annual events forms a kind of structure for this community. Double degrees and recognition of credits, curriculum alignment for accreditation, agreements on the syllabus and the body of knowledge, a joint language of PM science, and (last but not least) a common sense about how to collaborate and interact are important ingredients for the DNA of EuroMPM. This community is the playing field where the EuroMPM is developed, discussed, challenged and brought to life. Understanding the power of the consortium and playing to its strength will be a key to the success.

4. **Shape the PM world in Europe (external/ impact view):** For a quite informal and self-organizing community it is probably most difficult to describe the own philosophy, the values and the ultimate goal. Nevertheless, this kind of reflection is an important part of the definition of the EuroMPM DNA. Since the consortium is not a formalized organizational structure (with even no formal membership), the decision rights and norms are not codified. Decisions and norms are based on a common sense, agreement and understanding amongst the members of the consortium. It is based on a common view on PM and EuroMPM which is derived from a similar view on underlying principles. EuroMPM has the word "Europe" in its name. The consortium members come from (or to) the cultural space of Europe. Their efforts are driven by beliefs and motivations – meaning by their emotion. This emotion about how things are or should be is the basis for many informal organisations. People share the same view and strive for impacting reality by joining forces. The EuroMPM consortium wants to transmit its view on project management in the 21st century and in Europe. The common ground is a belief in fact based decisions, in equality and humanity, into the philosophy of enlightenment, in the rule of law, into European values, into international and transnational cooperation, into the European principles of higher education, and into the principles of science. This view is not based on the assumption of superiority (since European values include the responsibility for colonialism and imperialism, for example) but on openness and curiosity towards others. Such values are important for the EuroMPM consortium in terms to be able to describe the impact which the EuroMPM wants to have on the PM community, on industry and society, and on Europe and the world. Shaping the PM world in Europe means to innovate, to change (which involves discontinuity), to steer and to

influence. To tell others where to go, the EuroMPM people need to know where to go for themselves first.

Implications for the development of the EuroMPM

A joint formulation of a EuroMPM DNA can help to derive decisions and strategies from it. This can form the basis for the further development of the EuroMPM in a goal driven, structured process. Taking into account that the EuroMPM consortium is not a formal organization but a self-organizing system of independent (and sometimes contradicting) organizational units (the Master's programmes and universities), it is difficult to set up formal decision processes. Therefore, a joint strategy has to be based very much on joint views which have to emerge in discussions and which have to arrive at a kind of consensus. With a consensus about what the EuroMPM is and what it should be, a strategical analysis can identify the relevant areas for action. Connected with the different bases of the DNA and the description of the respective characteristics, a SWOT (strengths, weaknesses, opportunities and risks) analysis can be formulated. It is the basis for the further steps. Goals are derived from the opportunities, taking the strengths and weaknesses into account. For the risks, counter measures and mitigation measures can be defined.

With an action plan based on the SWOT the consortium can work on the implementation of the actions. This involves (for example):
- Working on the Master's and PhD programmes at the partner universities.
- Developing exchange and interaction.
- Defining projects for implementation of the actions and acquiring funding.
- Attracting the right people and partners.
- Increasing the scientific impact of EuroMPM.
- Building networks and strategic partnerships.
- Communicating and marketing the EuroMPM.
- Positioning with in the universities, the HEI system and the PM community.

Working on these items is about setting up projects. Driving the development of EuroMPM is project management. Identifying the areas for development is research about project management. Therefore, thinking about the EuroMPM is a kind of meta-research about us and our work. Something, universities and scientists are very good in.

Conclusions

Thinking about the DNA of EuroMPM can be an important step for the further development and for achieving success. Furthermore, discussing and thinking about us is a motivating team experience where a consensus is an experience of success. Such a discussion forms a team spirit and leaves the consortium members with a feeling of strength. Coming back to their home institutions, they can convince others and communicate what their work is good for. Coming from a strong consortium their position is strengthened, too. This is the reason why

organizations like to talk about themselves. It's about self-assurance. It should not distract people from doing their work in delivering education and doing science on project management. Instead, it should help to become better, to have better outcomes and a bigger impact on how project management is done in the 21st century in Europe.

Acknowledgement

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PROJECT MANAGEMENT IN A CULTURAL CONTEXT

Christian Büll, **Silke Palkovits-Rauter**, **Monika Beata Szabo**
University of Applied Sciences Burgenland, Austria

Abstract

Theories of project management are well structured guidelines to bring projects to success. Available studies on project success factors stress out that commitment on decisions, reliability and engagement within organizations as well as the benefit for the project sponsor decide over success or failure. In an international context projects face other cultural, technical and economic challenges. For project teams that work together in EU-funded projects the acceptance of cultural differences and the consideration of one´s own and foreign cultural peculiarities form the basis for a successful cooperation. These projects usually produce results for several project sponsors, decisions are made by the coordinator and not directly with the project manager on the partner side. Agile methodologies are simply not possible and project communication is well defined in the project planning phase and alignments are difficult to put through. The authors of this paper stress out that one important project success factor are culture. According to current literature this issue in the context of international project management has potential for further research. With the aim to close this gap a set of selected EU-funded projects are analysed for success factors and problem areas. This paper provides the criteria catalogue of the conducted analysis and a recommended course of action.

Key words: *project management, globalization, regionalization, project goals, intercultural projects*
JEL code: A1, A3, J5, J8

Introduction

The European Union is one of the world's major trading partners and the world's largest donor of development aid. It faces many challenges and opportunities in an increasingly complex and interconnected world. Cohesion and peace in the border regions create closer cohesion in the EU and represents a role model for the outside nations. This effort to strengthen economic and social cohesion within the European Union is being realized within the framework of the Regional policy of the European Union. This framework invests in balanced territorial development that promotes economic growth, improves quality of life and supports sustainable development as a whole (Fligstein, 2008).
This territorial cooperation is being implemented under the INTERREG programs of the European Regional Development Fund (ERDF). Aiming to find common solutions to common problems in joint projects between national, regional and local actors from different member states (Interreg Programme, 2017).
International projects are associated with immense investment costs. Particular attention should be paid to publicly funded projects, as missing them means not only a material loss, but much more: these projects are financed with taxpayers' money and the project aims generate

added value for the general public. Such projects are instruments of shaping the future, which can provoke positive and sustainable developments in society. Therefore, it is more important to bring them to a successful conclusion. The main goal of project management is to complete a project successfully. Successful means that earnings have been achieved and deadlines and budgets have been met. Different perceptions, goals, and work results, but also how the collaboration is organized can hinder success (Thomas, 2013).

The distinction between national and international projects also arises from varying degrees, the number and types of stakeholders and the risk intensity. Due to their increased complexity, projects that cross national, cultural and temporal borders have increased demands on project management. Complications and misunderstandings arise often not only through the language itself, but through cultural differences, through the different meanings of the said and culture-related behavioural differences. These are different expectations of leadership behaviour, proximity and distance, different ways of dealing with time, or to what extent information explicitly or implicitly is expressed (Köster, 2009).

According to Thomas et al. (2011) there are estimates that postulate that 40 to 70 percent of all international projects fail. Various studies show that problem areas in international project work are often caused by the factor "culture" (Kinast & Thomas, 2011).

Project managers in international projects need the ability to contribute to the international economy in a qualified and informed manner. To be taken seriously on a global scale, a project manager must have a sound understanding of environmental issues. The ability to intuitively grasp cultural differences and adapt behaviour accordingly in an intercultural encounter with foreign business partners may very well have a positive, long-term effect on the business relationship in terms of communication and sustainable cooperation (Thomas, 2013).

Culture and organizations are thus considered being two sides of a medal: both are reciprocal and conventionalized communication products. On one hand, both the culture and the organizations in which we operate influence our thinking, speaking and acting. On the other hand, we reproduce them again - cultures and organizations can only exist because we think, talk and act that way. Culture and organizations are organizing a force that gives meaning and orientations, facilitates and legitimize communications and actions, but at the same time limit them.

Culture is not only unified by enabling cooperation and collaboration, but also differentiating: Different cultural embedded leads to different behaviours, yardsticks and behavioural expectations. Cultural artefacts give people the framework for action. There is a great potential for synergy in the diversity, but also the danger of disturbances, which make it difficult for us as a group to make the necessary adaptations (Becker & Alafont, 2015).

Every person carries patterns of thinking, feeling, and potential acting, which were learned during his or her lifetime. In most Western languages culture commonly means the refinement of the mind and is partly shared with people, who live in the same social environment. Each individual is determined by the inherited physical and psychological characteristics of humans, the culture learned and the individual personality (Hofstede, 1997).

One of the classical considerations of evolutionary theory is the Red Queen Hypothesis. It generalizes that the intensive exchange between different individuals increases the survivability of a population. In order to be a successful for an organization in its constantly changing environment, the most diverse communication means must accompany the changes in the framework conditions in order to enable adaptations over and over again. The more intensively these communications take place, the greater the likelihood that an organization will succeed in its environment (Bell, 1982).

We distinguish intercultural project management from the international one by the fact that it takes place not only under the conditions of different countries, languages and legal systems, but also that different behavioural expectations, styles, narratives, mindsets, moral concepts, habits and worldviews, different ideas of right and wrong, of good and evil, of just and unjust, and above all of appropriate and inappropriate must collide and come together. Above all, intercultural project management has higher social complexity, not technical or legal (Becker & Alafont, 2015).

This article aims to interrogate the phenomenon of intercultural competences within the field of EU-funded projects. The aim of this work is to develop an interculturally adapted competence profile for the international project staff and to derive recommendations for their intercultural development. Within the thesis, the theoretically determined peculiarities of international project management are presented. The paper describes the working methods in European projects, potential problem areas of intercultural interaction and intercultural competences. Therefore, in the empirical part, the project participants will be questioned, in order to gain insights of an independent competence profile of the international project member. This guarantees a safe and successful appearance in the foreign cultural environment.

The realization that the complexity of international project management can only be successfully overcome by considering cultural peculiarities summarizes the core message of this work.

Project and Knowledge Management

Next to standardized or semi-standardized project management theories and their methodologies with an impressive research track record, knowledge transfer and collaboration are major topics within the discipline of project management. The main aim of knowledge transfer within a system is to make knowledge available at the right time, the right place and to the appropriate circle of users. The term collaboration describes the common work of people within a team, projects or departments. Usually this collaboration work is based on a social collaboration software used to communicate and collaborate within teams.

Knowledge management aims in generating an environment where sharing knowledge is one major pillar instead of hiding it from others. This management discipline emphasizes the teamwork of persons willing to share their knowledge and gain advantages at the same time (Al-Alawi et al., 2007). Back in 1998, KPMG published a study called "Knowledge Management" where participating organizations claimed knowledge management to be a major part of business life and to change their organizations dramatically. Success factors of knowledge management are new strategies and ways of teamwork, the alignment of organizational culture and the allowance to invest time in knowledge generation for employees (KPMG, 1998).

Project management as such depends on formal and informal knowledge exchange between team members within a project. Sometimes these knowledge transfer processes happen automatically, and team members are not conscious about the importance of knowledge in this environment. Explicit knowledge turns to be an important success factor for projects.

In this context an appropriate definition for project management in relation to knowledge is provided by the Project Management Institute: *"Project Management is the application of knowledge, skills, tools and techniques to project activities to meet project requirements. This application of knowledge requires the effective management of appropriate processes."* (PMI, 2013).

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There is general consensus that projects are value drivers for industries. On the other hand, it is difficult for companies and research institutions to define and measure success. Framework concepts such as Project Management Body of Knowledge (as a basis for the waterfall model) (PMI, 2013) or agile approaches such as SCRUM provide clear guidelines for the evaluation of success (Scrum Alliance). However, these are very one-dimensional and often negate the complexity of projects. Projects in this environment can be classified as complex, individual and highly specific (Kütz, 2007). It is therefore important to define the terms "performance" and "success".

"Performance" has different meanings depending on the field of application (Gleich, 2001). For example, "Performance" subsumes the doing as well as the result of the doing, depending on the context. In (Aguinis, 2009) two characteristics for performance are mentioned: the first one where performance is linked to subjective perception/evaluation and external factors and the second where performance is not linear, it depends on many factors, not least the circumstances and objectives, not just the result achieved or the fulfilment of expectations.

In the style of (Aguinis, 2009) it can be said that performance describes goal-oriented action. The characteristics that make up the desired performance depend on external factors and the behavioural characteristics of the people performing the work. Performance has several dimensions, including measures for profitability, goal and customer orientation in terms of quality (effectiveness) and indirect benefits for the organisation, such as impact on reputation or knowledge acquired. Performance management is part of the corporate culture and can be summarized in simple words: Where do we want to go, and how do we get there? According to Marr (2006) the performance measurement can be divided into three categories: 1) Reporting: to fulfil organizational and legal obligations, 2) Control people's behaviour: Making progress, achievement of results and personal goals visible is an essential aspect of reward systems and motivation and 3) Learning organizations: New decisions must be questioned, decisions already made must be reflected upon in order to drive continuous improvement.

Performance measurement must be aligned with the organisation's strategy and objectives (De Waal, 2013). Moreover, if the project team members who manage a project cannot learn from their previous experiences, then the achievement of the objectives cannot be guaranteed. Performance cannot be improved without people, and people are the drivers of project success. (Abbas, Gravell, & Wills, 2008).

Project success, on the other hand, is often measured in the categories on time, on budget and on quality. *"Doing something right may result in a project which was implemented on time, within cost and to some quality parameters requested, but which is not used by the customers, not liked by the sponsors and does not seem to provide either improved effectiveness or efficiency for the organisation, is this successful project management?"* (Atkinson, 1999). However, this approach is the most widely used approach to measure project success. Time, cost and quality can easily be measured against quantifiable indicators that take financial efficiency into account. Measuring other aspects that are more related to quality and achievement of objectives than financial aspects is more complex (Cooke-Davies, 2002).

It is clear that project performance and success consist of several qualitative and quantitative components. Completeness is only achieved if a model takes these multidimensional aspects into account (Shenhar et al., 2001).

Project Management in an International Context
International projects are an extension of a national project with an additional international client, an international project group, or with the provision of a substantial service

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abroad. Culture with its basic assumptions, values, norms, attitudes and beliefs manifests itself in a variety of behaviours. Thus, these cultural specifics play a central role in international projects (Giesche, 2010).

The typical uncertainties and risks of project management above all due to resource, information, and time constraints, are massively increased or even multiplied by the influence of intercultural communication processes. Giesche (2010) identifies the following subjects as critical success factors in international project management:

- Stakeholder

- Negotiations

- Communication and information

- Team development

- Leadership

- Decision making

- Conflicts and conflict management

- Quality (the fulfilment of the requirements)

- Major project services abroad

Communication

Project communication plays an important role within the entire project phase. It's about conveying information between project members, project owners, stakeholders and other environments. Care must be taken to ensure that the right amount of information is provided at the right time with the appropriate conduit of communication so that a productive exchange of information as well as knowledge is guaranteed. To design the communication strategy in a project accordingly, a communication concept that is already prepared in the planning phase should be designed (Bär et al., 2017).

Communication is seen as management task and therefore the project manager is responsible to manage the communication interfaces to customers, team members, colleagues, experts, consultants and other stakeholders (Noe, 2009).

Project communication management includes the timely and appropriate generation, collection, distribution, storage, retrieval and final disposition of project information. Project managers spend most of their time communicating within the team and with other stakeholders. Needed communication skills are for example active listening, asking questions, finding facts or confirming information, being convincing, negotiating, resolving conflicts, combining facts and identifying next steps. (Snyder, 2014).

Communication activities can have many forms, such as: internal and external, formal and informal, vertical and horizontal, official and unofficial, written and spoken, verbal and non-verbal.

Oral and written communication is, according to Patzak & Rattay (2008) part of a project information system. Problems that can arise in practice in the field of communication are that the team members talk past each other because they do not have the same understanding or a different interpretation. Decision making can also lead to problems due to communication when project leaders make decisions without having previously obtained sufficient information and coordination. Too much information can be a hindrance. Not every project member needs the same amount of information. It is important that every employee receives the relevant information for him or her.

There are a lot of different communication channels in a project. The project manager should include the number of possible communication channels in the planning of the communication. The calculation results from n (n-1) / 2. In this case, n is the number of stakeholders in the project (Snyder, 2014).

The two most commonly used informal communication media in the professional context are telephone and e-mail. E-mails are used to receive messages and send them to as many people as you like. E-mails count as asynchronous communication (Patzak & Rattay, 2008). The difference between synchronous and asynchronous communication is that with synchronous communication the communication partners are in the communication situation at the same time. Examples of synchronous communication are chats or audio and video conferencing.

Communication in Project Management Phases

According to the PMBOK Guide (PMI, 2013), project communication management includes the following processes, so that the information can be generated, collected, distributed, stored and retrieved in due time, and thus the communication process (see Fig. *1*) within the project results (Snyder, 2014):
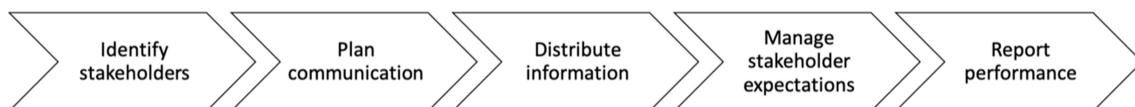
Source: (Snyder, 2014)

Fig. 1 **Communication Process**

The goal of the starting phase of a project is to create a unified picture (big picture) within the project team and its environment. It is important to communicate the goals and visions of responsibilities. If no communication rules have been set up in the project team, this should be recorded in writing during the project starting phase for all types of communication used (Patzak & Rattay, 2008). Oral communication channels are for example interviews (with clients, project managers, etc.), the kick-off meeting, project start meeting and workshop, informal discussions. Reports and documentation in written for are project order, project planning documents, project organization, the project information system, various protocols and the project handbook.

A very important step in the project starting phase is the identification of stakeholders. As already mentioned, stakeholders are individuals or organizations that will influence or be influenced by the respective project. The documentation about stakeholders contains the level of interest (high, medium low), the type of relationship (negative, positive or neutral) and the influence on the project´s success.

In the second project phase, the planning phase, the designed communication plan determines the conduits of communication per stakeholder. It is about what kind of information, when, how and by whom is provided to which receiving entity. What is important to mention at this point is that the content of the provided information is always the same, meaning that everyone receives the same information but in a tailored manner. The aim of the planning phase is a communication plan and the updated project management documents (project plan, stakeholder register, stakeholder management strategy). The communication plan is part of the project management manual or supports it. The scope is based on the needs of the project. Contents of such a communication plan are for example stakeholder communication requirements, rules for communication (language, format, level of detail, etc.), persons responsible for distribution and authorization of the information, timeframe and frequency for the distribution of information, people (groups) receiving information, methods and technologies how the information is transmitted, resources available for communication activities (time and budget), escalation process, glossary, flowcharts, communication restrictions or guidelines and templates (Snyder, 2014).

During the realization phase two main activities in the context of communication have to be considered. The process of distributing information involves the transmission of relevant information to stakeholders as determined in the previous project phase. This process takes place throughout the entire project. The distribution of the information can be done through various channels and methods, such as meetings, video and audio conferencing, electronic communication or printed material. The process of managing stakeholder expectations consists of the active communication and the teamwork with stakeholders where necessary. The goal is to meet the expectations of each single stakeholder and to identify or to counteract the issues as they occur. With this behaviour the stakeholders feel to be actively engaged so that the acceptance of the project results is more easily accepted. If problems with the stakeholders arise, these are addressed or, in the other case, included in the risks. If there are changes in the stakeholders' behaviours or attitudes, they will be processed in change requests (Snyder, 2014).

Within the monitoring and controlling process which spans all over the entire project duration the reporting process is collecting and distributing information about the project's past success, including status reports, progress measurements, and forecasts. The information that is distributed must have the relevant level of detail for the target audience. To report the performance, the project plan and other documents are necessary. The goal of this process is to summarize and present the necessary information within appropriate reports (Snyder, 2014).

According to Patzak & Rattay (2008) the following communication takes place in the project completion phase: oral forms are lessons learned a final presentation to the project sponsor and/or customer and feedbacks, reviews, retrospectives and reflexions on project course. Written reports and documentations include project completion report, lessons learned and an inventory documentation of the project.

The conduits of communication and the quality of the content are critical for the success of a project. Everyone absorbs and processes information differently. Through this behaviour individuals create their subjective reality. Because of these different views, misunderstandings

in communication between people often occur. Important information is left behind because it is not understood. One of the main challenges arising in projects is the clear and understandable presentation of the content that is to be communicated (Artreus GmbH, 2013). Since projects are separate social systems, communication and culture may differ from the rest of the organization (Patzak & Rattay, 2017). However, the structure of the organization has a major impact on project communication requirements (PMI, 2013). The motivation of each individual and the project team as a whole is a great challenge for each single project.

Cultural Dimensions

The term culture is defined in various ways in social sciences. The authors Thomas and Ulter (2013) summarize the different cultural definitions as follows. By 1952, Kroeber and Kluckhorn had found over 150 cultures and began to compare them. The results range from the thesis that culture should not be defined at all says Segall in 1984. Trompenaars and Hampden-Turner (1997) interpret culture in the light of Schein (1985) as *"the way in which a group of people solves problems and reconciles dilemmas"*. Although they take an application-oriented perspective, they limit the function of cultures exclusively to the solution of problems. Hofstede (2001) describes culture as *"the collective programming of the mind"*. The idea that culture is the collective programming of people's thoughts, feelings and actions appears to be mechanistic-technicity, ignoring the fact that culture is actively created and constructed by people. Thomas (1993), on the other hand, designs an application-related and yet differentiated definition of culture: Culture is a universal, but for a society, organization and group very typical orientation system. This orientation system is formed of specific symbols and transmitted in the respective society, etc. It influences the perception, thinking, values and actions of all its members and thus defines their affiliation with society. Culture as an orientation system structures a specific field of action for the individuals belonging to society and thereby creates the conditions for the development of independent forms of environmental management (Thomas & Utler, 2013).

For this study, the following definition is used, which is appropriate for the requirements of management teaching: *"Culture is the set of basic assumptions, values, norms, attitudes, and beliefs of a social entity that are manifested in a variety of behaviours and attitudes"*. According to Kutschker culture consists of two levels. An invisible level called Concepta and a perceptible level of Percepta. Concepta is the deeper part of the culture and is a summary of basic assumptions, values, norms, attitudes and convictions of the people. Percepta is a phenomenon in which the Concepta expresses itself and which is empirically perceptible, observable, tangible through behaviours and artefacts (Kutschker & Schmid, 2008).
Different cultures influence each other in international projects and ventures. They combine a variety of subcultures. The main culture is the corporate culture. It is typical for a company and is influenced by subcultures. These include the national cultures, branch cultures and social cultures (Kutschker & Schmid, 2008).
Cultural differences are manifested in different ways. The variety of terms is divided by Hofstede as follows:

- Symbols are words, gestures, pictures, or objects that have a specific meaning that only insiders recognize as such (e.g., words of a language, clothing, hairstyle, flags, status symbols). New symbols are developing rapidly, and old ones are disappearing.
- Heroes are persons (dead or alive, real or fictitious) who possess qualities that are highly regarded in a culture. They are more like behavioural models.
- Rituals are collective activities that are actually superfluous for the achievement of desired goals but are considered necessary in a culture. They are practiced for their own

sake (for example, forms of greeting, homage, religious ceremonies). This also includes business meetings, which seemingly take place for a rational reason but, for example, give only the leading personalities the opportunity to assert themselves.

- Practices summarize symbols, heroes and rituals. They are visible to outsiders, but their cultural significance is not. It lies exactly and exclusively in the way these practices are interpreted by insiders (Hofstede, 1997).

Values build the core. Values show a general tendency in preferring certain circumstances over others. They are feelings with an orientation, for example evil and good, dirty and clean, ugly and beautiful, unnatural and natural, abnormal and normal, paradox and logical, irrational and rational. Values are among the first things a child learns. Learning values and practices changes with age. Until the age of 10-12 years, we quickly and largely unconsciously record all information from our environment. This includes the symbols, heroes, rituals and our core values. It then develops to a more conscious way of learning, which is mainly related to practices. The cited theoretical approaches related to culture form the basis for the development of cultural dimensions and cultural standards, which have become known in recent decades as central models for determining cultural differences and are presented below (Hofstede, 1997).

The concept of cultural dimensions is based on the basic idea that there are universal categories or themes that all cultures of the world have to deal with and for which they have to develop answers. Hofstede initially named four cultural dimensions that added another dimension later:

- Power distance: This dimension describes to what extent a society accepts that power is unequally distributed. A low power distance means that more participatory decision-making processes and flatter hierarchies are lived and desired.
- Uncertainty avoidance: This dimension describes the extent to which insecure situations are perceived as a threat. Applied to economic activity, a high degree of uncertainty means that a high degree of standardization is sought, and this may lead to a less innovation-friendly climate.
- Individualism / collectivism: The dimension describes the extent to which personal goals (individualism) are preferred to common goals (collectivism). For example, work with the goal of self-realization is more likely to be expected in societies with a high value in the field of individualism.
- Masculinity / Femininity: A masculine society is characterized by the prevalence of classical gender roles (men are tough, women are sentimental). Feminine societies, on the other hand, are less divided between these roles, and classical feminine attributes are generally more positive. In an economic context, masculine societies focus on monetary incentives and career perspectives; in feminine societies they are more of a harmonious and long-term employment relationship.
- Long-term / short-term orientation: A long-term orientation is characterized by the pursuit of goals with continuity and consistency. For example, this leads to higher savings rates and investment activities. A short-term orientation is characterized by a high priority of short-term profits and leisure time (Hofstede, 1997).

The cultural standard concept is a cultural relativistic approach to understand behavioural differences. The starting point is a definition of culture, which understands culture as a specific

system of orientation that fulfils binding interpretations and meaningful functions for a nation, society and group (Thomas & Utler, 2013).

Thomas (2013) writes *"If culture is defined as a national and linguistic entity, which provides its members with a sense-giving system of orientation, then the question arises which culture-specific orientation signals come into play for persons of different cultures when the encounter takes place under particular circumstances such as conflict resolution or managing specific, work-related tasks."*

In general, cultural standards can be defined on the basis of the following five indicators:

- Cultural standards are forms of perception, thought patterns, judgment and interaction that are shared by a majority of the members of a specific culture who regard their behaviour as normal, typical and binding.
- Own and other unfamiliar behaviour is directed, regulated and judged on the basis of this cultural standard.
- Cultural standards provide a regulatory function for mastering a given situation and dealing with people.
- The individual and group-specific way of applying cultural standards to adjust behaviour can fluctuate within a range of tolerance.
- Forms of behaviour that exceed this specific range are not accepted or sanctioned by the respective collective (Thomas & Utler, 2013).

Such cultural standards are in no way indicative for an entire culture. They provide insights into what makes up the respective culture as a whole. They are, however, helpful in navigating and accumulating knowledge about the other culture system of orientation and serve to explain unexpected and unfamiliar behaviour on the part of the interaction partner (Thomas, 2013).

The development of adapting one´s own cultural environment, such as parents and siblings, the expanded family, peers, educators, etc., is called enculturation. Enculturation builds a specific cultural orientation system that serves as an instrument for what is perceived and valued, how decisions are made, what is motivating, what goals are pursued, what yardsticks and frames of references are used to judge one's own behaviour and that of others. In cultural overlapping situations, people of different cultures become meaningful to one another and their own and foreign orientation systems become so effective that their own expectations regarding partner behaviour, the interaction and communication process and the entire situational context are not fulfilled. The doer is irritated and cannot quite explain what is happening (Thomas & Utler, 2013).

Intercultural Competence

Intercultural competence is explained differently in several research works. In order to better understand and limit the complexity of the term "intercultural competence", this article assumes that this term describes the ability to pursue processes that are describing the dynamics of closely linked members of different living environments, their relationships to each other and their interactions with each other (Bolten, 2007).

Intercultural constellations are "happening" in projects that are known to be temporary. Crisis caused in international cooperation can be divided into three areas: work (factual aspect), human (personal aspect) and culture (country-specific aspect). In factual or personal problems, the common methods can also be used. In contrast, a cultural problem area requires a sense of touch and intercultural understanding. Many conflict situations are caused by partners through

cultural misunderstandings, awkwardness or personal reasons. Often, such minor disagreements add up to international business. It happens that they are displaced by one party, and the other party may not even notice them. Such an accumulation of small discrepancies has a snowball effect. At a later date, it manifests itself in the form of apparently objective differences of opinion or methodological differences. When the conflict eventually escalates, it's very hard to figure out what the original and true causes are (Saidoun, 2015).

The Harvard concept of negotiation by Roger Fisher and William Ury achieves constructive cooperation and peaceful settlement in conflict situations. In the case of a sustainable agreement, therefore, the personal sensitivities of the participants should be taken into account alongside the entrepreneurial endeavour. While healthy mistrust is justified in certain circumstances, a constructive attitude is to use positive mistrust instinctively, which also has a natural protective function. It makes you clairaudient for a trick or a cunning manoeuvre. Mistrust should not stand in the way of creating a good partnership. It should also not be a question of who starts to trust first. Whoever takes the initiative, also directs the course of the project (Fischer, Ury, & Patton, 2013).

Culture characteristic of Austria and Hungary

Civilizations are differentiated from each other by history, language, culture tradition and, most important, religion. These differences are the product of centuries. They are far more fundamental than differences among political ideologies and political regimes. Differences do not necessarily mean conflicts, and conflicts do not necessarily mean violence. Over the centuries, however, differences among civilizations have generated the most prolonged and the most violent conflicts (Huntington, 1993).

Especially in Europe you can find even more heterogeneity in a small space. Striking are the different languages and the fact that not all EU states have introduced the euro. The further one digs into details, the clearer are historically shaped differences (Dörrenberg et al., 2014)

Even two nations that share a common history for a while may be completely different. Austria, the former Habsburg Empire, was one of the largest and most politically significant powers in Europe over centuries. For this reason, it is especially important not to be know-it-all, but to be cautious and courteous in communication relations. Thus, everyday communication in Austria is very polite and much is expressed in the subjunctive. The communication is indirect, direct rejections are uncommon and seem harsh. One emphasizes rather the own effort, than to reject a thing roundly. Rejection is often done by delaying and delaying, not a hard no (Eiselsberg, 2018).

Hungarian history is characterized by foreign rule and occupation. This fact has had an impact on the identity and inner attitude of the Hungarians to this day, leading to an ambivalence of the national self-understanding: national pride and upholding of one's own cultural values, mistrust of neighbouring states and fear of loss of meaning. Good personal relationships are essential for every business contact; they often count more than contracts. Everyone therefore struggles to create a good relationship at the beginning of collaboration: they eat together, chat about their private lives, and show themselves friendly and sociable. The communication is not direct and binding. "Yes, we agree," can also mean "We are not fundamentally averse". One should therefore always pay attention to the context of a conversation, take small objections seriously ("no" is rare) and sometime after the trial again carefully inquire about the state of affairs (Kövary, 2009).

Against this background, someone should always meet project partners on an equal footing. Devaluing statements about local customs or business practices are to be avoided in any case.

The Research Focus

The work focuses on the topic of intercultural competence as a central key factor for the successful implementation of international EU-funded projects. Consequently, the theoretical part of this thesis dealt with the discussion of topics such as international project management as well as culture and intercultural competence. The analysis of the topic international project management showed that international projects pose special challenges to the project in general. Cultural differences are one of the most important challenges. The examination of the topic of intercultural competence has shown that knowledge of the different cultural dimensions helps to facilitate the understanding of logical relationships between the norms and rules of a culture in international projects. Intercultural competence is an important basis for the encounter with foreign cultures. Therefore, this paper puts the focus on the topic: What competences, skills or characteristics should a project member, a project leader has in order to successfully implement international project work in the border region of the EU?

Data Collection Method and Data Analysis

Qualitative research methods are used when the goal of the research process is the exploration of phenomena and the development of new theories (Seidman, 2006). At the centre of the qualitative research interest are the personal perspectives of the respondent. In the foreground of the research interest are the subjective experiences and opinions of the interviewees. Consequently, the qualitative research method is used to address this objective (Mayer, 2012).

For the empirical investigation, an international project team was observed and interviewed. The project team members came from Austria and Hungary. Data collection focused on the personal perceptions of the individual project team members in terms of intercultural competences. In the evaluation of the narrative interviews, ten final categories were used, which influence the dynamics of the team as part of an intercultural project work. These are: balance of knowledge, emergence of a common language, organizational framework, culture, knowledge transfer, project management, project team, experts, and concept for cooperation, motivation and social interaction.

Findings

As mentioned earlier the empirical data was gathered through document analysis and interviews with members of the project team. This helped to identify the possible problems throughout the project and the preventive actions which were taken.

People who are aware of being in an intercultural situation tend to suspend their own basic cultural assumptions and behave differently than they would in a familiar and routine context. It is important to deal with the cultural dimensions of the host country and to get a first impression of what you can expect. It is equally important to develop awareness that cultural dimensions provide a first orientation, but their significance through cultural imprinting of the project partner to understand his or her way of thinking and working.

The main challenge which the project management team faced from the very beginning of the project was the fact that different partners had different perceptions of the project goal. It is

important to have an integration competence yourself, to understand one's counterpart; to absorb its otherness and to act in the interest of the project.

The principle of "abide by the agreed", which in Austria and other European countries is generally taken for granted in project work, is often interpreted differently in our project context by project partners.

A special cultural feature is also the handling of efficiency and the associated understanding of time. This also applies, for example, to the start of a conference, which is often delayed by 30 to 40 minutes, and in addition the meeting time was wasted on issues that could have been clarified faster in a different way.

There is no responsible initiator for relationship management. Project managers and all team members all need to get involved in relationship management and invest personally. It is important to know concrete behaviours that can build a personal relationship and reduce fear of contact. The word "fear of contact" is to be taken almost literally, since in many cultures, such as in Hungary, more frequent physical contact is sought than is customary in Austria. If you want colleagues to speak freely, you have to do something about it. You have to get to know the partner a bit closer. If there is a certain amount of intimacy and familiarity, then everyone is ready to give their honest opinion.

Difficulties during the project management were influenced by factors that only became effective during the project implementation, such as the implementation of preparatory and follow-up discussions in the intercultural project team or the evaluation of the project against the background of different organizational cultures. These factors could hardly be changed or adjusted by planning and the agreement of small-scale target values. We therefore advocate risk management in the preparation of intercultural projects, the cross-cultural forms of conflict transformation, mediation or similar offering.

Additional to the fields of competence for international project teams the empathy or emotional intelligence should become a crucial role.

Conclusion

The international projects are fragile constructs, because of their dynamics and involved risks. The special feature of international projects is the complexity of frustration-inducing factors and the lack of awareness of the lead organization to counteract with suitable measures. Therefore, traditional project management methods cannot fully capture the unexpected events. These hinder timely appropriate reactions but paying attention to the early signals and responding them at the right time is a support to face the challenges. A project manager must be familiar with the peculiarities of the national context in order to consider essential intercultural skills of success even before the project is deployed. These can be supported through the selection of the right project staff, strong mentoring, the contextualisation of project processes and project results, intensive verbal communication with all project partners, strengthening the bond by emphasizing the common past and much improvisation talent.

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ANALYSIS OF SWITCHING COSTS OF USING FLOSS FROM THE PERSPECTIVE OF PROJECT MANAGEMENT: OPPORTUNITIES AND THREATS

Cielo Gonzalez Moyano
Technische Universität Berlin, GHermany

Abstract

Given the increasing use of Free/ Libre and Open Source Software (FLOSS) in companies and the role of project managers leading the implementation of these solutions; it is more than relevant to evaluate the opportunities and threats that FLOSS brings into the project management ambit because of its own nature. These opportunities and threats are analyzed in relation to switching cost and the project management diamond. This analysis shows which of them could influence specific types of switching costs and in which aspects of project management may be taken into account in a FLOSS implementation project.

Keywords: Free/ Libre and Open Source Software, FLOSS, switching costs, project management diamond, open source implementation project.
JEL Code: O3

Introduction

Free/ Libre and Open Source Software is software that could be considered Free Software and Open Source Software. Whitout dealing with the controversy of what specifically implies to be one or another, it is possible to describe it as openly accessible source code, and based on this definition complete business models have been created. As impossible as it could sound to someone, the idea of freedom of distribution, freedom of use, not restrictions over the software and the knowledge behind it, and where one of the most important sources of work to create this knowledge comes from voluntary work, has developed a sustainable business model generally focused on services related to the use of FLOSS software (Donald & Foulonneau, 2014). A few years ago, FLOSS was just considered a topic related mainly to developers who were interested in sharing and creating software for their own needs and interests (Lakhani & von Hippel, 2002;Lakhani & Wolf, 2003;Demaziere, Horn, & Jullien, 2006;Jullien & Zimmermann, 2011). However, this impression is not up to date. Today this business model has penetrate the coorporate environment to the point that even if independent developers are still relevant in the open source community, the companies are one of the strongest investors in Open Source projects. Google, Facebook, Adobe, and even Microsoft consider Open Source as indispensable for their businesses (Sijbrandij, 2016; Vaughan-Nichols , 2018), which is not a surprise, given that it is a central point that attracts innovation and revenues.

FLOSS is generating an impact from the economy to the Information Society. Its spread and influence represents one of the most important achievements in the IT industry, and in other sectors by extension of the relevance of technology in the society. Gone are the days where Open Source Software (OSS) was considered a violation to intellectual property, now successful business models are created around it. Open Source Communities have really clear that customers do not buy technology, they buy solutions to their problems, and the complexity of the problems evolve pregressively with the level of innovation. This generates an economy where knowledge as a mutual resource is more than valuable, it is the key element of evolution. However, knowledge itself does not change the global economy, and Open Source

Communities know that. They have created solutions that throght the years have not just support a global technology growth integrating knowledge around the world, but also have boosted high quality software that compete with proprietary software without laying aside the FLOSS vision and the community support. They have created a sustainable business model from that, and they continue changing according to society's requirements. Normally, these businesses are oriented to offer services for OSS, generate incomes from commercial licences, propietary extensions of Open Source solutions, complements to allow proprietary software to interact with highly accepted OSS, and solutions that immediately solve specific needs. These are just some examples of how adaptable are business model around FLOSS. This adaptability has achieved the point where it is possible to find companies such as Black Duck Software that despite not directly contribute to Open Source projects, helps organizations to make easier the use of FLOSS. They offer services for identifying and managing FLOSS, ensuring compliance with licences, and identifying vulnerabilities. However, what it is even more impressive is that they have more that 2000 clients which include Nintendo, Intel, SAP, Samsung, and Siemens. This shows how far FLOSS has penetrated the corporate environment, that now companies are willing to pay to administrate their Open Source solutions. As is to be expected, companies do not invest where there is not a higher direct or indirect benefit. Therefore, it is relevant to analyze some of the benefits that FLOSS offers, and that attracts companies to use it:

- The opportunity of having a wide community of motivated people creating a product, increases the quality of it and allows to have fixed errors in a not significant amount of time.
- Legal right to use the software has been one of the key points in the consolidated growth of FLOSS, and depending from the Open Source license, it has provided companies the opportunity of use, modify, and even commercialize the product.
- Opportunity to pay for additional services if they are needed is also an option. When the company does not want or is able to provide specific services that a product could need, there are companies that support these processes. As was mentioned before, this is one of the main business models around FLOSS that represents incomes, which is why the services tend to be more approachable and reactive.
- Business agility in a constantly changing environment is a valuable opportunity offered by FLOSS to the companies. Through the use of Open Source Software, companies are able to generate faster solutions to their needs without the complexity of dealing with contracts management.
- Reduction of cost is one of the most significant advantages that FLOSS can offer to companies. Because they are not worried about spending millions of dollars developing software from zero, they can focus on what is really important, genereting value with their products.

The list of benefits could continue, but the question in that case should be why, if there are so many gains on using FLOSS, there are still companies and sectors which do not use Open Source solution. According to the 2018 Open Source Program Management Survey implemented by The Linux Foundation with the support of The New Stack and TODO, 53% of the companies say that they use Open Source Software or have plans to start to use it in a short period of time. This survey also presents that 85% of the IT companies with more that 10000 employees have or will have an Open Source Program, but also it shows that 74% companies with the same amount of employees in sectors such as multimedia, telecomunication, media,

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and financial are doing exactly the same. However, these percentages dicrease when we start to talk about companies with less than 10000 employees. In this case the use of Open Source is 56% in IT companies and 47% in others (The New Stack, 2018).

With this study, we can conclude that the size and the sector of the company influence how open they are to use FLOSS. However, the percentage associated to medium size companies is relevant, and according to the development process that FLOSS has had in the last years, we can predict this percentage will grow. For this reason, it is relevant to analyze some of the challenges that companies may face at the moment of starting an Open Source Program. The 2018 Open Source Program Management Survey presents as some of the main challenges: the strategy planning or knowing how to approach it (54%), getting executive support and buy it (36%), finding legal staff with Open Source expertise (29%), identify budget and estimating cost (25%), and finding an Open Source Program manager (17%).

Additionally to the previous aspects, there is also the challenge of the lock-in effect, which refers to a situation when the customers are forced to maintain a relationship with a specific provider because of the cost and the uncomfortable situation that could emerge from changing the provider (Eurich & Burtscher, 2014). These costs are called switching costs, and FLOSS business model is also influenced by this situation.While there is several information regarding the relation between the lock-in effect of propietary software, and what it means for open source projects inside of the industry, little is known about the perspective of project management in this kind of projects.

Given that project managers are one of the roles that will be the responsibles of leading the future of Open Source Programs inside of different companies, it is more that logic to evaluate Open Source implementations since the point of view of project management. In order to achieve this, we could evaluate different aspects; however, the focus of this paper is one of them, costs. In specific, this document will evaluate switching cost according to the project management diamond.

In this way this study will attend to contribute to some of the challenges of future Open Source Programs by analyzing from a project management perspective the three types of switching cost associated with the implementation of a FLOSS project. This analysis generates a set of opportunities and threats that could help project managers to understand how to approach a project of this type, how to justificate the project inside of the company and get executive support, and understand which specific aspects should be taken in mind regarding estimating costs at the moment of change from a proprietary to a FLOSS application. By helping project managers to evaluate financial, procedural, and relational switching cost in FLOSS projects with a focus on scope, quality, time and expectations; this document pursues the possibility of increasing the number of project/program managers with the skills to manage a transition to Open Source. As was stated before, this is a skill which is highly needed in today's business environment.

The remainder of this paper is structured as follows. Section II describes the basic concepts needed regarding FLOSS, Switching Cost and Project Management. Section III presents the relation between Switching Cost and FLOSS, and the analysis of this relation from the project management perspective is stated in Section IV. Finally, Section V presents conclusions and future work.

FUNDAMENTAL CONCEPTS

Free/Libre and Open Source Software Concepts

Free/Libre and Open Source Software refers to the software that stands for the four freedoms: freedom to execute the software, freedom to study and analize it, freedom to redistribute it, and freedom to redistribute the own work that is done over the application.

Switching Cost Concepts

Burnham, Frels, et al (2003) define switching cost as the "one time cost that customer associate with the process of switching from one provider to another". Aditionally, they also emphasize the importance of not associate them just with the immediate switching, but also with the process in general. This paper take into consideration this definition, and analized switching cost in the context of a software implementation until the operation is normalized. Normalized is defined as the moment when a company has in operation the software and has a plan for support, future developments in case these are necessary, and has already accepted what they win and what they lose with the change. The switching cost that are analized here correspond with the typology introduced Burnham, Frels, et al (2003) and Blut, Evanschitzky, et al (2016) . This typology is decribed below:

- Finantial switching cost: these costs represent suck cost, lost performance costs, and benefit loss cost.
- Procedural switching cost: these cost represent uncertainly costs, search cost, cognitive costs, and setup costs.
- Relational switching cost: these cost represent personal relationship cost, and brand relationship cost.

Project Management Concepts

The Project Management Triangle states that a change in one of the vertices will affect the others, and in order to maintain the level of quality in a project, it is necessesary to compensate the change in the other vertices.

Most recently, a new model has been introduced. While it is not clear it origins, the Project Management Diamond shows a novel approach. It presents the Expectations as an aspect that could be influenced by scope, time, cost, and quality.

This paper presents the idea of Project Management Plus in Fig. 1. In this perspective, Expectation is influenced by scope, time, cost and quality. If one of them change, the expectations will be affected, and the others should be modified to keep he balance. However, expectations are also able to influence the four coinstraints, and that is why it is managed as one of the other vertices in this document.

ANALYSIS OF SWITCHING COST OF USING FLOSS FROM THE PERSPECTIVE OF PROJECT MANAGEMENT

The main goal of a company for using Open Source instead of proprietary software varies. For some organizations, saving is the most important factor, for others is the flexibility and others is the need of fast developments. While the reason for using FLOSS change from company to company, what normally does not change, is that these companies have to face switching costs. The literature states that switching costs are classified in three categories: procedural, finantial and relational costs.
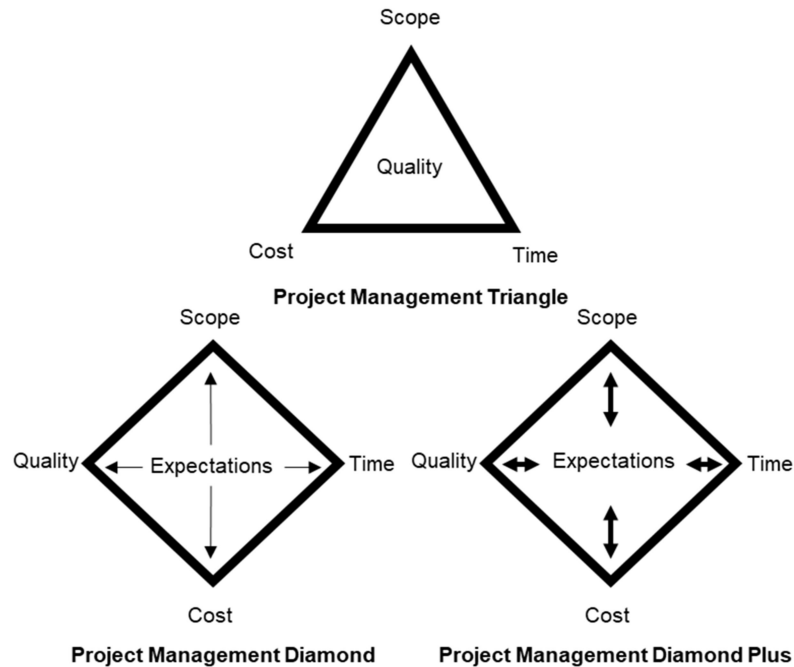
Fig 2. **Project Management Diamond Plus**

Procedural switching costs, also known as direct switching costs, are the first cost that a company has to confront when it is switching from proprietary to FLOSS. In this category, we can find as examples, the effort and time of finding a new provider, the uncertainty of adopting a new service, set-up costs and cognitive cost. On the other hand, finantial switching costs are easier to quantify because they are associated with loss of financial value. These costs include direct monetary expected costs such as the fee for breaking a contract or the fee to start a new one. However, they also include the cost of the perception of decreasing on financial performance and having sunk costs, which although are subjective in comparison with strict quantity values, have a relevant impact on a switching decision. This decision is mainly influence for the last type of switching costs, the relational switching cost. Personal relationships, emotional bonds, and identification with a brand are some of the results of bonding and loyalty strategies, and have the most important role at the moment of change from one product to another (Blut, et al., 2016).

Normally, a company considers changing from a proprietary to an Open Source application an implementation project, and in this context in the best scenario a project manager will be involve since the decision process. Additionally, in some cases a project manager may also be involved in the analysis of strategies and business decisions (Project Management Institute, 2018). That means that analyzing switching costs in the implementation of FLOSS applications from a project management perspective makes more that sense, it is vital. No matter why the organizational leaders decide to initiate these kind of projects, either because of legal requirements, stakeholders needs, changes in business or technological strategies or improvements in their products, process or services; a project manager is going to be the responsible for initiating, planning, executing, monitoring and controlling, and closing the

project. Through these Project Management Processes, the main function of a project manager will be to integrate the Project Management Knowledge Areas by tailoring tools, skills, knowledge and techniques according to the needs of the project. But what should have in mind a project manager when he/she is in charge of a project that consists in changing a proprietary software for an Open Source solution? What are the implications of switching costs in this process? Is an implementation of a FLOSS application as the implementation a proprietary application? Or are there specific opportunities and challenges that a project manager should evaluate regarding these type of projects? One way to unify in some extend all of these questions in one is asking: what are the opportunities and threats regarding switching cost of using FLOSS from the perspective of project management?

In this document, we pursue to answer this question by analyzing opportunities and threats of implementing a FLOSS solution taking into account particularities of Open Source business models. These opportunities and threats are related to switching costs in a way that they could affect them by reducing in case of an opportunity or increasing in case of risk. The paper identifies to which of these switching costs each of the opportunities or threats could be related. Additionally, it also suggests in which of the aspects of project management these opportunities and threats should be taken into account in an implementation project. Fig. 2 presents graphically this goal, and Table 1 and Table 2 show the result.
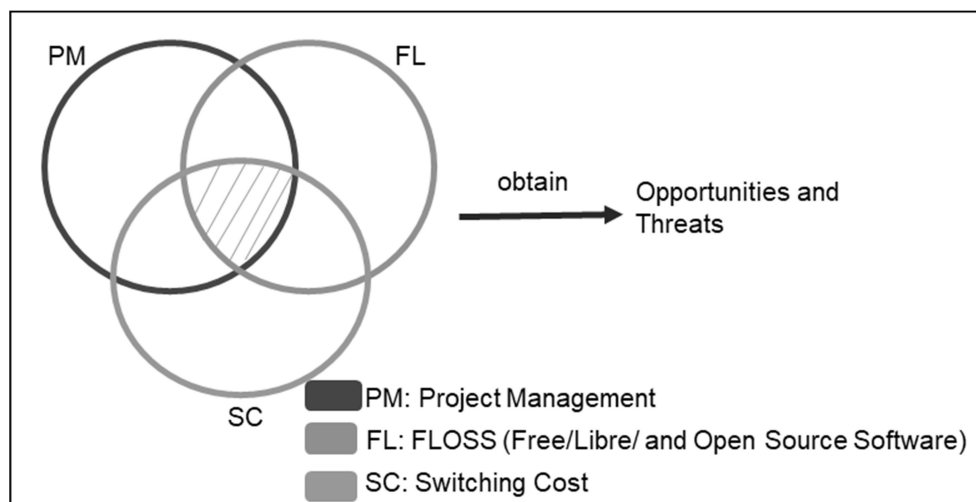
Fig. 3. **Strategy to obtain opportunities and threats regarding the switching cost of using FLOSS from the perspective of project management**

The opportunities and threats presented in this paper are the result of unifying the most common aspects that are mentioned as benefits or risks in formal and informal literature.

Opportunities

Taking into account that switching costs include all the cost that a company has to face when changing suppliers, and they are not just the cost at the moment of the switching (Burnham, et al., 2003); it is important to analyze the switching cost since this perspective. For example, when changing one software for another, a project manager shall evaluate the financial costs of breaking the previous contract and the suck costs. This includes among other

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aspects fines, monetary privileges that the contractor receives from the provider and that will not receive any more, and the monetary value that has been invested in the current software to achieve the expected functionality and that maybe could lose with the new application. However, a project manager also has to analyze the future financial implications of the change until the operation with the new software is normalized. In this paper, we consider normalized as the moment when a company has in operation the software and has a plan for support, future developments in case these are necessary, and has already accepted what they win and what they lose with the change.

This holistic analysis of the process shall be generated from the financial, procedural and relational point of view. According to this aspect, this paper analyzes in the Table 1 what would be the particularities of switching to an Open Source Software since the project management diamond perspective. The notation in this table is: Type of Switching Costs (TSC), Quality (Q), Time (T), Scope (S), Cost (C), and Expectations (E).

Table 1

Opportunities of using FLOSS and their relation with Switching Cost and the Project Management Diamond

Aspect	Type	TSC	Q	T	S	C	E
1	Opportunity	Procedural	x	x			
Normally, to execute research on quality attributes over a proprietary software in case of an auditory, the companies need explicit permission from the provider to access the source code or they need to use black box techniques (Spinellis, et al., 2009). This kind of research are executed throught specialized companies that charge a considerable amount of money. On the other hand, the use of Open Source Software allows an open inspection of the source code and the asociated data which ensure the quality of the applciation. Aditionally, tracking data bases, wikis, and forums make possible a transparent evaluation of the quality an security of the software. Before deciding to implement a new application in a company, it is possible to have the need of identifying quality aspects that could affect the decision, which could be done easily with OSS.							
2	Opportunity	Procedural	x				x
Before acquiring an application, companies perform a market study between the different possible applications. Candidate providers present brochures, proposals, demonstrations of the application and other activities that are required to sell an application. Selling is the main goal, and that is why is not common that they present quality issues in the application. Thus, the probability of having a realistic view of the status of an application is extremely low, making difficult to compare candidate applications since a detailed quality point of view. In this scenario, companies normally take one of two options, either do not evaluate the candidate applications in detail or to hire an external company with expertise in the domain, which recommends one of the providers according to the business model to be implemented. In comparison, the broad number of Open Source Projects that compete between each other in the same field, allow to compare them in quality aspects without the intervention of commercial or marketing areas (Spinellis, et al., 2009). Having the possibility of comparing the quality criteria of different applications, reduce search and uncertainty cost.							
3	Opportunity	Procedural	x				x

Aspect	Type	TSC	Q	T	S	C	E
The access to general historical information related to bugs and solutions from Open Source Projects is valuable at the moment of finding the causes to specific problems and possible solutions (Spinellis, et al., 2009). Compare with proprietary software, where companies have access just to the bugs and solutions that are related to them, Open Source Software offers an efficient way to improve and monitor quality.							
4	Opportunity	Finantial				x	
Costs that have been paid for the proprietary software are going to be sunk cost. However, the advantage is that the costs of proprietary licensing shall not be taking into consideration anymore.							
5	Opportunity	Procedural			x	x	
The setup of an application is an opened and known process, which in most of the cases is documented. When it is not documented, it is possible to extract the knowledge. This allows to retain control over the own computing environment and customize it (Varian & Shapiro, 2003). The company gains flexibility to face unknown requirements, and with this to unknown costs.							
6	Opportunity	Relational	x				x
Depending on the selected Open Source application, the brand recognition of the company could increase due to the well-known application. Additionally, if the application is well known, that means that there is an important amount of people supporting the application. This increases the quality of the product.							
7	Opportunity	Procedural		x	x	x	x
Open source commonly uses open interfaces (Varian & Shapiro, 2003), but also they create interfaces with the most common proprietary software. This provides flexibility, and ensure that the costs, time, and scope of the application is controlled. Interfaces between systems are a key point during an implementation project, and having the opportunity of controlling them, reduce time and cost of negotiations. Furthermore, it is a benefit that could be used to engage users.							
8	Opportunity	Procedural /Finantial	x	x			x
The opportunity of having a wide community of motivated people creating a product increases the quality of it and allows to have fixed errors in a not significant amount of time. A fast respond generates positive expectations on final users and increases the perception of having a high performance.							
9	Opportunity	Procedural /Finantial		x		x	
Legal right to use the software has been one of the key points in the consolidated growth of FLOSS, and depending from the Open Source license, it has provided companies the opportunity to use, modify, and even commercialize the product.							

Aspect	Type	TSC	Q	T	S	C	E
This is an enormous advantage in comparison to proprietary software because the company does not have to spend time or money in contracts or licenses. These processes are normally tedious, and depending on the provider and internal policies, it could take several months to concrete the purchase. Furthermore, if in the future the company wants to change the Open Source Software for another application, the suck cost will be minimal in comparison with a proprietary application.							
10	Opportunity	Procedural/ Relational	x	x	x	x	x
Opportunity to pay for additional services if they are needed is also an option. These services could go from training, manuals, or a complete customized environment, implementation, data migration, until more continuous services such as support and personalized developments. When the company does not want or is able to provide specific services that a product could need, there are companies that support these processes. This is one of the main business models around FLOSS that represents incomes, which is why the services tend to be more approachable and reactive. Reactiveness and business agility in a constantly changing environment is a valuable opportunity offered by FLOSS to the companies (Araújo & Gava, 2012), and it helps to develop a strong relationship between the providers and their clients because it generates the feeling of having a partner who understands the urgency of your needs and reacts according to this.							
11	Opportunity	Finantial/ Relational		x		x	
Reduction of cost is one of the most significant advantages that FLOSS can offer to companies. Because companies are not worried about spending millions of dollars developing software from zero, they can focus on what is really important, generating value with their products. This generates a feeling of high productivity and at the same time generates a stronger connection between FLOSS companies and their clients. However, it is important to mention that in some cases the Total Cost of Ownership (TCO), which represent not just the initial price, but also the cost of training, support, and upgrade, does not differ significantly between specific proprietary software and Open Source in specific cases. For example, some studies mention that the difference in TCO between Linux and Windows is just within 10% and 15% (Varian & Shapiro, 2003). This is not a significant variation, but if the relation Cost/Benefit is analyzed, it is understandable why Open Source Software presents an advantage in relation to proprietary software. This does not mean that there are not relevant economic advantages with other software, but this aspect should be analyzed carefully. An example of this is the Beaumont Hospital. In 2013 they had budgetary complications in the IT department that represented 17 million. As a measure to fix this situation, they decide to change all the applications to open source solutions. This change included basic products like email and desktop applications in the first phase, and the core applications of the business in the second phase. The reduction in the initial costs was 95,8% and in the running cost of five years was 95,3% (Fitzgerald & Kenny, 2004). So, the economic benefit of using OSS could be different depending on the strategy of the company and the applications are needed.							
12	Opportunity	Finantial				x	
As it has been shown in this document, switching costs are relevant at the moment of chance an application. Companies procure flexibility at the moment of taking a decision, and							

Aspect	Type	TSC	Q	T	S	C	E
they do not want to be lock-in to a specific solution. Although it is not possible to say that Open Source Software is lock-in-free, it is clear that for its own nature of FLOSS it is easier to change to another vendor because there is access to file formats, data, system calls, APIs, interfaces, and communication standards. This information is generally well documented, but if it is not the case at least there is access to the source code. That is something that is not possible in proprietary software. This means that the time and money that is invested in an Open Source Solution, is not going to be completely lost if the company decide to change the application.							
13	Opportunity	Relational	x				x
Although reliability is difficult to measure, studies show that Open Source Software is relatively equivalent or even more trustworthy than proprietary solutions. One of the main factors that make Open Source more reliable is that its developers are also its own users which ensure quality in the product. Furthermore, there are thousands of developers cross-checking their work, so the possibility of detecting errors or security problems is higher (Pandey, R. K. & Tiwari, 2011).							
14	Opportunity	Finantial/ Relational			x	x	
There are several licenses in the Open Source scenario, and these licenses could be classified as protective, non – protective, and public domain. Depending on the type of license, companies can even modify the software without returning the code back to the community (Public Research Centre Henri Tudor, 2014). It this case, sensitive information can be retained by paying the license or even without doing it if the license allows it. This ensures that a company could work with a specific open source application without being worried about not sharing changes.							
15	Opportunity	Procedural			x		x
Experimenting over an open source application in order to discover the functionalities is easier than with proprietary software (Dedrick & West, 2013), and with that, the possibility of finding benefits and gaps are higher. The reason for having this possibility is that a version of OSS is always accessible through the internet. In contrast with proprietary software, wherein the best cases you can access a just a trial before buying the software, this represents an enormous advantage because it allows to reduce the anxiety for the uncertainty and get early knowledge of the application.							

Risks

The same considerations that are taking into account to analyze the opportunities, are taken in the analysis of risks in the Table 2.

Table 2

Risks of using FLOSS and their relation with Switching Cost and the Project Management Diamond

Aspect	Type	TSC	Q	T	S	C	E
1	Risk	Relational		x		x	x
The same that commercial projects fail, Open Source projects are also in risk of not							

Aspect	Type	TSC	Q	T	S	C	E
succeed. However, this risk could be mitigated or transferred. As a proposal to mitigate this situation, we suggest evaluating open source application as a company would evaluate a proprietary application. That means to evaluate years on the market, the number of users, and type of clients using the application and financial statements in case that is possible to get this information.							
2	Risk	Procedural/ Relational	x	x			x
The open source communities are effective at resolving issues but they are not obligated to that. There is not a contract which forces them to answer in a specific amount of time, or indeed to answer. This may restrict companies from using OSS. Nevertheless, for most of the OSS, there are agencies or freelancers who can offer this services at a cost and with a contract. So, this risk could be entirely avoided. Another option to mitigate this risk is to have internal staff with the necessary technical expertise.							
3	Risk	Procedural		x	x	x	x
It has been mentioned that OSS is less user-oriented that proprietary software, and because of this, it is difficult for not technical users to adopt it. Without discussing how precise is this statement, it is important to have in mind that this is a commonly mentioned aspect that is not related to the implementation of open source solutions in companies (Mora, et al., 2016). In this scenery, the recommendation to avoid this risk is to evaluate the application using one of the selection models of FLOSS solution. Models like the Multi-Attribute Decision Making (MADM), Navica Open Source Maturity Model (OSMM), Quality Model for Open Source Selection (QMOSS), OpenSource Maturity Model (OMM), Open Business Quality Rating (OpenBQR), QualOSS, Software Quality Observatory for Open Source Software Model (SQO-OSS), Quality Platform for Open Source Software (QualiPSo), Method for Qualification and Selection of Open Source Software (QSOSv2), EFFORT, IRCA, and CapGemini could be used to evaluate not just the usability but also the software since product and organization attributes (Mora, et al., 2016). Additionally, to reduce the resistance to FLOSS applications, it is important to dedicate time and budget for extensive training. It should be made clear that this effort is not exclusive for FLOSS applications since it is also a necessary process in proprietary software implementations.							
4	Risk	Finantial/ Procedural				x	x
Administrate different Open Source applications could be difficult because it is necessary to manage at the same time different compliance requirements which came with the different types of licenses. This is a situation that has been generated for the increasing use of FLOSS applications, but there are already companies such as Black Duck Software or White Source which provide solutions to manage this situation.							

Conclusions

In the scenery of a FLOSS implementation project, the opportunities that FLOSS brings into the context according to the business models that support it and its own characteristics, are significant. Mostly, it influences procedural switching costs. From 15 relevant opportunities that are analyzed, 50% of them influence procedural switching cost, 27% financial and 23% relational. Additionally, regarding the number of aspects of project management that shall be taken into account, the result is balanced. The opportunities shall be analyzed in equal proportions in relation to quality, time, scope, cost and expectations.

On the other hand, it was not found a strong connection between the 4 risks of FLOSS presented in this paper and their impact in financial switching cost. However, a meaningful association exists at the moment of manage the expectations in a FLOSS implementation project.

In future work, the author plan to evaluate selection model of FLOSS since the perpective of project management.

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THE PROJECT RISK REGISTERS ANALYSIS BASED OF THE PROJECT RISK MANAGEMENT NOTION 'RISK REGISTER'

Juris Uzulans, University of Latvia

Abstract

The project risk register is an important project risk management document. It can be seen that the risk registers vary from 3 to 5 columns and to more than 20 columns in registers. The project management theory does not have generally accepted well-established or logically correct criteria for correctness. The eligibility criteria can be maturity, practical application, compliance with a group of criteria chosen by the authors.

The author of the study believes that all of the listed criteria are not sufficient to evaluate the risk registers. Therefore, in addition to the above-named criteria in the evaluation of risk registers, the results of the concept 'risk register' or similar concept analysis is proposed. Objective of the research is to clarify whether the results of the definition 'risk register' or similar concept analysis can be used to improve recommendations for risk register. The study analysed 23 sources and 30 risk registers.

The research results suggest that the results of qualitative analysis can be used to develop or evaluate a project risk register.

Key words: *project, risk, risk register concept, qualitive analysis*.
JEL code: M00, M10, M190

Introduction

The project risk register is an important project risk management document. It can be seen that the risk registers vary from 3 to 5 columns and to more than 20 columns in registers. Project management is not a scientific discipline with generally recognised concepts. The author believes that the project management theory does not have generally accepted well-established or logically correct criteria for correctness. Among the he eligibility criteria there may be maturity, practical application, compliance with a group of criteria chosen by the authors.

The current research like the previous research by the author, including the ontological, epistemological and methodological analysis studies, is based on the use of qualitative research methods. Considering the restrictions of the article volume, 23 and 30 sources were selected. However, the author concluded that the conducted research accounts for the confidence that ontological and epistemological analysis is a method in which, together with the methodological analysis, it is possible to perform the analysis of risk management sources aimed at improving risk management, especially for creating the risk register (Uzulans J., 2018). However, the results of the three studies were not enough to develop justified recommendations for the development of risk registers.

The objective of the research is to clarify whether the results of the definition 'risk register' or similar concept analysis can be used to improve recommendations for development or improvement of a risk register.

The tasks of the study are as follows: first, the analysis of the concept 'risk register' or similar concept, second, the analysis of the uses of 'risk register' or similar notions, and, third, the evaluation of the risk registers.

Research Methodology

For the research we selected 23 sources, 18 are publicly available on the Internet. Selection criteria are, first, definitions of the notions 'risk register' or similar notions and definition of the notion 'risk' and, second, the use of the notions in the text.

The number of sources used in the study was reduced because the number of applications was small in several sources. We selected the key terms in the definitions and verified how they have been used.

The study is based on the use of qualitative research methods. For the study purposes, the author used the Find and Advanced search function of programme Adobe Acrobat Reader DC 2019. Adobe Acrobat Reader is available online free of charge. The remaining 23 sources were analysed in their original format of Adobe Acrobat Reader DC.

The results of the definition analysis are used to analyse the use of concepts in the source text and then use both results to evaluate the risk registers. The author is aware that the number of analysed sources is not large. The small number of sources is offset by the analysis that include the analysis of definitions, the use of concepts in the source text and evaluation of the risk registers.

Descriptions of the sources

Each of the sources contained a definition of 'risk', the sources were in Adobe Acrobat pdf format. Table 1 summarizes the information about the sources. The sources numbers match to the number in the References section at the end of source.

Table 1

Information about the sources

No.	Information about source
1.	The author's book about step-by-step application of project management techniques to managing science, technology and engineering projects. Definitions of the notion 'risk register' and definition of the notion 'risk'. Both definitions in the glossary.
2.	The author's book about the processes required to start up, define, plan, launch, execute and complete a project successfully. Definitions of the notions 'risk log' and definition of the notion 'risk'. Both in the glossary.
3.	The author's book based on the Method123® Project Management Methodology (MPMM) by outlining the phases, activities and tasks throughout the project's life. Definition of the notions 'risk register' and definition of the notion 'risk'. 'Risk' in the glossary, 'risk register' in the text.
4.	Organization's guide from PM4NGOs, international NGO. The book presents project management in the international development sector with activities as for writing project proposals, developing project plans, implementing project activities, monitoring project progress, and evaluating project impact. Definition of the notion 'risk' and description of the 'risk register'. Both in the text.
5.	Organization's book from APM, Association for Project Management. The book clearly structured with 52 areas of knowledge and definitions and explanations. Definitions of the notions 'risk register', 'risk log' and definition of the notion 'risk'. All definitions in the glossary.
6.	Organization's book from GPM Global, global organization which promotes sustainability in the project management profession. PRiSM™ (Projects integrating Sustainable Methods) is described in the book. PRiSM™ is sustainability-based on the project delivery method that is structured project management, which combines sustainability and traditional core project phases. PRiSM establishes a framework of considerations derived from ISO 21500, ISO 14001, ISO 26000, ISO 50001 and ISO 9001. Definition of the notion 'risk register' and definition of the notion 'risk'. Both definitions in the glossary.
7.	Organization's manual from International Labour Organization, with the policies, rules, procedures, and tools

	needed to manage extra-budgetary technical cooperation projects divided to the stages of a project and explain ILO's evaluation policy and management. Definition of the notions 'risk register' and definition of the notion 'risk'. 'Risk' in the glossary, 'risk register' in the text.
8.	Organization's book from Project Management Institute with description of the project management life cycle and its related processes and provides and promotes a common vocabulary within the project management profession. Definition of the notion 'risk register' and definition of the notion 'risk'. Both definitions in the glossary.
9.	State authority manual from State of Queensland to provide guidance on rules and standards for the preparation of cost estimates for all transport infrastructure projects. Definition of the notion 'risk register' and definition of the notion 'risk'. Both definitions in the text.
10.	Organization's handbook from the Council of Europe provides step-by-step instructions and guidance for the project team throughout the project lifecycle. Definition of the notion 'risk register' and definition of the notion 'risk'. Both definitions in the glossary.
11.	Organization's guide from European Union about the PM², which is a Project Management Methodology developed by the European Commission in order to facilitate the management of a complete lifecycle of a project. Definition of the notion 'risk register' and definition of the notion 'risk'. Both definitions in the glossary.
12.	Organization's guide from The Health Boards Executive with a structured, accessible, user-friendly approach to the key areas of project management. The guide and is based on the Project Management Body of Knowledge. Definition of the notion 'risk log' and definition of the notion 'risk'. Both definitions in the glossary.
13.	The City of Winnipeg manual for applying PMBOK project management standards to the City of Winnipeg's specific situation with addition from Projects in Controlled Environments 2 (PRINCE2) methodology. Definition of the notion 'risk' in the text, definition of the notion 'risk register' in the glossary.
14.	State authority guideline from The Malaysian Public Works Department for application of the standard project risk management process for all JKR projects, programs, plans and activities based on the Joint Australian/New Zealand Standard, AS/NZS 4360:2004. Definition of the notion 'risk register' and definition of the notion 'risk'. Both definitions in the glossary.
15.	State authority guideline from The Tasmanian Government with a structured approach to managing projects with eleven Key Elements that should be applied throughout the project lifecycle for all regardless of their size and complexity. Definition of the notion 'risk register' and definition of the notion 'risk'. Both definitions in the glossary.
16.	Borough Council of Wellingborough framework for project management as a combination of the roles of the project, the organisational structure and the processes that will deliver the required outcome. Definition of the notion 'risk log' and definition of the notion 'risk'. Both definitions in the glossary.
17.	University of Birmingham handbook that provides guidelines for the day-to-day management and control of any size or complexity projects by project processes, roles and responsibilities, and the documentation and administration of a project. Definition of the notion 'risk register' and definition of the notion 'risk'. Both definitions in the text.
18.	State authority framework through the Project Management Lifecycle for projects of all sizes, so that they achieve expected outcomes and thereby project success by highlighting important project management priorities. The framework conforms to industry standards as defined by the Project Management Institute (PMI) and adapted to the context of California State government Definition of the notion 'risk register' and definition of the notion 'risk'. Both definitions in the glossary.
19.	Organization's guidebook from Federal Acquisition Institute providing practical concepts and useful tools and templates to adopt or adapt so that management of projects are appropriate and effective in achieving the desired results. Definition of the notion 'risk register' and definition of the notion 'risk'. Both definitions in the text.
20.	State authority guide where project risk management is a scalable activity and should be commensurate with the size and complexity of the project under consideration. Definition of the notion 'risk register' and definition of the notion 'risk'. Both definitions in the text.
21.	Company report about the techniques to assess risk and return outlines of investments of the renewable energy technology to classify, assess and manage different elements of the project. Definition of the notion 'risk register' and definition of the notion 'risk'. Both definitions in the glossary.

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22.	State authority handbook present scalable approach to managing project risks by knowing, communicating and accepting risks through the phases of project delivery. Definition of the notion 'risk register' and definition of the notion 'risk'. Both definitions in the text.
23.	State authority guide that represents a guidance and direction for practicing risk management for Capital transportation project development providing direction, outlining the appropriate methods and techniques used for risk management decision making un for risk management. Definition of the notion 'risk register' and definition of the notion 'risk'. Both definitions in the text, also 'risk charter' are used.

Source: The author's valuation

A specific place between the selected sources belongs to source number 8, A Guide to the Project Management Body of Knowledge, the guide has been mentioned in other sources 15 times, including three sources where the influence is recognized. In the A Guide to the Project Management Body of Knowledge is an important sentence for current research "A common vocabulary is an essential element of a professional discipline" (PMBoK Guide, 2013).

According to the author, the most important thing that affects the risk management, is project life cycle conception, project as a process with phases. It is important to meet the specific needs and requirements of the organization by providing a structured and systematic approach.

Analysis the "risk register" or similar notion definitions

We analyse the "risk register" or similar notion definitions to identify the criteria for risk register analysis. The notions, which are different than the "risk register", start with naming the notion.

Table 2

The definitions of the "risk register" or similar notions

No.	Definitions	Definitions analysis
1.	The document containing the results of the qualitative risk analysis, quantitative risk analysis, and risk response planning. The risk register details all identified risks, including description, category, cause, probability of occurring, impact(s) on objectives, proposed responses, owners, and current status. The risk register is a component of the project management plan.	Results of the risk management process, risk register content, component of a higher-level document. Criteria for analysis of the risk registers: results of qualitative and quantitative risk analysis; risk response activities; impact(s) on objectives; component of the project management plan.
2.	Risk log – sequential listing of all risks identified throughout the project's life and information about their ranking, probability and management.	Updates throughout the project's life, risk register content. Criteria: information about identification that identifies a project's life time; information about ranking, probability and management.
3.	The risk register is the log within which all risks are registered and tracked through to closure.	Used throughout the project's life. Criteria: information about identification that identifies project's life time.
4.	Risk register document provides a more formal and more detailed identification of risks and the plan for addressing them … list of significant risk … contains information about the magnitude of probability and impact of risk occurrence. It may also include proposed mitigation responses, "owners" of the risk, and current status of the risk. The risk register can also include information about the cost and schedule impacts of these risks.	Formal and more detailed information than the red flag list. Criteria: risk analysis and mitigation and current status information; the cost and schedule impacts.
5.	A body of information listing all the risks identified for the project, explaining the nature of each risk and	Results of the risk management process. Criteria: the nature of each risk and information

	recording information relevant to its assessment, possible impact and management. Risk log – A document that provides identification, estimation, impact evaluation and countermeasures for all risks to the project.	relevant to risk assessment.
6.	A record of identified risks including results of analysis and planned responses.	Results of a risk management process. Criteria: results of analysis and planned responses.
7.	A risk register is a risk management tool that acts as a central repository for all risks levels identified.	Risk management tool. Criteria: results of identification, risk management tool, risks levels.
8.	A document in which the results of risk analysis and risk response planning are recorded.	Results of a risk management process. Criteria: results of analysis and planned responses.
9.	The risk register is the most appropriate record of such decisions, regardless of whether the risk is owned by the customer, contractor, or the project manager.	Record for decisions, customer, contractor, project manager as the risk's owners. Criteria: record for decisions, risk owner.
10.	The list of main risks identified with details of the measures taken to tackle them.	Main risks, measures for prevention. Criteria: measures for prevention.
11.	Risk log – A central repository for all risks identified by the project or organisation.	Risk identification. Criteria: results of identification.
12.	A table for recording project risks is called a risk log.	Risk table. Criteria: are not.
13.	The record of risk events identified and assessed, and actions developed to address those risk events.	Results of a risk management process. Criteria: results of analysis and planned responses.
14.	A record, under formal change control, of all identified risks, their assessment, treatments and outcomes.	Results of a risk analysis. Criteria: results of analysis.
15.	A document that records the results of a risk analysis process.	Results of a risk analysis. Criteria: results of analysis.
16.	A document that provides identification, estimation, impact evaluation and countermeasures for all risks to the project. It should be created during the start-up of the project and be reviewed and maintained throughout the life of the project.	Results of a risk management process. Criteria: results of analysis and planned responses, reviewed and maintained throughout the life of the project.
17.	A living document and should be reviewed and updated regularly, making sure that contingency arrangements are checked and risk ratings are reassessed where necessary.	Document that is reviewed and updated regularly. Criteria: contingency arrangements, reassessment.
18.	Documents and manages known risks in accordance with the Risk Management Plan (may be incorporated within the PMP). This includes tracking information such as probability, impact, triggers, mitigation plans, and contingency plans.	Results of a risk management process. Criteria: results of analysis and planned responses.
19.	A list of identified risk events that are prioritized based on their probability and impact.	Results from a risk management process. Criteria: results of analysis.
20.	Once the base cost is established, a list of uncertainties is created of both opportunities and threats, called a "risk register."	Results from a risk management process. Criteria: not present.
21.	Database for risks associated with the project (Also known as risk database or risk log).	Risks associated with the project. Criteria: are not.
22.	A risk register is a tool that project teams can use to address and document project risks throughout the project life cycle.	Tools for the project team. Criteria: throughout the project life cycle.
23.	A document detailing all identified risks, including description, cause, probability of occurrence, impact(s)	Results of a risk management process. Criteria: results of analysis and planned

	on objectives, proposed responses, owners, and current status.	responses, current status.

Source: The author's valuation

Table 3 summarizes the information about the criteria according to definitions in the Table 2.

Table 3

Criteria from the "risk register" or similar notions definitions

No.	Criteria	Explanation	Verification
1.	Risk management process.	Column names correspond to the names of the risk management process steps.	Identification step – risk name, risk description or similar word for column which contains information about risk without analysis. Analysis step – results from risk qualitative and quantitative analysis. Risk management planning step – risk response activities, responsibility. Risk management executing step – risk response activities status, risk current status.
2.	Detail of the risk management process steps.	Comments for column names with explanation about column content.	Only names or more detailed information.
3.	Risk register status throughout the project's life.	Risk management time borders against project' s life time.	Columns or information about risk status, risk response activities state, reassessment.
4.	Risk register usage.	Comments or explanation about risk register usage.	Information about risk register usage to higher level documents, component of risk management plan.
5.	Additional information.	Information which facilitates the use of the risk register.	Risk prioritisation, explanation, notes, suggestions, historical information about previous risk states and similar.

Source: The author's valuation

The "risk register" or similar notion usage

In addition to the criteria from the "risk register" or similar notion definitions, the next step was the analysis of the notions 'risk register' or similar applications in the text of the sources. Table 4 summarizes the information about the usage of the notions.

Table 4

The usage of the "risk register" or similar notions

No.	Information about usage	Summary of usage
1.	Risk register 16 times	Nothing new against the criteria from the definition of the notion 'risk register'.
2.	Risk log 58	Part of the project brief document; the owner for every risk.
3.	Risk register 22, risk form 22	Nothing new compared to the criteria from the definition of the notion 'risk register'.
4.	Risk register 17	Nothing new compared to criteria from the definition of the notion 'risk register'.
6.	Risk register 6	Risk register opening time after first risks are identified; ownership; communicates with the ownership through the whole risk management process.
7.	Risk register 5, risk log 1	Nothing new against criteria from notion 'risk register' definition.
8.	Risk register 117	Risk register is updated according to scheduling assumptions, risk response costs, impact to the project quality requirements; create the risk register step-by-step according risk management process steps; risk responses are executed

		during the life cycle of the project; information for the risk register updates are outcomes of risk reassessments, risk audits, and periodic risk reviews.
9.	Risk register 12, risk registers 1, risk log 5	Nothing new against criteria from notion 'risk register' definition.
10.	Risk register 19	Use risk register to make risk owners fully responsible for their risks; regular risk assessment.
11.	Risk register 2, risk log 31	Used to document and communicate the risks and relevant risk response actions and responsibilities; risk status.
12.	Risk log 19	Multiple entries for responses; regular renewal; date of the last update.
13.	Risk register 26, risk registers 1	Linking risks to at least one of the project objectives (cost, scope, schedule, and quality); systemic risk contingency.
14.	Risk register 34	Monitor and track risky events; updated frequently; involves analysis of project metrics.
15.	Risk register 37	Source of learning for future projects; version control; risk unique identifier; changes in the risk status;
16.	Risk log 10, risk register 1	Responsibility for renewal.
17.	Risk register 16, risk registers 3	Historical risks of the project, contingency or preventative measure(s).
18.	Risk register 67, risk log 8	Updates based on new risk information.
19.	Risk register 11	Nothing new against criteria from notion 'risk register' definition.
20.	Risk register 26	Risk trigger; list of uncertainties; opportunities and threats; risk event.
21.	Risk register 34, risk log 1, risk database 2	Primary risk and secondary risk.
22.	Risk register 93	The risk register conformation and signature; total cost of all risks.
23.	Risk register 13, risk charter 20	The risk register help control cost escalation.

Source: The author's valuation

Based on Table 4. additional criteria table was created.

Table 5

Additional criteria from the "risk register" or similar notions definitions

No.	Criteria	Explanation	Verification
1.	Risk management process.	Columns names correspond to risk management process steps names.	For risk management planning step – measures.
3.	Risk register status throughout the project's life.	Risk management time borders against project's life time.	Start un update dates; version controls.
5.	Additional information.	Information which facilitates the use of the risk register.	Information about communications; information for future projects; risk triggers; risk classification.
6.	Information for update.	Information which are used for the risk register update.	Information from risk reassessments, risk audits, and periodic risk reviews or similar.
7.	Information about acceptance.	Information which are used for the risk register update.	Information about responsible persons, signatures and similar.

Source: The author's valuation

The author developed a set of criteria when performing the definitions and the notions usage analysis. There are 7 sets of criteria in total, two new (6. and 7.) and three updated (1., 3. and 5.).

Evaluation of the risk registers

For risk register analysis, the author chose 30 risk registers publicly available on the Internet. The existence or absence of criteria is in Table 6.

Table 6

The risk registers evaluation

No.	Criteria	Risk registers
1.	Risk management process.	11 risk registers contain columns with information on all stages of risk management, 18 risk registers contain columns with information on risk identification, analysis and risk management planning, 1 risk register contain columns with information on risk identification and analysis.
2.	Detail of the risk management process steps.	9 risk registers comments for column names with explanation about column content.
3.	Risk register status throughout the project's life.	3 risk registers contain date for next review, 3 risk registers last update date, 3 risk registers risk status with dates, 1 risk register action status and date, for 3 risk register it is not possible to determine whether the date is changed or only one, start date.
4.	Risk register usage.	7 risk registers is part of the risk management plan, 2 risk registers is part of the project plan.
5.	Additional information.	7 risk registers contain explanation for completion, 9 risk registers contain the risk categories, 8 risk registers contain other information.
6.	Information for update.	No record contains the appropriate criteria.
7.	Information about acceptance.	2 risk registers date of signature or approval date.

Source: The author's valuation

Practical recommendations and conclusion

Qualitative research methods are suitable for risk register analysis because the registers differ – they may many have unique columns or other elements. None of the selected registers was equal to another register. The selected criteria were applicable to the analysis of the selected risk registers.

The first criterion is compliance of the register with the risk management process, including the risk identification, risk analysis, risk management planning and executing. The project risk management process is described similarly to authoritative sources. The notion 'risk register' is used in the context of the risk management process in the texts of all selected sources.

The differences in the definition of risk register in sources are great. 11 risk registers contain information on all stages of the risk management process, 18 risk registers do not contain risk management execution and 7 risk registers do not contain risk identification. Only 4 definitions contain the names of all stages or other information that can be attributed to the stage. In the source text, when analysing the use of the notion 'risk register', it can be stated that that the notion 'risk register' is used in conjunction with the names of all risk management stages. The origin of the definitions was not analysed in the study.

It may be considered that the risk register should contain information on all stages of risk management. However, this cannot be considered a mandatory condition if the project contains other documents on risk management that feature relevant information on the stages, such as progress reports because there is no definition that a mandatory condition in a risk register is a document that contains all information about the project risk management stages.

The author believes that the risk register is a document that requires knowledge of risk management and risk management experience. Additional information about the risk registry

column information can be found in 9 registers. Additional information cannot be considered a significant risk register criterion if the project has other risk management documents or the risk register is a part of another risk management document. The 7 risk registers are a part of the risk management plan.

Risk management is an ongoing process in the lifetime of the project, 10 definitions of the register include the renewal of the risk register during the lifetime of the project, it is not possible for 3 registers to unambiguously establish that the date is the date of renewal. Information on the renewal of the risk register during the lifetime of the project is considered to be an important criterion for evaluating the risk register.

As different project participants are involved in the risk management process, the information that facilitates participation in the process is positive. Only 7 registers contain information that facilitates participation in the risk management process. However, as in the criterion of compliance with the content of the risk register at all stages of the process, additional information may be included in other project risk management documents.

There is no information on risk reassessments, risk audits, and periodic risk reviews or similar elements in any risk register. Similarly to the information about updating the risk register during the lifetime of the project, it is considered to be an important criterion for evaluating the risk register, and the information on the information used in the renewal is considered significant.

2 risk registers contain the date of signature or approval date. This criterion can only be assessed as meaningful when the order of circulation of project documents stipulates that the date of signature or approval date should be in the project documents.

The criteria selected may be considered to be applicable in the assessment of risk registers. However, the author did not gain confidence that the number of criteria was sufficient. It is necessary to carry out additional studies to add new criteria, to clarify the existing ones and to establish the relationship among the criteria.

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PERFORMANCE MEASUREMENT FOR CONSTRUCTION PROJECTS

Kejun Meng, Peter Fenn
University of Manchester

Abstract

Construction industry as one of the investment-led industries has exerted significant influence on the economy in the UK. Over the past few decades, the complicated business environment and rising competitiveness have increased the difficulty in performance measurement (Neely, 2005). Before taking steps to improve project performance, it is essential to accurately and integrally measure performance. Through critically reviewing literature from 1987 to 2018, the need for an integrated measurement system is a considerable gap because contemporary frameworks just research one of the multi-facets of performance from a particular angle (Jin et al., 2013).

The aim of this research is to develop a comprehensive model (HMCPPM) to hierarchically measure performance from the contractor perspective at the project level. HMCPPM is structured for linking measurement benchmarking to the project objectives more explicitly, assessing project outcomes and guaranteeing outputs, and realizing the performance comparison among different construction projects.

The quantitative method is utilized in this research because building a performance measurement model needs to make sure the generalization and broad applicability among different construction projects. As for data collection, literature-based data and first-hand data from questionaries will be collected to accomplish the model establishment. Analytical Hierarchy Process (AHP) as a decision-aiding method could be utilized to structure the hierarchical model and calculate the weights through pairwise comparisons and judgments of experts to derive priority scales.

Keywords: Performance Measurement, Construction Projects, Quantitative Research Method, Analytical Hierarchy Process.
JEL code: M10

Introduction

Construction industry as one of the cannonading investment-led industries exerts significant influence on the economy in any country. For the prosperity of any nation, numerous stakeholders attach importance fully to construction projects. Meanwhile, over the past few decades, the gradually complicated and global business environment and rising competitiveness have emphasized the significance of performance measurement (Neely, 2005). Construction industry usually acts as a catalyst to trigger the economic growth, however, plenty of government documentation mention that construction project performance is difficult to accurately measure and meet the requirements of environmental change and progressing alteration. (Harris and McCaffer, 2013).

Beatham et al. (2004) and Costa et al. (2006) state that the current performance evaluation lacks compatibility, applicability, and rationality. Most performance measurement frameworks just assess performance from one specific perspective in accordance with the technical background of researchers. There is a lack of a concrete hierarchical model to measure performance from the contractor perspective and realize performance comparison among different projects. Incongruous measurement system causes the misunderstanding of real to-date

performance, and it will further exert negative effects on decision-making and project objectives realization.

This research critically reviews the literature related to construction project performance measurement and find the gaps in knowledge and practice. The hierarchical model and PI equation are developed to fill the gaps. Data deriving from questionnaires will be collected and analyzed to calculate factor loading and realize model modification through confirmatory factor analysis. Analytical Hierarchy Process (AHP) will be further used for differentiating formative and reflective factors, classifying prerequisites, identifying and quantifying indicators, calculating factor loading and implementing model modification (Kline, 2015).

Research Gaps in Knowledge and Practice

After reviewing literature related to construction project performance measurement, there are six gaps in knowledge and practice. Firstly, frameworks including BSC, KPIs, and EFQM generally measure the multifaced performance from different perspectives, however, specific to the construction project, there is no comprehensive model to effectively measure the performance from contractor perspective at the project level. It remains the main gap in knowledge, which could be further researched for the better-structured model.

Secondly, construction project performance measurement is relatively subjective over the past 30 years. To some extent, financial measures have historically been accumulated across functions aiming to project level. However, the non-financial indices related to construction project performance measurement are not easy to identify, and it has not been adequately researched, aggregated and restructured into a model. Research is still limited in this area.

Thirdly, The performance measurement indicators identified by previous research are relatively overloaded. Therefore, excessive measures will decrease the execution efficiency and increase administrative cost in practice. The measurement indicators with proper quantity need to be accurately identified.

Fourthly, construction project performance is difficult to precisely compare among different projects owing to the lack of a unified performance index. Researchers and practitioners encounter obstacles to compare the performance of different projects because of the shortage of universal and feasible measurement method, model and index, which could be transferred to use in every construction project and resolve contradictions among the various performance indices.

Fifthly, most performance measurement for the construction project will be executed after project delivery. It is lack of to-date model to measure construction project performance in the middle of the construction project implementation process rather than at the end of the project.

Sixthly, most construction projects only exist the static performance measurement system, however, with the advancement of the complexity of projects and growing uncertainty surrounding internal and external environment, the dynamic and flexible model needs to be structured to counteracting the deviation stemming from the changes in actual implementation.

Research Aim and Objectives

The research aim is to develop a performance measurement model for construction projects.

To achieve this aim, the following research objectives are established.

1. To critically analyze current performance measurement methods and frameworks;

2. To systematically review the performance measurement system;

3. To identify, quantify and normalize performance measurement indicators;

4. To calculate the priority weight of every indicator;

5. To investigate the integrated project performance index (PI) equation;

6. To develop a performance measurement model of construction projects;

Contribution

In this research, the model of construction project performance measurement is hierarchically structured through redesigning the Balanced Scorecard framework, KPIs model, switch indicators as the prerequisite, and other seven measurement indicators to comprehensively, flexibility and timely assess performance. This model fills the gaps for the lack of the construction project performance measurement model.

Perfrmance measurement indicators are all identified, quantified, and normalized in an Integrated Project Performance Index (PI) equation. Sub-factors also could be identified during the project implementation process to reflect the to-date performance status. Cooperating with the priority weights calculated by Analytical Hierarchy Process (AHP), PI could accurately measure performance and realize performance comparison within projects or even among different construction projects. It is further in favor of performance control and improvement.

In practice, the hierarchical model of construction project performance measurement (HMCPPM) and Integrated Project Performance Index (PI) exist wide applications. From the perspective of contractors, HMCPPM and PI could assist them to more accurately control the to-date performance and adopt targeted measures for improving performance. HMCPPM and PI could further be coded as a plug-in of computer software to automatically and momentarily evaluate project performance using various data of different construction projects. Furthermore, HMCPPM and PI could help the contractors show strong evidence of previous successful performance to win the bid in the tendering and bidding conference. From the aspect of clients, HMCPPM and PI are beneficial to compare performance experience among different contractors, choose more proper contractors for future cooperation, audit real-time performance, and comprehensively evaluate the level of project performance in the whole construction industry.

Main Body
Concept of Performance Measurement

To quote Neely et al. (1997), "Performance measurement can be defined as the process of quantifying the efficiency and effectiveness of actions." Similarly, Ghobadian and Ashworth (1994) propose that performance measurement has already exerted to enhance effectiveness and efficiency in the projects. More specifically, Mbugua et al. (1999) define the performance measurements as the process for systematically gathering and assessing the information about inputs, effectiveness, and efficiency of the construction projects' actions.

On the basis of different priorities, some researchers more focus on the association between project objectives and performance measurement. Sinclair and Zairi (1995) define that performance measurement as a process for assessing how successful organization or individuals have been realized their objectives. To be more explicit, Kulatunga et al. (2007) define the performance measurement as a process for determining progress to attain the prearranged objectives, containing the information on the efficiency with which resources are converted to outputs including goods and services, the quality of the outputs (how successful the deliveries are and how satisfied the clients feel) and outcomes (the variation between the predetermined goals and actual consequence).

Some authors define project performance measurement from the perspective of application value. Measuring performance is to measure the ability of previous performance in evaluating the prospective performance (Lebas, 1995). Conformably, researchers hold the similar view that performance measurement could be defined as a systematic method as a tool to evaluate the inputs and outputs in the process of project execution for constant enhancement (Love and Holt, 2000, Chan et al., 2001). As for construction projects, performance measurement has been defined as the formal and typical collecting and assessing of inputs, efficiency and effectiveness of construction projects activities (Sinclair and Zairi, 1995; Stevens, 1996; Atkinson, 1999; Mbugua et al. 1999; Love and Holt, 2000; and Chan, 2001).

Therefore, the concept of performance measurement in this research is utilized covering the above-mentioned extensive perspectives as a multi-dimensional set of factors and sub-factors to integrately, effectively, and flexibly evaluate the construction project performance.

Significance of performance measurement

According to Crowther (1996), it is forthright and explicit significance to the commercial community, as the vital survival of a commerce count on the competence of assessing performance. Performance measurement as an indispensable section of project management has operated since project management existed (Bassioni et al., 2004). According to Kaplan and Norton (2001), in contemporary literature, the research of performance measurement could be retrospected the first use of the technique of planning and controlling by U.S. railroad programme in the 1870s. The constant assessment for preceding accomplishment is a critical demand for advancement and process, and suits for cross-sectional comparison with other construction projects and further longitudinal comparison with the programme level or company level.

Bourne et al. (2000), Neely et al. (2000) proposed that there are seven reasons why managers give priority to performance measurement in the management process. Reasons cover dynamic nature of all the projects including enhancing competition, explicit advancement dynamism, domestic or international quality rewards, altering institutional roles, educated customers, and information technology. Beatham et al. (2004) further explain the reasons why it is imperative to utilize performance measurement system in the construction industry for assisting analyzing questions, measuring the definite activities, and predicting the future situations. However, good performance measurement further depends on the efficiency of human resource management. Data provided by practitioners without sufficient performance management ability will restrict the utilization of useful information to make constructive decisions (Alsulamy, 2015).

As cited by Phusavat et al. (2009), quantitative and qualitative data are applied to enhancing the performance through the decision-making process as follows. Project managers

utilize the information to thoroughly comprehend and identify the objectives in current situations and further make more appropriate decisions.

Beatham et al. (2004) mention performance measurement in the project-oriented firms is being included as a portion of strategic process control planning owing to four justifications including position checking, position communicating, priorities confirmation, and progress compulsion. Firstly, performance measurement could constantly keep track of the procedure in every phase and evaluate the ongoing situation as position checking. Secondly, position communicating as another reason could notify clients and working staff the specific working performance evaluation results with an aim to improve the transparency and promote employee involvement. Thirdly, priorities confirmation means that performance measurement is beneficial to confirm the unified priorities and sequence of every activity and during the project life-cycle. Fourthly, progress compulsion demonstrates that explicit performance measurement contributes to identify potential enhancement spaces and further promote performance advancement.

The significance and necessity for the more integrated and well-structured model to flexibly, dynamically, effectively and accurately measure construction project performance are highlighted through analyzing the importance of performance measurement.

Performance Measurement Framework

The performance measurement framework is defined as an outright series of performance measures derived in a coherent pattern in line with the forward established regulations or guidelines (Anderson and McAdam, 2004). According to Neely et al. (2001), the frameworks for measuring performance including Balanced Scorecard (BSC), Key Performance Indicators (KPIs), and European Foundation Quality Management (EFQM) are all valid and correct. However, these frameworks research the multi-facets of performance from various angles. Different theories and frameworks related to performance measurement will be reviewed and discussed with an aim to develop further a more comprehensive model, which incorporate the more suitable relevant perspectives for measuring construction project performance from contractor perspective at the project level.

Balanced Scorecard (BCS)

In 1992, Robert Kaplan, the accounting professor at Harvard University and David Norton, a consultant from Boston area propose Balanced Scorecard (BCS) to prevent researcher or practitioners for unduly focusing on the financial measures rather than operational measures. It is not suitable enough for modern business companies and commerce to assess business performance from a sole financial aspect (Kaplan et al., 2001). Owing to the profound simplicity and unmistakable effectiveness, BCS is widely accepted by different size of enterprises and hailed by Harvard Business Review as one of the most dominant ideas in the 20th century. According to Niven (2002), BCS could play a significant role as a communication tool, measurement system, and strategic management. Specific to the construction industry, Bassioni et al. (2004) note that BSC as one of the most vital performance management tool was utilized and cited during the last 75 years. BSC keeps the balance between lagging performance measures (financial indicators) and leading performance measures (non-financial indicators) and further between outcomes evaluation and drive performance assessment (Kagioglou et al., 2001).

Typically Balanced Scorecard is used at the company level. However, it could be transferred to apply at the project level because to some extent; the project could be seen as a

temporary firm (Lundin and Söderholm, 1995, Packendorff, 1995, Grabher, 2002). Specific to the construction project, the duration of the construction project is usually relatively longer. Over a period of time, the status of the construction project is comparably stable no matter for staff composition, management structure, team collaboration, personnel allocation, resource distribution, external environment, internal process, and ultimate objectives. It is even more rational to regard construction project as the temporary company and utilize Balanced Scorecard at the project level in this research.

Although Balanced Scorecard is the most prominent model in research and practice, it still exists some disadvantages (Neely et al., 2000). BSC only generally identify the four dimensions without measurable and fixed sub-indicators. In application, the firms using BSC still spend a high proportion to go into liquidation (Bourne et al., 2000). Furthermore, actual perspectives related to construction suppliers and contractors are supposed to cover. Hence, there is a gap for exploring and developing a more comprehensive model for measuring construction project performance by referring to BSC and other theories and models.

In this research, for structuring more suitable and effective construction project performance measurement, three aspects in the Balanced Scorecard will be transferred to utilize in the second level of HMCPPM model. As for the learning and growth perspective, it is more valuable to measure organizational performance rather than project performance. Considering the various project duration and project types, the feasibility and applicability to take learning and growth as measurement consideration are not very practical. For example, it may exist low-value and high-administrative cost to evaluate the differences in learning and growth aspect for one more time doing specialized construction activities (e.g. the installation of a variety of utilities). Furthermore, according to reviewing the literature from 1987 to 2018, most vital KPIs to assess construction project performance does not pertain to this field. Therefore, for avoiding overloading the model and increasing unnecessary management cost, three perspectives (Internal business, financial and customer perspectives) of BSC will be utilized in the second level of HMCPPM model to effectively and comprehensively evaluate performance.

European Foundation Quality Management (EFQM)

EFQM is a non-profit institution build up in 1988 originally with an aim to motivate business excellence in European. Based on concise practical experiences of private or public companies across the whole Europe, the EFQM assessment format as the huge breakthrough in performance and quality management has been applied effectively (Yang et al., 2001, Van Marrewijk et al., 2004). EFQM model is used to systematically assess the business performance and proposed nine weighted criteria including five enablers and four results with details of weighted sub-criteria for every criterion (Martín-Castilla, 2002). The "Enablers" are the aspects to apply force for future "Results" delivery. To put it another way, the "Enables" is related to what a company does and the "Results" are identified with what an enterprise accomplish (Carlos Bou-Llusar et al., 2005). Five enabler criteria including people, policy and strategy, partnership and resources and processes further could be separately divided into four to five sub-criteria. Four results contain people results, customer results, society results, and key performance results.

European Foundation for Quality Mangement (EFQM) Excellence Model as one of the performance measurement framework is the commonly utilized not only in Europe but also all over the global markets (Bourne et al., 2000). For instance, more than thirty thousand institutions in twenty-five countries use the EFQM Excellence Model to evaluate the performance and improve the bottom line (Soltani and Lai, 2007).

EFQM Excellence model effectively measures the performance for long-term organizations and to some extent, it could be transferred to use at the project level. Comparing with the utilization of EFQM Excellence Model in relatively permanent organizations to focus on efficiency, projects give more priority to project objectives (effectiveness) because it exists the obvious completion date (Westerveld, 2003).

In this research, EFQM is not in compliance with the construction project performance measurement model. Firstly, Quality-based EFQM attaches more importance to project quality, however "Quality" and "Stafy" as basic switch indicators will be only guaranteed in the acceptable qualified level, so it is unnecessary to overassess these two indicators. The more specific explanation for the hierarchical structure of construction project performance measurement model (HSCPPMM) will be discussed. Secondly, the assumption of EFQM for same weights (50%) between enablers and results shows that critical success factors (CSFs) are regarded as enablers area and project performance measurements are deemed as results area (Westerveld, 2003). However, the precise coefficient of every KPI should be accurately calculated for matching the hierarchical measurement structure in this research hence there is no evidence to support the same weights for enablers and results are both 50%. Therefore, it exists high research and practical value to develop a more proper model for construction projects to link successful performance with proper performance measurements.

Key Performance Indicators (KPIs)

The first use of KPI was in 1961 for enhancing enterprise strategy in the firm named D Ronald Daniel (Pollard and Cater-Steel, 2009). After that, KPIs was developed generically as a benchmark since 1998 through Innovation Government Movement and Construction Best Practice Programme (CBPP) (Beatham et al., 2004) and further has been widely applied by the whole construction industry (Lin and Shen, 2007) to evaluate client satisfaction, schedule and financial situation, productivity, and deficiency.

By reviewing literature related to construction project performance measurement from 1987 to 2018, diversified key performance indicators are mentioned and analyzed from different perspectives. According to Swan and Kyng (2004), Ali et al. (2013), Chan and Chan (2004), the most reasonable range for identifying KPIs to effectively measure performance is from nine to twelve. Basic statistics in the following table mentions that there are nine indicators are widely recognized by researches during the past thirty years. The mentioned times from large to small for approved KPI to measure construction project performance is the cost (recognised as measurement indicator for 26 times), time (recognised as measurement indicator for 22 times), quality (recognised as measurement indicator for 17 times), client satisfaction (recognised as measurement indicator for 17 times), safety (recognised as measurement indicator for 14 times), team satisfaction (12), profitability (10), communication (7), and Billing (7) in following table.

Therefore, nine key performance indicators will be contained and restructured in the main levels of the hierarchy model for construction project performance measurement (HMCPPM)to comprehensively and effectively measure performance.

Discussion of the different frameworks

Through reviewing the three most extensively used theories or frameworks to evaluate performance including Balanced Scorecard (BSC), European Foundation Quality Management (EFQM), and Key Performance Indicators (KPIs), these frameworks evaluate multifaced performance from diverse aspects using unique classification method. There are some

overlapping parts among the three theories, however, the limitations of each framework cannot be ignored.

The balanced scorecard is just generally identified the four perspectives without quantitative sub-indicators to feasibly implement in a specific business. Specific to the construction project, the differences between company and project impose restrictions on BSC applicability. Although BSC is a popular model, it can not be accepted and applied to directly transfer and utilize at project level without any adjustment. Owing to the simplicity and the intuitive logic, the widespread adoption and high acceptance by users of the balanced scorecard give a concise overview of company performance. EFQM gives too much priority to quality, the subjective indicator and the weights for "Enablers" and "Results" are both 50%. However, there is no evidence of showing the reason why Enablers and Results account for the same ratio. As for key performance indicator theory, KPIs are lack of the accordance with organization or project objectives and may not achieve the strategic demands. Concrete to construction project, project objectives as most explicit project development direction needs to be identified in the concept phase of project lifecycle. Furthermore, KPIs are difficult to precisely identify.

Therefore, the three frameworks are not perfectly matched with the need for construction project performance measurement. It remains the main gap in knowledge to develop a better-structured model. Therefore, there is a lack of comprehensive performanc measurement model to more accurately and effectively assess construction project performance.

Hierarchical Model for Construction Project Performance Measurement

Through reviewing the knowledge, methods, frameworks, measurement systems and indicators, a hierarchical model for construction performance measurement is structured. After that, every indicator in HMCPPM is quantified and normalized to further develop an integrated construction project performance equation. It fills the gap in knowledge and practice for accurately, flexibly, dynamically measuring construction project performance.

After critically reviewing and discussing the project performance methods, frameworks, systems, measurement indicators adopted in the literature from 1987 to 2018, the hierarchical model for construction project performance measurement (HMCPPM) as a formal and unified construction performance evaluation system is structured for accurately and flexibly measure to-date performance by all different layers.
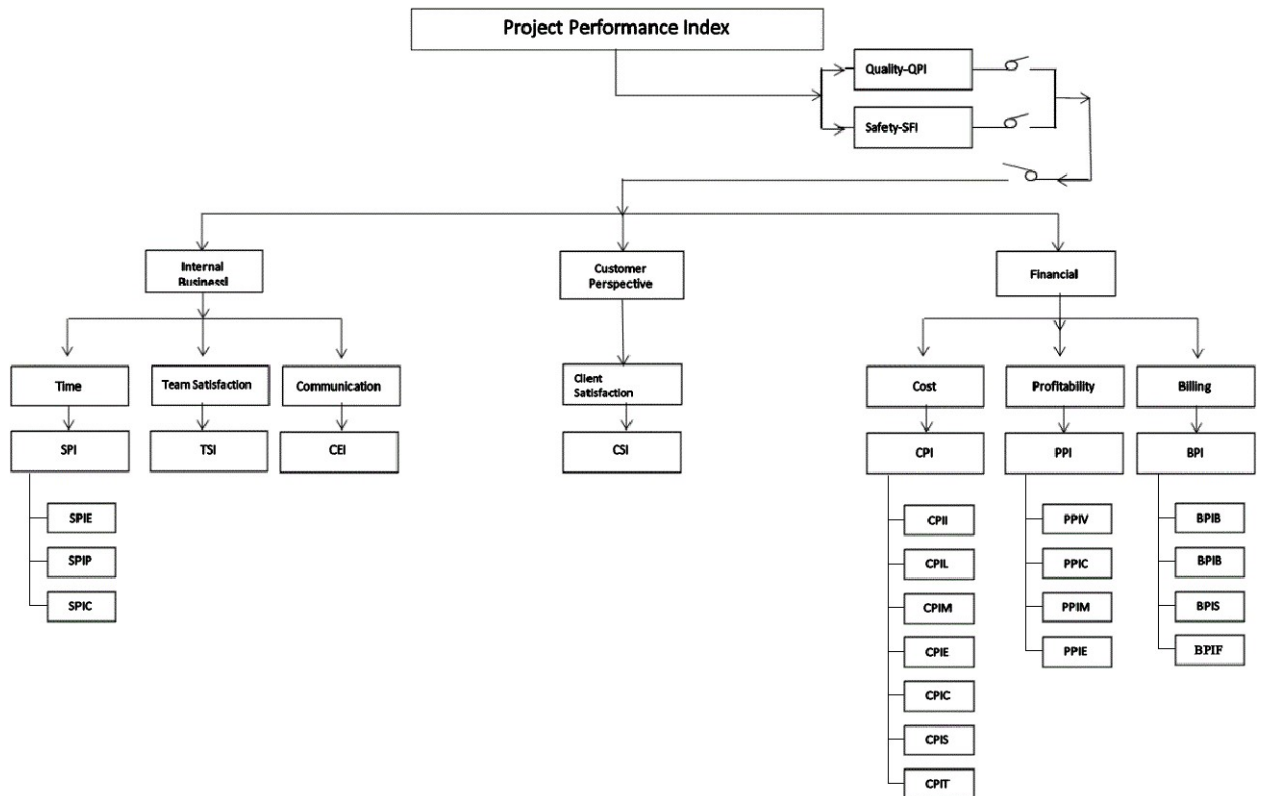
Fig. 1: **Hierarchical Model for Construction Project Performance Measurement**

As can be seen in figure 1, the first level is the integrated project performance, which should be further quantified and calculated to realize comparison among projects using project performance index (PI). Balanced Scorecard with high practical value to connect project objectives into short-term operational actions (Kaplan and Norton, 1996). Matching with the hierarchical structure and top-down method, for developing a more comprehensive and dynamic model, three aspects (Financial perspective, internal process, and customer perspective) of BSC are transferred to used at the project level as a second layer and each dimension is further divided into several KPIs following the objective-oriented performance evaluation (Bassioni et al., 2004). As for the reason why the fourth perspective of innovation and learning in BSC does not be utilized in the HMCPPM model, to some degree, it is needless for excessively taking long-term learning progress into consideration of temporarily construction project performance measurement (Kagioglou et al., 2001).

According to Parmenter (2015), the aspects of balanced scorecard could be further classified into more specific KPIs. According to a systematic review of performance measurement systems covering all the performance indicators for measuring construction

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performance from 1987 to 2018, nine KPIs was identified in this research including time, cost, quality, safety, team satisfaction, client satisfaction, profitability, billing, and communication.

Thereinto, quality, and safety as the switch indicator play a vital role in assessing whether the construction project is fundamentally qualified to keep measuring the specific performance. Quality and safety as two prerequisites screen out the qualified construction project, which meets the initial standards of successful project performance. If one of quality and safety is not qualified, there is no need to keep calculating the PI number. Another seven KPIs in the third layer separately are belonged to one of the three perspectives in the second layer. Internal business indicators include time, team satisfaction and communication. Client satisfaction belongs to customer indicator. As for financial indicators, there are three indices to measure containing cost, profitability, and billing.

Furthermore, according to different situation of each diverse construction project, indicators in the third level could be further classified into more detailed sub-indicators in the fourth level for flexibly satisfying the requirements in time.

In conclusion, the Hierarchical Model for Construction Project Performance Measurement is structured to fill the gap in knowledge and practice to optimize the accuracy and practicality of project performance evaluation. From the contractor perspective, HMCPPM could diagnose and correct the issues that might get in the way of achieving project objectives, manage expectations, improve the planning and control, advance the project process, take prompt measures for performance improvement, and further make longitudinal comparison among various construction projects. Moreover, HMCPPM and PI could help the contractors show strong evidence of previous successful performance to win the bid in the tendering and bidding conference. From the aspect of clients, HMCPPM and PI are beneficial to compare performance experience among different contractors, choose more proper contractors for future cooperation, audit real-time performance, and comprehensively evaluate the level of project performance in the whole construction industry.

Research Methodology

Quantitative research strategy will be used to test a theory. This research entails a deductive approach to the relationship between theory and research. It has incorporated the practices and norms of the model and of positivism in particular and embodies a view of social reality as an external and objective reality. As for data collection, literature-based data as second-hand data and first-hand data form questionaries will be used in this research.

The Analytical Hierarchy Process (AHP) as a decision-aiding method proposed by Saaty (1982) is a multi-criteria decision-making approach in which factors are structured in a hierarchical model. It could be calculated the weights even for intangible and subjective factors through pairwise comparisons and judgments of experts to derive priority scales.

Through AHP, Factors and sub-factors in different layers give the overall view of complicated inherent relationships in proposed conditions and assist the model users to evaluate whether the factors in different level are of the same order of magnitude. It is further beneficial for model users to easily and accurately compare the homogeneous elements.

There is no need to complete all levels of the hierarchical model and the factor in a given layer does not have to function as an attribute for all the sub-factors in below level. The feature of the AHP is suitable for the hierarchical construction project performance measurement model because it could keep the HMCPPM flexibility for adapting the potential possibilities for practitioners to further divide the index into more detailed sub-factors according to the real situation of construction projects.

AHP could be transferred to use in construction project performance measurement (Zeng et al., 2007, Al-Harbi, 2001, Handfield et al., 2002). In this research, the hierarchy construction project performance measurement model is designed from the top (the construction project objectives) through the intermediate layers (classification on which subsequent levels depend) to the lowest level which covers more specific subfactors or indices. The structure of the model is appropriate for AHP analysis.

Data utilized in AHP usually comes from professionals judgments. Through pair-wise comparisons, priority vector calculation, consistency ratio and consistency index analysis of data from questionnaires, the priority weights (coefficient in PI equation) will be calculated. An integrated hierarchical model for construction project performance measurement will be further implemented to accurately evaluate to-date performance, provide strong evidence of performance assessment in tendering and bidding conference, proceed performance comparison among projects, assist project managers to take effective actions of performance improvement.

Integrated Construction Project Performance Equation

According to the Hierarchical Model of Construction Project Performance, the Integrated Construction Project Performance Equation should be shown as follow:

Integrated Construction Project Performance
$= f(Internal\ Business, Customer\ Perspective, Financial)$
$= f(time, team\ satisfaction, communication) + f(client\ satisfaction)$
$+ f(cost, profitibility, billing)$

In the second level of the model, integrated construction project performance could be measured by internal business, customer and financial perspectives. The equation could indicate relations.
Integrated Construction Project Performance
$= f(Internal\ Business, Customer\ Perspective, Financial)$

In the third level of the model, Internal business perspective is further divided into three indicators including time, team satisfaction, and communication. Customer perspective is shown through client satisfaction and financial perspective is classified into cost, profitability, and billing. The relation in the third level should be expressed using the following equation.
Integrated Construction Project Performance
$= f(time, team\ satisfaction, communication) + f(client\ satisfaction)$
$+ f(cost, profitibility, billing)$

Furthermore, the key performance indicators are quantified using related indices. Time (SPI), Team Satisfaction (TSI), Communication (CMI), Client Satisfaction (CSI), Cost (CPI), Profitability (PPI), Billing (BPI) are all quantified using unified standards name Earned Value Management (EVM) developed as the complement of PMBOK (Guide, 2004, Larson and Gray, 2015). Furthermore, for guaranteeing the arithmetic functions and operation among indices, all the indices in the equation should be normalized in accord with the range of CPI (Normally from 0.85 to 1.15) (Christensen and Heise, 1993, Christensen, 1994, Christensen and Payne, 1992).

Project Performance Index (PI) =

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w1*SPI + w2*TSI + w3*CMI + Y*CSI + z1 *CPI +z2* PPI + z3*BPI

Where:
W is the priority weight for internal business perspective calculated in the second level of the model by AHP. w1, w2, w3 are the priority weights for SPI, TSI and CMI calculated in the third level of the model by AHP.
Y is the priority weight for customer perspective in the second level and CSI in the third level of model calculated by AHP.
Z is the priority weight for the financial perspective calculated in the second level of the model by AHP.
z1, z2, z3 are the priority weights for CPI, PPI and BPI calculated in the third level of the model by AHP.

w1+ w2+ w3= W
z1+ z2+ z3= Z
W+Y+Z= 1
w1+ w2+ w3+ Y+z1+ z2+ z3= 1

As for the calculation for the weights as the coefficient of indicators need to be considered in line with the different priorities in the construction projects performance measurement (Olson and Slater, 2002).

Conclusion
This research critically analyzes previous performance measurement literature. HMCPPM is hierarchically built to more effectively and accurately measure construction project performance. Quality and safety as two preconditions could guarantee qualified level performance with an acceptable output. Other seven factors (time, team satisfaction, communication, client satisfaction, cost, profitability, and billing) will measure performance from three aspects including internal, customer, and financial performance. In accordance with HMCPPM, integrated construction project performance equation is developed through analytical hierarchy process. The gap for lack of a comprehensive performance measurement model at construction project level from the contractor perspective is filled by HMCPPM and PI number.

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PROJECT FINANCE: PRINCIPLES AND EFFICIENCY

Lyudmila N. Voropaeva, Tatiana V. Yurieva
Russian Presidential Academy of National Economy
and Public Administration (RANEPA)

Abstract

The paper covers the analysis of project finance, one of the most effective mechanisms for attracting investments to implement major, complex and expensive projects under high risks and uncertainty. The notion of 'project finance' and its key features were redefined by analyzing scientific publications, research carried out by experts and international economic organizations. It was demonstrated that a risk management system, identifying and sharing risks among its participants and assuming the presence of an appropriate security and guarantee package, is an integral element of project finance system. Project finance is characterized by a large number of stakeholders, necessitating organization of an effective system for managing their interests and contracts. Project finance involves a comprehensive analysis, the level of detail of which depends on project scale, possible risks, and social and economic impacts of management decisions. The advantages and disadvantages of project finance were determined in comparison with other financing models with regard to the interests of their participants. A significant share of global project finance market accounts for infrastructure projects, as well as projects in oil and gas production, involving both developed and developing countries. Modern project finance market is characterized by the decreasing share of public funds in financing of major infrastructure projects, including based on PPP principles, continuously improving the mechanism for attracting new sources of financing (infrastructure bonds, etc.). In the Russian economy, project finance is mainly used in large investment projects in oil and gas production, transport infrastructure, electric power industry, etc. Many of these projects are implemented based on PPP mechanism, allowing not only getting the financial resources required, but also increasing the efficiency of utilizing state budget funds, applying advanced production, information and management technologies, professional competencies and skills of private partners, and reducing entrepreneurial investment risks. Effective interaction between the state and private businesses is based on sound legislative base, proven bureaucracy, reasonable return on investment rates, acceptable project payback periods for public and private partners.

The research involved analysis and synthesis, comparison, classification, as well as logical and statistical analysis methods.

Introduction

Project management has proven to be an effective tool for initiating, planning and implementing any project. The essence of project management is using appropriate methods, tools, techniques and competencies when implementing projects (Voropaeva L.N., & Yurieva T.V., 2017). It should be considered that project management is carried out by implementing a set of processes (ISO, 2012).

Emergence of project management in major economies dates back to the 1950s. Project management techniques are traditionally used in construction, defense, oil and gas complexes and information technology. Over the last period, they have been increasingly introduced in social sector, and in state and local government system. Organizations using the project approach manage to ensure an innovation-based development, improve competitiveness, and prevent crisis amid continuous change (Kerzner H.R., 2013).

Financial security of projects is the most important part of project management. Projects can be implemented based on various financing models. Large investment project management under high risk is generally based on a special financing model, referred to as "project finance".

Scientific publications, research carried out by experts and international economic organizations give much attention to understanding the notion of project finance.

In particular, the Basel Committee on Banking Supervision at the Bank for International Settlements defines project finance as a special financing method when funds are raised to carry out a particular project on the condition that they will be repaid from future project income with project assets being the only pledge. It is noted that a characteristic feature of project finance is the presence of a legally and economically independent project company operating based on own project initiators (sponsors) funds (Basel Committee on Banking Supervision, 2004, p.61).

The first research papers on project finance were published in such journals as Harvard Business Review and Sloan Management Review in the late 1970s and early 1980s. The most part of research on various project finance aspects was carried out during the past decade. Many of them have been published in such well-known journals as the International Journal of Project Management, the Journal of Applied Corporate Finance, the Project Management Journal, World Development, and others, and are mainly practical (Müllner J., 2017).

The theory and methodology of project finance is best described in the works by the following researchers: P. Benoit, E. Bulievich, S. Gatti, E.R. Yescombe, WL. Megginson, I.A. Nikonova, P.Nevitt, Y. Park, A.L. Smirnov, A. Steffanoni, F. Fabozzi, A. Fight, B. Esty, etc.

Emphasis should be laid on works by S. Gatti (Gatti S., 2005, 2008, 2013), P. Nevitt and F. Fabozzi (Nevitt P., & Fabozzi F., 2000), who were the first to comprehensively study the project finance mechanism. Their works define project finance as a special financing model based on raising funds to carry out a particular project on the condition that they will be repaid from future project income, and only project assets are considered as a pledge.

Works by B. Esty and other authors (Esty B., 2004; Esty B., Chavich C., & Sesia A., 2014) pay great attention to studying the nature and functions of the project company, which is central to and a feature of the project finance model. In B. Esty's opinion, the essence of project finance is to make three management decisions: investment, organizational and financial. The mechanism of their implementation in developing and executing a project gives grounds to distinguish project finance from other financing models (Esty B., 2004).

Many aspects of project finance mechanism, especially when implementing public-private partnership (PPP) infrastructure projects, are disclosed in research by E.R. Yescombe (Yescombe E.R., 2014, 2018).

Among Russian experts, research by I.A. Nikonova (Nikonova I.A., 2012; Nikonova I.A., & Smirnov A.L., 2016) and A.L. Smirnov (Nikonova I.A., & Smirnov A.L., 2016) give the most complete idea of project finance, taking into account its global development trends and the specifics of Russian economy. In Russia, various aspects of project finance are researched and coordinated by the Federal Center for Project Finance, State Corporation "Bank for Development and Foreign Economic Affairs (Vneshekonombank)", which is one of the development institutions.

Although there is a number of publications on project finance, some matters remain understudied. This particularly applies to treating project finance as a system involving a number of stakeholders, the principles of their performance and interaction. PPP project finance

model and the mechanism for evaluating its effectiveness call for further research. All of the above determines relevance of the research.

Project Finance as a System

The core of project finance is that investment is made in a particular project, rather than in the borrower's business operations in general. Therefore, the source of return on investment is profit made from a particular project isolated from project initiators' business performance. Project finance can be provided by banks, corporations, and in partnership with the state.

Bank project finance uses the following financing products: non-recourse; limited recourse; full recourse.

With non-recourse project finance, lenders take into account only the expected project cash flows, their credit assessment does not depend on the creditworthiness of project sponsors. Therefore, the cost of finance is high, since all project risks are borne by the lender. This form of financing is typical for highly profitable projects.

Limited recourse finance is based on identifying and distributing potential risks among project participants. With full recourse finance, financial resources are received under specific guarantees, i.e. a certain form of limitation of project lenders' liability. The risks are borne by the borrower, and, as a rule, the price of loan is moderate, allowing for a quick receipt of funds for the project. This type of financing is typical for low-profit and charitable projects.

Real-world contexts allow for a combined form of financing, when lenders mainly rely on future project cash flows, but at the same time, it is allowed to use the borrower's ongoing business' net profit to repay the debt. Both the project assets and the borrower's property are pledged.

Corporate project finance involves financing projects with the organization's own resources.

Project finance in partnership with the state is a special type of contractual project financing between private and public partners, involving sharing of their assets, risks and benefits from the production of goods, works and services. This project finance scheme is mainly used in PPP project implementation.

The project finance model is opted for in a situation when there is a need to make solid long-term investments with insufficient own funds, high level of risk, and the complexity of the project itself.

Project finance is a high-risk financing involving identifying and sharing risks among its participants and assuming the presence of an appropriate security and guarantee package. Therefore, building and developing a risk management system is an integral element of project finance system. Project finance is characterized by a large number of stakeholders: project sponsors/initiators, project company, lenders, third-party investors, contractors, customers, suppliers, buyers, insurers, risk managers, government agencies, consultants, etc. All that makes it necessary to organize an effective system for managing their interests and contracts.

Project finance necessarily involves a comprehensive analysis, the level of detail of which depends on project scale, possible risks, and social and economic impacts of management decisions, etc. Project analysis employs such methods as express diagnostics, strategic analysis and other types thereof (technical, business, institutional, economic, financial, environmental), as well as quantitative and qualitative risk analysis, etc. All of the above determines the essential role of consultants with the necessary professional competencies in various areas of project finance.

Project finance has advantages and disadvantages in comparison with other financing models.

The overall advantages of project finance include:
- project-based approach;
- total risk management;
- high level of control during project implementation;
- higher added value due to expense reduction, asset and liability structure improvement, tax mitigation, etc.

From the borrower's perspective, the benefits of using project finance mechanism include:
- treating the project as a separate part of business;
- risk sharing among the participants;
- project management without reducing resources for the organization's core operations.

The benefits for project finance lenders include:
- a high level of income in the absence of risks unrelated to project implementation, and a possibility to partially fund lending resources;
- potential losses are limited only to the amount of capital invested in a project company,
- project and its inherent risks separation does not affect the overall investment rating of the company.

Application of project finance techniques may not lead to certain benefits, since it is a complex process fraught with high level of risk and uncertainty.

The overall disadvantages of project finance model include:
- conflicts due to the large number of participants representing different interests, various complex contracts, high risks;
- higher administrative costs driven by creation of an independent organizational structure, involvement of highly qualified specialists, complex expert examination, property appraisal, etc.

Imperfections of project finance for the borrower include:
- high loan interest rates;
- substantial time and transaction costs;
- constant supervision by the lenders;
- low level of independence in making management decisions.

Negative implications of project finance for the lender:
- the need for an in-depth project analysis;
- tightened control at all project stages;
- no recourse to the project company's owners.

Global Project Finance Market

In global practice, project finance is mainly used in major, complex and expensive projects (construction or reconstruction of energy, transport and telecommunications infrastructure facilities, etc.) under high risk. In today's context, Burj Khalifa Skyscraper in Dubai, the Eurotunnel, the Hong Kong-Zhuhai-Macau Bridge can be used as examples of project finance.

Data published by International Financial Law Review (IFLR), the leading professional publication, show that at the end of 2017 the volume of the global project finance market slightly decreased compared to 2015-2016 and amounted to USD 338.5 million (Project Finance

Report, 2018). A regional analysis of the global project finance market shows that the model is actively employed not only in developed but also in developing countries (Fig. 1).
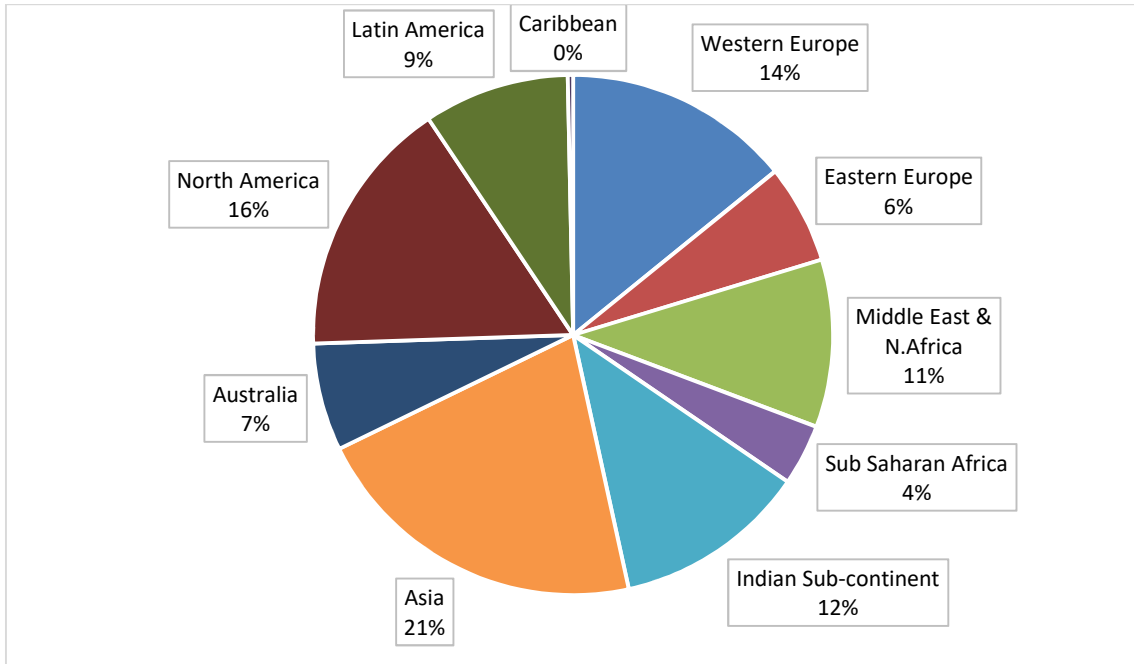
Source: author's construction based on Project Finance Report 2018. IFLR International Financial Law Review

Fig. 1**. 2017 Global Project Finance Market: Regional Dimension (USD million)**

Industry analysis of the global project finance market brings us to a conclusion that a significant share of costs accounts for infrastructure projects, as well as projects in oil and gas production (Fig. 2).
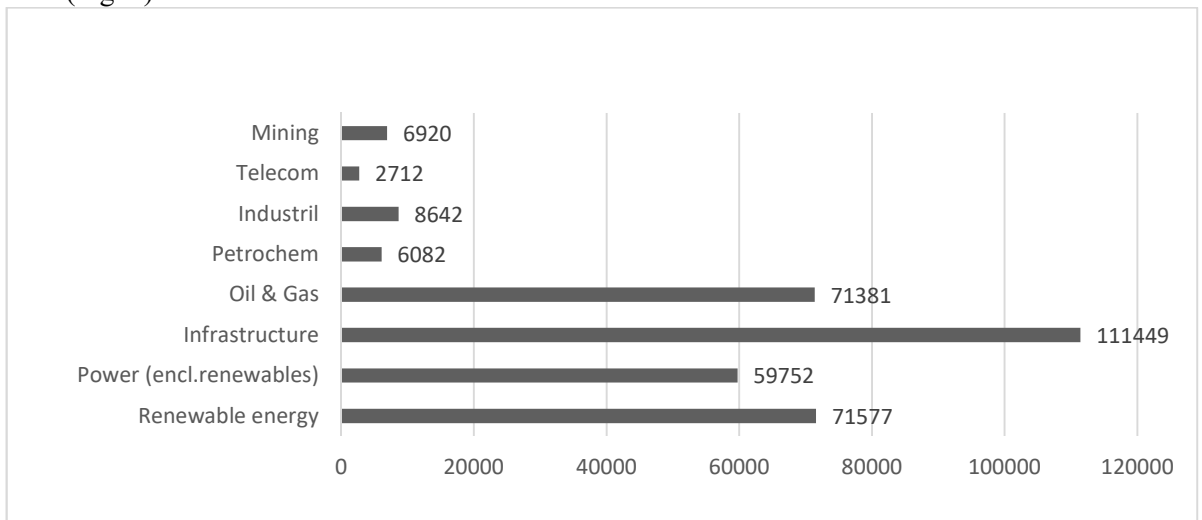
Source: author's construction based on Project Finance Report 2018. IFLR International Financial Law Review

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Fig. 2. **2017 Global Project Finance Market: Industrial Composition (USD million)**

Modern project finance market in developed countries is characterized by the decreasing share of public funds in financing of major infrastructure projects, including based on PPP principles, continuously improving mechanism for attracting new sources of financing, like infrastructure bonds, etc. (Müllner J., 2017).

According to IFLR agency, in 2017 Russia ranked 6th in the global project finance market with a transaction volume of USD 16,611 million (Project Finance Report, 2018). In the Russian economy, project finance is mainly used in large investment projects in oil and gas production, infrastructure projects in electric power industry, transport, etc.

PPP Projects as a Form of Project Finance

Given the state budget limits, it is critical to search for new mechanisms to attract long-term investment resources. PPP is one of the most effective mechanisms. It should be noted that this mechanism allows not only getting the financial resources required, but also increasing the efficiency of utilizing state budget funds, applying advanced production, information and management technologies, professional competencies and skills of private partners, and reducing entrepreneurial investment risks. Effective interaction between the state and private business is based on sound legislative base, proven bureaucracy governing relations between public and private partners (Yurieva T.V., 2016).

According to PPP Development Center (Rosinfra, 2019), a significant part of PPP projects in the Russian Federation is implemented in utility and energy sector, mainly at the regional and municipal levels (Fig. 3).
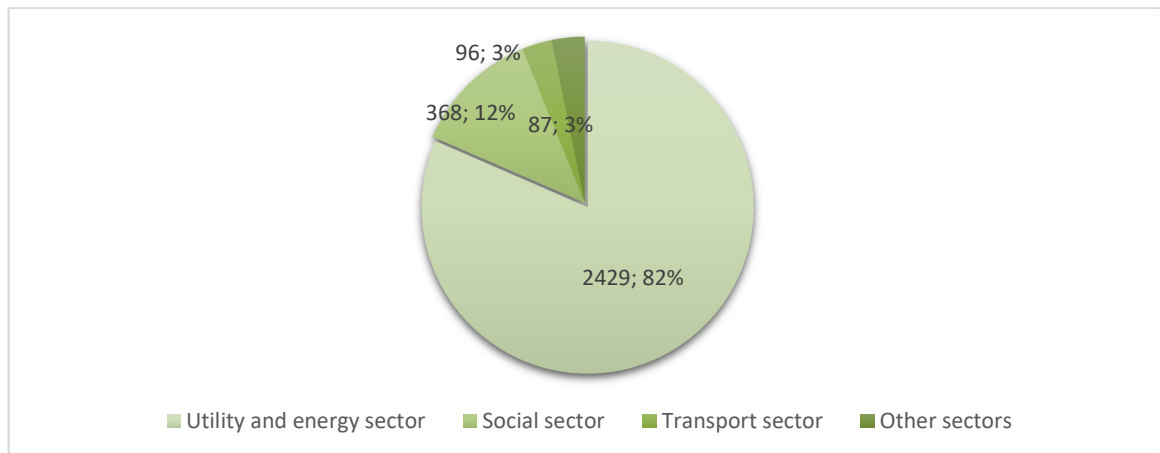
Source: Rosinfra, 2019

Fig. 3. **Industrial Composition of PPP Projects in the Russian Federation**

PPP projects play a major role in creating and upgrading infrastructure facilities that create key factors for the development of the national economy and its interaction with the international market. Transport infrastructure is one of the most important tools for spatial integration and improved availability of various places. On a mid-term horizon, the Russian Federation will focus on projects for the construction of new and reconstruction of already

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existing transport infrastructure facilities, the scope of financing of which goes beyond the federal, regional and city budget limits. Therefore, project implementation would involve various extra-budgetary sources of financing, including participation of private capital based on PPP principles.

Airports are the fastest growing transport infrastructure segment in Russia. Between 2010 and 2017, the number of people transported by air has increased from 59 to 108 million people, that is, nearly doubled (Russian Statistical Yearbook, 2018, p. 449). The growing public demand for high-quality airport services makes airport infrastructure very attractive for investors. That's the segment of the transport infrastructure that has been reforming and upgrading, creating concessions the most.

Main industry trends:
- federal airports asset consolidation;
- transfer of airport airfield infrastructure to private shareholders to concession;
- transfer of ownership of regional airports to the regions and regional airports privatization. Over the past few years, airports in Perm, Irkutsk, Krasnoyarsk, and Sakhalin have been transferred from federal to regional ownership. Regional governments started to work more actively to attract private investors in airport development, which also reduces the burden on the federal budget.

In 2017-2020, investments in airport infrastructure will amount to about RUB 330 billion at the level of the past five years, the share of private investment is 40% (RUB 130 billion). Sheremetyevo airport expansion is still the biggest investment project: construction of runway-3 funded by the federal budget and terminal B with an underground passage between the southern and northern areas of the airport (construction is funded by private investors). Construction of Yuzhny airport in Rostov-on-Don is the second biggest project in terms of investment with a value of RUB 37.2 billion, half of which is public money and the other half is private investment made by Airports of Regions holding company, a part of Renova State Corporation. Big investments go to upgrade regional airports in Tyumen, Novosibirsk, Yakutsk, Khabarovsk, Kaliningrad, Nalchik, Surgut, Murmansk, Chelyabinsk, Saratov (Voropaeva L.N., 2017, p. 39).

The largest airport holding companies - Novaport, Airports of Regions, Basic Element, are ready to develop Novy Urengoy Airport, which still has no key investor. Its current passenger traffic does not exceed 1 million people a year. Though investors expect to have significant income due to a steady demand from oil and gas industry workers. Over 2018-2020, a new air terminal will be built, the runway will be upgraded, and boarding bridges will be purchased resulting in passenger services provided up to the international standard. The complexity of the project is driven by physical features limiting construction season to a short summer period. Runway reconstruction is meant to provide an opportunity to accommodate all types of medium-haul aircraft flying to the European part of the country. The capacity should increase from the current 150-200 people per hour to 800.Investments are tentatively estimated at RUB 6 billion. Under the tender terms and conditions, all airport facilities will be leased to the investor for 30 years, and then returned to the ownership of Yamalo-Nenets Autonomous District. The agreement with investors provides for the second stage of reconstruction if the passenger traffic reaches 1.45 million people per year: international terminal creation, capacity increase to 1,200 people per hour, runway elongation to 3 km.

Regional analysis of PPP projects shows that the level of PPP development is different across Russian regions. It is evaluated with "the level of public-private partnership development in the constituent entities of the Russian Federation" indicator calculated taking into account the following factors: institutional environment; legislative environment; project experience. So far,

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Moscow, Saint Petersburg and Moscow Region are on top of the list in terms of PPP development. The Republics of Kalmykia, North Ossetia-Alania, Ingushetia have the lowest indicator.

Since PPP projects involve both public and private partners with different economic interests, it becomes important to find effective types of return on private investment. These include the following: availability payment; direct tolling and other business operations carried out by a private partner at controlled prices (rates); guaranteed minimum return; direct tolling and other business operations carried out by a private partner with no guarantees from the public partner, etc. Table 1 presents data on PPP project distribution in the Russian economy by the type of return on investments to private partners.

Table 1

Type of Return on Private Investments for PPP Projects in Russian Federation

Type of Return on Private Investments in PPP Projects	PPP Projects Administration Level					
	Federal		Regional		Municipal	
	Number of Projects	In % of the total	Number of Projects	In % of the total	Number of Projects	In % of the total
Availability Payment	10	66.7	38	19.7	53	2.7
Direct tolling and other business operations carried out by a private partner at controlled prices (rates)	0	-	85	44.0	1,817	92.0
Guaranteed Minimum Return	1	6.6	20	10.4	2	0.1
Direct tolling and other business operations carried out by a private partner with no guarantees from the public partner	4	26.7	50	25.9	103	5.2
Total	15	100	193	100	1,975	100

Source: author's calculations based on "Study "Public-Private Partnership in Russia 2016-2017, p.9-10.

When analyzing PPP project performance, it is reasonable to distinguish two levels of the rate of discount (E): macroeconomic (E_n) and business (E_b). The separation is due to the fact that the state and a private partner have different rates of return due to different acceptable payback periods. Several authors point out that the rates of discount require a nuanced approach (Khalturin R., 2012; Volkov B.A., 2009). 3-7 years, up to 10 years in big projects, is an acceptable payback period for a private partner. 25-30 years and 50 years in socially significant projects can be acceptable for the state (Voropaeva L.N., 2017, p.40). In some cases, the state

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may not be aimed at returning the invested funds. Therefore, the rate of discount E = 5-10% can be used for the state, and E = 12-18% - for a private partner. This will allow the state to be more flexible with the range for adjusting the shares in investment projects, by increasing its investment burden and reducing the burden on a private partner.

The choice of the value of the rate of discount (E) depends on the following factors:
- investment goals and project implementation conditions;
- the rate of inflation in the national economy;
- investment risk value;
- alternative capital investment opportunities;
- investor's financial and other insights and ideas (Voropaeva L.N., 2017, p. 41).

To encourage participation of private businesses in PPP projects, a special bonus system can be applied, ensuring that a private partner gets remuneration from the state for a timely facility commissioning.

Generally, it might be said that though project finance in view of PPP principles is attractive for infrastructure development, investor attraction is somewhat held back, which is explained by a number of factors, including macroeconomic ones.

Conclusion

Given limited own financial resources of organizations, they should be more actively raised under project finance principles, the essence of which is that an investment is made in a particular project, rather than in the borrower's business operations in general. The source of return on investment is profit made from a particular project isolated from project initiators' business performance.

Project finance is a system including many elements (participants, projects to be financed, contracts, risk management, infrastructure) that are closely interrelated and ensuring cash flow efficiency. The project finance model is opted for in a situation when there is a need to make solid long-term investments with insufficient own funds, high level of risk, and the complexity of the project itself.

Analysis of the global project finance market shows that the model is actively employed both in developed and developing countries. It is particularly effective in implementing PPP investment projects in countries and regions with underdeveloped institutions. Project finance in developed countries is characterized by the decreasing share of public funds in financing of major infrastructure projects and continuously improving mechanism for attracting new sources of financing.

In the Russian economy, project finance is mainly used in big investment projects in oil and gas production, electric power industry, transport, etc., many of which are based on PPP principles. PPP projects play a major role in creating and upgrading infrastructure facilities, especially airports. That's the segment that has been creating concessions the most. The PPP mechanism allows getting the financial resources required, reducing investment risks, gaining access to advanced technologies, using the professional competencies and skills of private partners.

Driven by the fact that both public and private partners with different economic interests participate in PPP projects, it is necessary to find effective types of return of investment to private investors, which depend largely on project administration level (federal, regional, municipal).

When analyzing PPP project performance, it is recommended to distinguish two levels of the rate of discount (E): macroeconomic and business. The separation is due to the fact that the

state and a private partner have different rates of return due to different acceptable payback periods. To encourage participation of private businesses in PPP projects, it is suggested to use a special bonus system ensuring that a private partner gets remuneration from the state for a timely or early facility commissioning.

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PRACTICAL VERIFICATION OF CLT ASSUMPTION FOR PERT APPLICATION

Maksim Goman, Department of Business Informatics –
Information Engineering, Johannes Kepler University, Linz, Austria

Abstract

One of the assumptions in PERT is the possibility to apply central limit theorem (CLT) to approximate path duration times with standard normal distribution. However, CLT presumes certain conditions in order to be correctly applied. This issue is often not adressed in related literature. The aim of this paper is to examine the conditions under which PERT can accordingly be applied. We consider the conditions and aspects of their practical application in order to verify the admissibility of CLT for given activity time distributions. Lindeberg-Feller condition turned out to be the simplest technique to verify that results of a PERT analysis are free from problematic CLT application. We also summarize other issues with current probabilistic project evaluation and propose a chance constraint optimization model for probabilistic project analysis.

Key words: *PERT, central limit theorem, CLT, project management, path duration.*
JEL code: M15, O22

Introduction

Project Evaluation and Review Technique (PERT) is known by project managers and scholars. The principal idea is attractive: To produce a probabilistic analysis for the project completion time. However, there has been a lot of criticism of PERT mostly due to its model assumptions since the 1960s, e.g. (Charnes et al., 1964; Hartley and Wortham, 1966; MacCrimmon and Ryavec, 1964; Roy and Roy, 2013). Charnes et al. (Charnes et al., 1964) have already admitted erroneous usage of central limit theorem (CLT). Nevertheless, it is still taught at universities, explained in textbooks, implemented in software, and there is no other widely used and concise stochastic method today. Improvements that produce better bounds or approximate time distributions have either the same or similar assumptions as the original PERT or require large analytical or modelling efforts and therefore, are not easy to implement for approximate time estimation (Elmaghraby, 1989).

There have been a lot of extensions of PERT proposed over the years. Although, there was enough work advancing several concepts, there is no finished alternative available. We would stress two main research directions: One tries to reduce the uncertainty of resulting time estimation, the other one aims at speeding up calculations for large stochastic networks. Both do not address the basic assumptions. Every theory or algorithm has its model. If the model does not reflect the observations of reality during empirical validation or the validity of the model cannot be explained theoretically, then the results should be explained somehow. Otherwise, the outcome is problematic.

There is no obvious technique of uncertainty reduction given initial input estimations from expert estimation with potential bias, and some scholars assume mathematically nice but not empirically proven distribution types. As regards fast computations with long time horizons, computers have enough power today such that a user in practice would not probably notice the difference between tenth of a second or one second and maybe agree to wait for minutes in

return to a reliable estimation, given realistic network size assumptions. The main need is reliable reduction of uncertainty, and better and stable estimations. This bias grows with prediction time horizon and results thus become practically useless with long time horizon. This was shown already by Charnes et al. (Charnes et al., 1964). This is easy to see especially for distributions having infinite tails (e.g. exponential, normal) or large variance (e.g. uniform). Accuracy of the methods can only be verified at the end of each task and after the end of the project when time realizations will have become known. As we use mathematical models that reflect reality to certain extent, only empirical validation of the methods is possible and this is what scholars and practitioners usually do not do.

Problematic assumptions of the original PERT (Malcolm et al., 1959) include:

– Unimodal Beta distribution that allows for only three possible types and does not reflect diversity of decision maker's (DM) preferences. Building of the distribution is a mathematical abstraction (Roy and Roy, 2013). Its choice for PERT was not supported with any evidence (Roy and Roy, 2013).

– Use of expected time instead of probability distributions. After setup, PERT transforms the problem to a deterministic one. It was shown that the deterministic problem underestimates all values even in theory, e.g. with Jensen's inequality (Benati, 2006; Elmaghraby, 1989; MacCrimmon and Ryavec, 1964).

– Independent distribution functions of individual activities. This assumption simplifies the problem, but is not realistic: Tasks are at least dependent on their sequence. If earlier tasks finish late, subsequent tasks on critical path should be late as well and vice versa. There can be explicit dependencies between certain tasks. Once parallel threads collapse into one event node, the time distribution function (DF) of the next task becomes a conditional DF. In reality, the paths in stochastic networks (SN) are not independent because they share some activities. However, most research so far did not take into account the dependency between paths. Yao and Chu (Yao and Chu, 2007) showed that significant bias exists in the approximated DF of the project completion time when path dependency is ignored.

– Large number of tasks in a path in order to approximate the sum of their time distributions with normal distribution applying CLT. This assumption is also wrong for projects with parallel activities. Obviously, almost all projects have parallel tasks. Leemis et al. (Leemis et al., 2006) and Elmaghraby (Elmaghraby, 1989) argue that in case of parallel networks with independent and identically distributed (iid.) stochastic activity durations, the resulting time distribution is skewed so therefore CLT is inappropriate. Another issue is possible dependence of tasks. In both cases, the DF becomes conditional DF and simple CLT is not valid. There exists multidimensional CLT, but its application was only considered for normally distributed times, e.g. by (Monhor, 2011).

- CLT introduces ambiguity about initial time distributions of tasks (Roy and Roy, 2013), i.e. they had initially beta DF functions (DFs), but going back from the resulting normal distribution of the whole project, we can assume that they are marginally normal. In this way, there is little use of constructing initial beta distribution of tasks.

As a result, PERT considers only one critical path and obtains only one of many possible lower bounds of total project's time. There are many competing critical paths and possible lower bounds in stochastic project time network.

There have been many attempts to use normally distributed times in PERT analysis, a review can be found in (Udoumoh and Ebong, 2017) Choice of a normal distribution was due to simplified modelling and calculations, especially for multivariate case. Assumptions of

independence of times, sequences, and paths usually accompany normality of activity time distributions. Unfortunately, the biased assumptions and lack of empirical evidence prevent us from accepting these models in practice. Computation time for a project network is not an issue today for realistic sizes of PERT networks. DF, cumulative distribution function (CDF) and inverse CDF functions were implemented in statistical tools and programming libraries. Aggregation of DFs can be done in a fraction of second today provided that DFs are known. On the other hand, the choice of normal distribution needs more explanations of its negative range of values and infinite tails. According to (Udoumoh and Ebong, 2017), some scholars use truncated normal distribution which is a solution to the problems with infinite tails. However, the result is not a normal distribution, and lacks the desired property of the normal family and the choice thus does not offer any advantages over any other distribution. Use of normal distribution was also found in (Monhor, 2011) and (Prékopa et al., 2004). Based on convenient qualities of multivariate normal distribution with correlations, a new approach to probabilistic critical path was presented. Although the papers provide an important step forward in identification of probabilistic critical path, because of the assumption of convergence of activity times on a path to normal distribution and model oversimplification, these models still do not seem fully practical.

We consider that any method or algorithm should be applied only under the conditions that were defined for them. Without meeting these requirements, the results are problematic because the method was not designed for arbitrary conditions and can not be expected to return consistent and reasonable results. Therefore, how can we rely on a priori unproved result in management? One of the conditions for PERT is applicability of CLT for time distributions. We believe that in order to obtain consistent estimations we should at least determine that the underlying conditions are satisfied.

Having described related problems with the PERT method, we formulate the research question: Can it be assured that PERT returns mathematically correct results through the use of CLT?

We are going to consider ways of mathematical verification of initial random time estimations of tasks in order to determine applicability of CLT to the data and assure validity of PERT results. This analysis assumes continuous time DFs, but it generalizes to discrete case. This can at least remove the bias of inappropriate CLT application to the given data, and constitutes a contribution to current PERT analysis.

We will also define an improved stochastic model for probabilistic project analysis including time, cost, quality, resources and other constraints. This new *probabilistic* PERT model aims at relying on more realistic assumptions and is based on chance constraint model. We believe that the term *probabilistic PERT* suits the new model better and we refer the usual PERT as *original* PERT.

The paper contains the following parts. We will consider four main approaches for checking the applicability of CLT to given data. Next, examples for data verification for CLT applicability will be given. The new model for future PERT improvement is proposed after a short discussion of potential directions for methods used in project analysis. Summary and future work directions are presented in the concluding section.

Verification of conditions for CLT application

According to original PERT, CLT is applied to approximate path duration times with standard normal distribution, independently of the DFs of individual activity times. There is an informal rule of thumb that there should be at least 30 activities on a path for proper CLT application and (Ludwig et al., 2001) claim that 10 activities on a path is enough for a good approximation. However, CLT presumes certain conditions in order to be safely applied and there exist several alternative conditions in theory. Unless we know a priori that distributions of the considered times satisfy them, we need to check these conditions. Violating CLT conditions can invalidate the project time estimation.

Let time of k independent tasks be random variables, i.e. we have a random vector $\boldsymbol{X} = (X_1, X_2, ..., X_k)^T$ that has the size k. According to the properties of independent random variables, we can obtain expected value and variance of aggregated time of tasks:

$$\mu = E(\boldsymbol{X}) = \sum_{i=1}^{k} E[X_i] \; ; \qquad \sigma^2 = \sigma^2(\boldsymbol{X}) = \sum_{i=1}^{k} Var[X_i].$$

The CLT theorem tells us that it should be applied only if summands meet certain conditions. Then, the sum of a large number of uncorrelated random variables can converge to approximately normal distribution and we can directly obtain any quantile of time distribution:

$$\sum_{i=1}^{k} X_i \sim N\left(\sum_{i=1}^{k} \mu_i, \sum_{i=1}^{k} \sigma_i^2\right).$$

There is no discussion in project management area on whether project time data a priori satisfy the requirements. If we do not have a-priori information, we need to check the conditions. We will show that CLT applicability check is not complex. However, violating CLT conditions means that convergence of the sum to normal distribution is not guaranteed and that thus PERT estimation could not be valid.

There are a number of alternative criteria for CLT applicability for a sum of k independent random variables with finite expected values and variances.

1. Lindeberg-Feller (L-F) condition (Spanos, 1999) checks that not a single variance is greatly larger than others. From Lindeberg's condition

$$\lim_{k \to \infty} \frac{1}{\sigma^2} \sum_{i=1}^{k} \mathbb{E}\left[(X_i - \mu_i)^2 \cdot \mathbf{1}_{\{|X_i - \mu_i| > \varepsilon\sigma\}}\right] = 0,$$

Where $\mathbf{1}$ is the indicator function, follows Feller's condition:

$$\lim_{k \to \infty} \left(\max_{1 \leq i \leq k}\left(\frac{\sigma_i^2}{\sigma^2}\right)\right) = 0.$$

The meaning of the conditions is that no single random variable dominates others in variance. Therefore, we can approximate: $\forall i \in [1, k]$ and given constant $\delta > 0, \max_i \frac{\sigma_i^2}{\sigma^2} < \delta$. Parameter δ is assumed to be small.

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Parameter δ regulates applicability of CLT regarding the quality of convergence. One may imagine it as a ratio of known values that is easy to maintain, e.g. $\delta \geq \dfrac{1}{k}$. Thus, the choice of δ or comparable parameter for CLT is a measure of applicability of the method. If Lindeberg-Feller condition does not hold, we can not use CLT.

2. Another possible solution for CLT applicability is Lyapunov's condition (Spanos, 1999):

$$\forall \delta > 0, \ \frac{1}{\sigma^{2+\delta}} \sum_{i=1}^{k} E\left[|X_i - \mu_i|^{2+\delta} \right] \xrightarrow[k \to \infty]{} 0.$$

Higher central moments or their absolute values are not given for the sum of random time variables (fourth order is an efficient substitution for the modulo), but we can derive the central moments from noncentral moments:

$$E[(X - \mu)^3] = E(X^3) + 2(E(X))^3 - 3E(X)E(X^2),$$
$$E[(X - \mu)^4] = E(X^4) - 4E(X^3)E(X) + 6E(X^2)(E(X))^2 - 3(E(X))^4.$$

Noncentral moments of the third or higher order can be computed as derivatives of the respective order of known characteristic function (CF) of each time distribution at point 0. And noncentral moments of the sum of time distributions are obtained as nonlinear combination of products of its marginal non-central moments, e.g.:

$$\mathbf{E}[(\mathbf{X_1} + \mathbf{X_2})^3] = E[X_1^3] + 3\left(E[X_1^2]E[X_2] + E[X_1]E[X_2^2]\right) + E[X_2^3],$$
$$\mathbf{E}[(\mathbf{X_1} + \mathbf{X_2})^4] = E[X_1^4] + 4E[X_1^3]E[X_2] + 6E[X_1^2]E[X_2^2] + 4E[X_1]E[X_2^3] + E[X_2^4],$$
$$\mathbf{E}[(\mathbf{X_1} + \mathbf{X_2} + \mathbf{X_3})^2] = E[X_1^2] + E[X_2^2] + E[X_3^2] + 2\left(E[X_1^X 2 + X_1 X_3^2 + X_2 X_3]\right),$$
$$\mathbf{E}[(\mathbf{X_1} + \mathbf{X_2} + \mathbf{X_3})^3] = E[X_1^3] + E[X_2^3] + E[X_3^3] + 3(E[X_1]E[X_2^2] + E[X_1^2]E[X_2] +$$
$$+ E[X_1^2]E[X_3] + E[X_2^2]E[X_3] + E[X_1]E[X_3^2] + E[X_2]E[X_3^2]) + 6E[X_1]E[X_2]E[X_3],$$
$$\mathbf{E}[(\mathbf{X_1} + \mathbf{X_2} + \mathbf{X_3})^4] = [X_1^4] + E[X_2^4] + E[X_3^4] + 4(E[X_1^3]E[X_2] + E[X_1^3]E[X_3] +$$
$$+ E[X_2^3]E[X_3] + E[X_2^3]E[X_1] + E[X_3^3]E[X_1] + E[X_3^3]E[X_2]) +$$
$$+ 6\left(E[X_3^2]E[X_1^2] + E[X_1^2]E[X_2^2] + E[X_2^2]E[X_3^2]\right) +$$
$$+ 12\left(E[X_2^2]E[X_1]E[X_3] + E[X_3^2]E[X_1]E[X_2] + E[X_1^2]E[X_2]E[X_3]\right).$$

Powers of expected values of orders of random variables in the last formulae, i.e. X^2, X^3, X^4, etc., are easily calculated for independent random variables. Assuming X and Y are independent random variables with DF (Spanos, 1999):

$$f_{XY}(X, Y) = f_X(X)f_Y(Y)$$
$$E[X \cdot Y] = E[X] \cdot E[Y]$$
$$Var[X \cdot Y] = Var[X] \cdot Var[Y] + (E[Y])^2 Var[X] + (E[X])^2 Var[Y].$$

Unfortunately, the complexity for these operations is at least polynomial in *k*, i.e., the number of summands grows very fast. Nevertheless, this operation is conceptually feasible because of existing recurrent relations for the formulae. Nevertheless, an algorithmic implementation is required.

3. Berry-Esseen (B-E) theorem with constant $0.4097 \leq C \leq 0.7975$ (Spanos, 1999) for independent random variables provides the rate of convergence of the sum to the normal distribution and the maximal error of approximation:

$$\max_{z \in \mathbb{R}} \left| Pr\left(\frac{1}{\sigma}\sum_{i=1}^{k}(X_i - \mu) \leq z\right) - \Phi(z) \right| \leq C \frac{\sum_{i=1}^{k} E(|X_i - \mu_i|^3)}{\sigma^3}.$$

Application of higher moments is possible. The relation gives a bound on the maximal error of approximation between the normal distribution and the normalized distribution of the sum of random variables (measured by the Kolmogorov–Smirnov distance). Use of the upper bound of parameter C requires thousands of iid. random variables for good convergence (Spanos, 1999) because convergence rate of the difference to zero is $n^{-1/2}$. Although it is not convenient, central moments for the sum of arbitrary distributions can be calculated in the same way as for Lyapunov's CLT condition above. The third central moment of modulo can be substituted with the fourth order higher central moment.

4. Finally, it is possible to check convergence of the sum of random time variables to the standard normal distribution using the following three metrics for arriving at parameters of the normal distribution because all the parameters are constant for any normal distribution:

– variance of the sum $\sum_{i=1}^{k} \sigma_i^2 \to 1$,
– skewness of the sum $E[(X - \mu)^3]/\sigma^3 \to 0$,
– kurtosis of the sum $E[(X - \mu)^4]/\sigma^4 \to 3$.

For the sum of arbitrary distributions, these parameters should be examined in the same way as for Lyapunov's CLT condition above.

There is multivariate CLT for random vectors that can be applied to joint distributions. For a sequence of iid. random vectors $\boldsymbol{X}_i$ with $E(\boldsymbol{X}_i) = \boldsymbol{\mu}$ and $Cov(\boldsymbol{X}_i) = \boldsymbol{\Sigma}$ under the restriction that no random vector dominates, it converges in order α to the following multivariate normal distribution (Spanos, 1999):

$$\sqrt{k}\left(\frac{1}{k}\sum_{i=1}^{k} \boldsymbol{X}_i - \boldsymbol{\mu}\right) \sim_\alpha N(\boldsymbol{0}, \boldsymbol{\Sigma}).$$

However, we do not go beyond the requirements of the original PERT method. Multivariate (conditional) time random variables need a better model that includes assumption of task dependence.

Thus, applicability of CLT is easy to verify and in the following we will consider two examples. It is obvious that Lindeberg-Feller condition is easier to verify because it needs only a ratio of each variance to the sum of all variances and a threshold.

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1. Examples of data verification for CLT applicability

We will consider two examples of sample problems where we check applicability of CLT. We assume different distributions (Beta, Normal, Triangular and Uniform) in the examples. We apply the simplest Lindeberg-Feller condition. A parameter $\delta = 0.05$ is used. This is very rough and conservative approximation proposal: It does not approach to zero well when applied with Feller condition. Nevertheless, even with such a favourable parameter, CLT conditions may not hold. Results of evaluation of CLT conditions for the single original PERT's critical path are given in the Tables 1 and 2.

Table 1

Critical path of 10 identical tasks, δ= 0.05

№	Distribu-tion	Opti-mistic	Most likely	Pessi-mistic	E(X)	VAR (X)	Sum VAR	L-F cond.	B-E cond.
				Part 1: Ten original random variables					
1	Beta-10%	54	90	135	91.5	182.3	1822.5	0.1	0.152
2	Beta	60	100	150	101.7	225.0	2250	0.1	0.152
3	Beta+10%	66	110	165	111.8	272.3	2722.5	0.1	0.155
4	Triangular	60	100	150	103.3	338.9	3388.9	0.1	0.074
5	Uniform	60	100	150	105.0	675.0	6750	0.1	0.098
				Part 2: Ten modified random variables (basis)					
1	Beta a	29.83	38.7	47.57	38.7	9.7	87.4	0.1	0.130
2	Beta	38	43	48	43	2.8	27.8	0.1	0.125
3	Beta b	37.57	47.3	57.03	49.3	10.5	105.2	0.1	0.129
4	Triangular	38	43	48	43	4.2	41.7	0.1	0.074
5	Uniform	38	43	48	43	8.3	83.3	0.1	0.098
				Part 3: Single additional random variable q (smaller variance)					
1	Beta	41	43	45	43	0.4	87.9	0.0995	0.129
2	Beta	41	43	45	43	0.4	28.1	0.0984	0.121
3	Beta	41	43	45	43	0.4	105.6	0.0996	0.124
4	Triangular	41	43	45	43	0.7	42.3	0.0984	0.072
5	Uniform	41	43	45	43	1.3	84.7	0.0984	0.095
				Part 4: Single additional random variable q (larger variance)					
1	Beta	33	43	53	43	11.1	98.5	0.1128	0.119
2	Beta	33	43	53	43	11.1	38.9	0.2857	0.170
3	Beta	33	43	53	43	11.1	116.3	0.0955	0.117
4	Triangular	33	43	53	43	16.7	58.3	0.2857	0.098
5	Uniform	33	43	53	43	33.3	116.7	0.2857	0.130

Source: Author's calculations based on Hajdu and Bokor (2014)

The first example in Table 1 was taken from sample 1 in (Hajdu and Bokor, 2014). Part 1 is simply a sequential set of 10 independent tasks with identical DF. Part 2 contains changed data: Derived from the most likely value (m.l.v.) of "Beta" were most likely values of "Beta a" m.l.v. ("Beta a")=0.9*m.l.v.("Beta") and m.l.v.("Beta b")=1.1*m.l.v.("Beta"). Optimistic

(pessimistic) values of distributions "Beta a" are obtained as m.l.v.*0.9-5 (m.l.v.*1.1+5). Finally, CLT is not applicable according to Lindeberg-Feller condition. The third and forth examples add an eleventh random variable of the same distribution as other 10 variables, but with slightly smaller variance in example 3 and larger one in example 4. In examples 3 and 4 optimistic, most likely, and pessimistic estimations of the additional random variable with its expected value and variance are given in Table 1. The variable is added to the 10 basis variables in the respective lines from example 2 to obtain the sum of variances and Feller's condition for the sum.

It is easy to see from Table 1 that the original data from the paper (Hajdu and Bokor, 2014) does not satisfy CLT conditions. Parts 2-4 show that adding a single random value with the same mean value but smaller variance does not change a lot, while on the opposite, adding an extra variable with relatively larger variance deteriorates the condition dramatically. It is worth to note that "relatively large" starts only at 15% larger variance in the example 4 and the difference of the criteria are evident.

Berry-Esseen condition for all the cases was computed using *fourth central moments*. It shows the maximum difference of cumulative DF of the sum and the respective normal distribution cumulative DF. It is clear to see that 10 iid. distributions are not enough to achieve a sufficient similarity to normal distribution. The difference is over 10% most of the time. Although a DM should decide on whether this is acceptable, the popular values of statistical significance today are 5% or less. In Example 4, it is clear to see that adding only one random value with larger variance increases the difference in all cases. Both L-F and B-E conditions behave consistently.

Table 2

Critical path of 10 tasks, $\delta = 0.05$

Parameter	Beta (Mean/Var)	Triangular (Mean/Var)	Uniform (Mean/Var)
Task 2	19/9	16.67/15.50	23/27
Task 5	2.33/0.44	2.67/0.72	3.00/1.33
Task 8	0.63/0.01	0.67/0.02	0.70/0.03
Task 15	3.17/0.25	3.33/0.39	3.50/0.75
Task 16	4.00/0.11	4.00/0.17	4.00/0.33
Task 17	10.00/0.44	10.00/0.67	10.00/1.33
Task 18	2.00/0.11	2.00/0.17	2.00/0.33
Task 27	0.52/0.025	0.53/0.03	0.55/0.07
Task 28	3.83/0.257	3.67/0.39	3.50/0.75
Task 29	2.17/0.25	2.33/0.39	2.50/0.75
Sum VAR	10.89	18.44	32.68
Max L-F cond.	0.83	0.84	0.83

Source: Author's calculations based on Birge and Maddox (1995)

The second example was taken from (Birge and Maddox, 1995). Assuming minimum duration as pessimistic, maximum as optimistic, mean as most likely from table 8 in (Birge and Maddox, 1995), we produced beta distribution parameters of task duration according to the original PERT method. Critical path was also determined according to the original PERT

approach: 2-5-8-15-16-17-18-27-28-29. We verified L-F CLT condition for the critical path and summarized in Table 2. We then experimented with triangular and uniform distributions based on the same initial three point estimates. Although the variance of these distributions is larger, the effect on CLT condition is limited.

We can see from Table 2 that in this case CLT is not applicable for 10 tasks in the path because variance of task 2 is dominating.

To conclude, reliance on CLT for good estimations is very poor. As it follows from theory, CLT is a tool for *large* number of summands of relatively close (preferred small) variance. Outliers in sense of variance will be dominating when sample size is close to infinity. Small samples may not assure sustainable and reliable approximation. The rule of thumb of 30 samples for CLT application does not hold either. From our further experiments with example 1 in Table 1, sample sizes should be about one hundred to get the Kholmogorov-Smirnov difference less than 1 % with conservative conditions and data. This conforms to the theory of CLT. We considered very simple case of iid. variables with only one outlier and it was hard to obtain close approximation of normal distribution. Results will clearly depend on data. Therefore, for project estimation, we suggest verification of the conditions, not relying on chance.

Discussion

We found that the research question can be answered affirmatively: By verifying CLT conditions we can assure that original PERT gives appropriate answer for the given critical path. Unfortunately, this is a fixture for only one PERT assumption. Moreover, we should consider next, what to do in case when CLT is not applicable.

We believe that further research activities should be applied to definition of multiple critical paths and usage of bounding methods to derive time bounds for each task. Search for uncertain duration presumes aggregation of time DFs along paths in the project stochastic network. A universal approach should presume arbitrary distributions and dependencies of tasks. We consider that the uncertain nature of the problem imposes little credit to very precise time estimations. Therefore, methods that can compute reasonable bounds of time distributions of task durations promise more practical benefits to DM. These reasonable methods should include DM's risk perception in some way.

Based on the current study, we propose a six-value-set that may describe every time distribution. These are expected value, variance, upper and lower bounds of DFs and corresponding probabilities for the upper and the lower bounds. In case of a lopsided DF, only information about variance can not reveal how much the distribution is skewed, but the bounds will always show this information. This gives efficient information about time DFs to judge about their criticality for DM. Next, attention to problems of conditional uncertainty and cases of complex multivariate distributions is also needed. Finally, project management is a continuous activity. After the project start we observe realizations of time of tasks in the network. This is vital information about real performance and hence, it should be used to update time estimations of remaining tasks and even for corrections of the model. This update is needed according to Deming Cycle and a possible solution for that is Bayesian approach.

Many researchers employ DFs that have nice mathematical properties in order to simplify formulas and computations. Ability to easily derive the resulting distribution of the convolution is vital for mathematical manipulations. But there are issues that have not been fully understood. For instance, if one applies normally distributed times, to what extent an infinite tail is realistic or what is the meaning of negative time in the left tail? It is not feasible to consider an infinite

delay of tasks: The tasks or the whole project will be terminated relatively shortly due to resource constraints and management intervention. Truncated random variables lose some of their nice properties and their addition is as hard as for uniformly distributed variables. Finally, how to build and verify normally distributed times based on the current state of knowledge and uncertainty about a particular project?

We believe that realistic DFs are important. Consideration of uniform or triangular distributions instead of beta distribution is new in this context since they were mostly not considered in the last 30 years. Nevertheless, these simple distributions are easier to build with an expert and understand their meaning. Johnson (Johnson, 1997) has shown that more simple intuitively obvious triangular distribution can be very close to beta DF and proposed a procedure for estimating the necessary parameters.

Chance constraint optimization model

We attempt to provide a model for prospective improvement of original PERT. An improved mathematical model should have realistic assumptions about distributions used and the notion of stochastic critical path. We aim at creation of *probabilistic* PERT with outcomes similar to CPM method, i.e. estimation of earliest and latest start and end times for every task. It should be not significantly more complex in use for practitioners than current deterministic methods, yet be based on well developed mathematical theory. Most often, the main goal is estimation of the maximum time of a project. However, resource and cash flow uncertainties are also important and should be represented in the model. There are models that consider costs or cash flows along with time, e.g. (Benati, 2006). However, to the best of our knowledge there are no fully stochastic models that combine all aspects of time, cost and resource availability, i.e. current solutions are stochastic only in one of the two aspects: time or cash flow.

One of the first chance constraint programming models for SN was proposed by (Charnes et al., 1964; Bruni et al., 2009). In their stochastic optimization problem activity times had exponential and discrete DFs respectively. The former model was shown to have errors (Bruni et al., 2009) and used a chance constraint programming method that turned out to be problematic (Elmaghraby et al., 2001).

A universal management approach should account for time and resources. The only assumption is that DFs of the activities' durations are known. We do not assume any specific DF types or independence. DM's risk aversion can be expressed with reliability thresholds α_i for different constraints. The model is as follows:

min $Ub(\pi_q)$ //upper time bound of critical path

$\quad(-Lb(\pi_q))$ //lower time bound of critical path

$\quad C_{\mathbf{r}}(\pi_q)$ //cost of resources

s.t. $Pr\{\pi_q \geq \pi_p\} \geq \alpha, \ \forall q,p \in \Pi, \ q <> p, \ q = 1,\ldots,Q$ //a) set of Q critical paths

$\quad Pr\{X_j^s \leq t_j^s\} \geq \beta_j^s$ //b) specific start time constraints

$\quad Pr\{X_j^f \leq t_j^f\} \geq \beta_j^f$ //c) specific finish time constraints

$\quad Pr\{f_{\mathbf{r}}^t(X_j) \leq \mathbf{r}_j^t\} \geq \rho$ //d) resource constraints at certain times

$\quad X_j^s \geq \max\limits_{i \in Prec.} X_i^f$ //e) start time of the current task

$\quad X_j^f \leq \min\limits_{i \in Succ.} X_i^s$ //f) finish time of the current task

$\quad \pi_p = \Sigma X_j | j \in$ path p   //g) time of a path p

where

$\quad X_j \in \mathbb{R}$ random duration of task j;

$\quad X_j^s, X_j^f$
start and finish time of task j;

$\quad \pi \in \mathbb{R}$ duration of a path;

$\quad t_j^s, t_j^f$ predefined time constants;

$\quad C_{\mathbf{r}}$ cost function of resource vector $\mathbf{r}$;

$\quad f_{\mathbf{r}}^t(X_j)$ function of resource requirements for task j at time t depending on task duration;

$\quad \rho$ reliability of meeting resource chance constraints for task j at time t;

$\quad Prec.$ is a set of preceding tasks to the current task;

$\quad Succ.$ is a set of following tasks after the current task;

$\quad \Pi$ set of all paths;

$\quad \alpha \in [0,1]$ is a reliability threshold for probabilistic critical path selection;

$\quad \beta \in [0,1]$ is a reliability threshold for task time constraints.

In general, this is a multicriteria stochastic optimization problem. Most potential deterministic and stochastic issues for a project can be represented with the model, therefore all

constraints are optional. Maximum time bounds of the project and cost of used resources are minimized. The bounds depend on *K* longest probabilistic paths. They are determined by chance constraint a). It is possible to have deterministic time thresholds t_j^s, t_j^f in chance constraints b) and c) that mean desired time of begin or end of certain task, e.g. a milestones or explicit dependency of project operations. Constraint vector d) defines probabilistic compliance with task resource requirements during task execution time. Constraints e) and f) are deterministic, but their variables are random time variables. Together, they represent the sequential task execution strategy in PERT networks. One of our goals should be the determination of time bounds of start and finish times of each task like in deterministic CPM method. The meaning of e) is the starting time of the current task is the longest finish time of all preceding tasks. The same is valid for f), the finish time of the current task is the earliest starting time of all following tasks. Finally, constraint g) accounts for stochastic time of a path.

We do not suggest any specific method to solve the model in the current paper. The model provides a uniform representation of uncertainty of project management problems. Cost functions of resources are reserved for future research possibilities. Stochastic task scheduling can be a natural extension of this model.

Conclusions

According to original PERT, CLT theorem approximates path duration times, regardless of DFs of individual activity times. However, the theory presumes that CLT is to be applied under predefined conditions. We considered verification of the conditions. While scholars usually omit CLT conditions or artificial data in experiments seem to converge with CLT to normal distribution, e.g. (Ludwig et al., 2001), this is an unproven heuristic. On two typical examples from literature, we showed that it may not be always true and data can contradict the theory of CLT. Regrettably, we did not find empirical data from a real project in literature for testing.

We considered the conditions of CLT and aspects of their practical application in order to verify the admissibility of CLT for given activity time distributions. These simple techniques allow verification of validity of classical PERT for specified activity time estimations. Every practitioner can use the verification to assure validity of PERT assumptions and feasibility of the results of PERT analysis, even using spreadsheet software. Illustrative examples were provided. We believe that this check should improve the degree of trust in PERT results.

While criteria for CLT applicability are well known in probability theory, our conclusion is that they may have restricted application. The constraints of CLT applicability are usually omitted in papers. We do not know whether CLT conditions are assumed in existing software. We consider that CLT can be applied to sequential critical path in classical PERT, but only after verification of CLT applicability. Aggregation of times of several parallel activities is to be done with other methods.

We can conclude that in order to improve original PERT, we should develop a better model with realistic assumptions and loopback control after the beginning of the project. We provide such a model in the paper. Our following research will be directed at obtaining time bounds for project tasks with the aforementioned model.

Finally, a project is not a static thing. After the start, time of finished activities become realizations of random variables. This is valuable information related to the current project with unique ambiance. In conformance with Deming principle, we should update our time

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estimations based on this recent information. Bayesian method is a natural tool for that. There are already attempts at this, e.g. (Cho, 2009; Gardoni et al., 2007; Kim and Reinschmidt, 2009). Thus, model assumptions can be amended and estimates of the following activities improved based on revealed times of previous ones. Apparently, the model should be updated every time new information is received using Bayes approach.

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PROJECT MANAGEMENT ON THE EXAMPLE OF IMPLEMENTATION OF CONTINUOUS IMPROVEMENT IN THE ENTERPRISE OF THE TFL SECTOR – ENABLERS AND INHIBITORS

Małgorzata Trenkner, Wrocław University of Economics, Poland

Abstract

In recent times, interest in the implementation of the idea of continuous improvement (CI) has been growing in enterprises. It is connected with the systematic and consistent improvement of the company's functioning as a result of carrying out a series of small improvements in a "bottom-up" manner, in order to gain a competitive advantage. The basis of these activities is the PDCA cycle and the implementation of management concepts based on the idea of continuous improvement, i.e., Lean Management, TQM, Six Sigma. The idea of continuous improvement has its origins in the sectors of the economy mainly related to the manufacturing industry. Currently, the interest in implementing this idea is also growing in the services sector - including the transport, freight forwarding, and logistics (TFL) area, where the optimization of service delivery processes revolves around such criteria as customer satisfaction, processing time and timely completion, process quality, and costs. Bearing in mind the specificity of this sector the following research problem arises: how to successfully implement CI management concepts in an enterprise that provides TFL services?

The article aims to identify enablers (and inhibitors) for continuous improvement on the example of implementing CI project in the enterprise from TFL sector. The following research methods are used to achieve the objectives: literature studies, diagnostic methods, case studies, interviews, and direct observation. Main results and findings of are as follows:

- Social factors, i.e., organizational culture, leadership, employee engagement, efficient communication are playing an essential role in the successful implementation of CI idea.
- In managing the CI implementation project, it is crucial to shape the organization's ability to improve continuously.
- Robotics of service processes can become an important enabler for continuous improvement in services. However, it is essential to cover social issues in this area.

Keywords: *Project Management, continuous improvement, enablers, inhibitors.*
JEL code: L20, M14, M10, O22, O30

Introduction

In recent times, interest in the implementation of the idea of continuous improvement (CI) has been growing in enterprises. It is connected with the systematic and consistent improvement of the company's functioning as a result of carrying out a series of small improvements in a "bottom-up" manner. These improvements do not take place in a radical way, but rather incrementally. These activities must be part of the day to day routine of the organisation and should be voluntary and not mandatory (Garcia-Sabater & Marin-Garcia, 2011). The objective of continuous improvement is to obtain improvements in costs, quality, flexibility and in productivity (Bessant et al., 1993; Choi et al., 1997; Garcia-Sabater & Marin-Garcia, 2011) in order to gain a competitive advantage. A characteristic feature of continuous improvement is its achievement of these aforementioned improvements at little cost (Choi et al.,

1997). The basis of these activities is the PDCA cycle and the implementation of management concepts based on the idea of continuous improvement, i.e., Lean Management, TQM, Six Sigma.

There is ample documentation about the success of the implementation of tools of continuous improvement in companies and of their effect on the improvement of various indicators, both productive and non-productive (Garcia-Sabater & Marin-Garcia, 2011; Jorgensen et al., 2003; Jung & Wang, 2006; Marin-Garcia et al., 2009). However, it is believed that continuous improvement, although now widely accepted by managers in all types of organizations, is a challenging task in terms of management (Pullin, 2005). According to J. Bessant & S. Caffyn (1997), the difficulty is not due to the idea itself but to the mistakes made during its implementation. J. Bessant et al. (2001) believe that the mechanisms by which a steady (continuous) increase in improvements can be achieved are not clearly defined. The research shows that continuous improvement is an evolutionary process in which five different levels of maturity can be identified (Bessant et al. 2001). The challenge for each organization is to learn at every level and move to a new level, integrating the existing solutions with new ones. The results of some studies show that not always initiatives of continuous improvement bring the expected results (Pay, 2008; Mendelbaum, 2006). The question arises, therefore, what is the reason for this? Some tried to explain it (Bessant & Caffyn, 1997; Formento et al., 2013; Loadgard et al., 2016; Schroeder & Robinson, 1991), but little in those attempts reveals how failed implementations of CI initiatives can be "rescued".

Although CI is widely practised, organisations have experienced difficulty with sustaining the momentum of their activities (Mauri et al., 2010). This difficulty has been attributed to a poor understanding of the process of change management within CI initiatives (Rapp & Eklund, 2002). A commonly adopted approach to CI has been to implement ad hoc process improvement projects by simply applying established CI tools and techniques. Implementing such an approach is most likely to fail if the infrastructure needed to sustain a momentum of improvement has not been put in place (Anand et al., 2009; Galeazzo et al., 2017). Previously reported failures to do this might be attributable to the abstract nature of published guidelines on CI capability development (Garcia-Sabater et al., 2012) and the lack of detail on the elements of a process for CI programme management. In the literature, attempts are being made to identify key factors – enablers and inhibitors of the CI process (Bessant & Caffyn, 1997; Formento et al., 2013; Garcia-Sabater & Marin-Garcia, 2011; Garcia-Sabater et al., 2012).

The interest in implementing continuous improvement idea is growing in the services sector – including the transport, freight forwarding, and logistics (TFL) area, where the optimization of service delivery processes revolves around such criteria as customer satisfaction, processing time and timely completion, quality, and costs. Bearing in mind the specificity of this sector the following research problem arises: how to successfully implement CI management concepts in an enterprise that provides TFL services?

The article aims to identify enablers (and inhibitors) for continuous improvement on the example of implementing continuous improvement project in the enterprise from TFL sector.

The following research methods will be used to achieve the objectives: literature studies, diagnostic methods, case study, interviews, and direct observation.

Implementation of a continuous improvement process: models, enablers and inhibitors

According to J. Bessant & S. Caffyn (1997, p. 11) CI is not a single event, nor is it a single technique or tool; it is a long-term learning process. Authors characterize five discrete "stages" or levels of development in CI (Maturity Model of CI):

1. "Natural"/ (background CI): problem solving happens at random, no formal efforts or structure, occasional burst punctuated by inactivity and non-participation, the dominant mode of problem solving is by specialists, short-term benefits, no strategic impact.
2. Structured CI: formal attempts to create and sustain CI, use of formal a problem-solving process, use of participation, training in basic CI tools, structured idea management system, recognition system, often parallel system to operations.
3. Goal oriented CI: all of the above plus formal deployment of strategic goals, monitoring and measurement of CI against these goals, in-line system.
4. Proactive (empowered CI): all of the above plus responsibility for mechanisms, timing, etc., devolved to the problem-solving unit, high levels of experimentation.
5. Full CI capability – the learning organization: CI as a dominant way of life, automatic capture and sharing of learning, everyone actively involved in the innovation process, incremental and radical innovation.

The progression from one level to the next is realized within an organization in accordance with the specific abilities acquired. These abilities are arranged in the following order:

1. "Getting the CI habit" – the ability to generate sustained involvement in CI,
2. "Focusing CI" – the ability to link CI activities to strategic goals of the company
3. "Spreading the word" – the ability to move CI activity across organizational boundaries
4. "Walking the talk" – the ability to articulate and demonstrate CI values
5. "Continuous improvement of continuous improvement" – the ability to strategically manage the development of CI
6. "The learning organization" – the ability to learn through CI activity (Bessant & Caffyn, 1997, pp. 13-15).

The evolutionary model has been confirmed by quantitative studies confirming this hierarchy of stages and the growing impact of continuous improvement on business performance indicators, along with the transition to subsequent stages (Jorgensen et al., 2006).

However, researchers pointed out several weaknesses in this approach. According to M. Butler et al. (2018), the weakness of the J. Bessant et al. (2001) model is that the development of employee behaviour required to support and sustain a CI initiative is depicted as a predefined sequence of behavioural changes that ultimately result in the development of a learning organisation. No recognition is given to the possibility of the loss of the 'discretionary effort' to be made by shop floor employees in order to sustain a momentum of improvement (Butler et al. 2018). C.W. Wu and C.L. Chen (2006) described three other limitations: 1) stable frameworks are required to sustain action, 2) model does not explain what skills are required as necessary to achieve the wanted solution, and 3) it does not take into account that any activity manifests the cycle of entry, growth, maturity, and decline.

Ability acquisition is manifested through characteristic behaviour patterns, which are widely and accurately presented by J. Bessant et al. (2001, p. 72). Case studies (Rijnders, 2002; Savolaine, 1999; Jorgensen, 2003) suggest that companies implement the CI behaviours in a much less linear fashion than proposed in the CI Maturity Model. Furthermore, these studies suggest that various issues, for example, those related to culture and leadership (Jorgensen,

2003) must be managed before embarking on CI development. Finally, these empirical studies suggest that specific characteristics of an organization may render some of the behaviours more critical than others in terms of improving performance (Jorgensen et al., 2006, pp. 331-336). Authors suggest that CI maturity need not necessarily follow a linear progression in order to impact performance positively and that the development of certain capabilities may lead to improvement of specific measures of performance. According to the analysis, the appropriate strategy for any given organization may depend on factors not included in their study. Future research should be targeted at identifying additional factors that may have an influence on which behaviours should be prioritized (Jorgensen et al., 2006, p. 336).

Critical management task in developing CI is putting behavioural routines in place and reinforcing them (Bessant & Caffyn, 1997, p.16). This development can be enabled by the use of a variety of structural and procedural devices – "enablers" and "inhibitors" ("blockage") – which can be deployed strategically. According to J.J. Garcia-Sabater & J. A. Marin-Garcia (2011, p. 30) "enablers and inhibitors are elements or characteristics in an organisation, that due to their existence or absence in the company, act as catalysts causing the development of continuous improvement or on the contrary restrain or even cause limitation of continuous improvement within the company".

Many authors have developed models and identified enablers and inhibitors for continuous improvement (Bateman & Rich, 2003; Bessant & Caffyn, 1997; Garcia-Sabater & Marin-Garcia, 2011; Garcia-Sabater et al., 2012; Formento et al., 2013; Butler et al., 2018). For example, table 1 presents a set of enablers and inhibitors proposed by J. Bessant and S. Caffyn (1997, p. 11).

Table 1

Enablers and blockage for continuous improvement

Ability	Enablers	Blockages
Getting the CI habit	PDCA or similar structural model plus training Simple idea management system, based on rapid response Recognition system Simple vehicles, based on groups Facilitator training	No formal process for finding and solving problems Lack of skills in problem-solving Lack of motivation No structure for CI Lack of group process skills
Focusing CI	Focus problem-solving on strategic targets/policy development	No strategic impact of CI
Spreading the word	Cross-functional CI teams Process modelling tools and trainings	Lack of co-operation across divisions Lack of process orientation
Walking the talk	Articulation and review	Conflict between espoused and practised values
The learning organization	Post-project reviews Story-board techniques Encapsulation in procedures	No capture of learning
Continuous improvement of continuous improvement	Formal CI steering group and strategic framework Regular CI review and relaunch	Lack of direction Running out of steam

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Source: Bessant J., Caffyn S., High involvement innovation through continuous improvement, "International Journal of Technology Management" 1997, Vol. 14, No. 1, s. 11.

H.R. Formento et al. (2013) in a review of the literature identified nine key factors and seventeen components aiming to evaluate implementations of a continuous improvement process (table 2) and evaluated those factors against a group of thirty large companies that had various level of success in CI their implementations.

Table 2

Key Factors and Components of a Continuous Improvement process

Key Factor	Component
Formalization & Structure	Existence of formal program Existence of continuous improvement teams
Continuity/Duration	Never was discontinued It evolved over time Age of the program (average)
Deployment/Scope of Program	Projects also apply to support areas Percentage of employees involved (average)
Training	Training program on continuous improvement Training for all staff
Management Commitment	Managers identify topics for improvements Managers approve topics for improvement Managers open and close projects Senior management participate in internal events
Program Coordination	Middle managers facilitate teams Different roles to coordinate teams
Methodology & Tools	There is an official method for teamwork Interdisciplinary teams Use of basic tools
Performance Measurement	Measurement of avoided cost Measurement of participation
Communication of Results, Recognition & Incentives	Existence of recognition program Teams presentation in internal events

Source: Formento H.R., Chiodi F.J., Cusolito F.J., Altube L.A. & Gatti S.P., 2013. Key factors for continuous improvement, Independent Journal of Management & Production, v. 4, n. 2., p. 408

The research confirmed that among companies with successful CI processes they had almost all of those components present and well developed. The companies struggling with their CI implementations were lacking in several areas. H.R. Formento et al. (2013) recommend establishing ways of working taking into account all of the factors listed in table 2, as they seem to differentiate between successful and unsuccessful CI programme. Authors recognize that each company needs to create its continuous improvement strategy; a specific plan, fitting to the company situation, increases the success possibilities.

The research by J.J. Garcia-Sabater et al. (2012, based on the studies of literature on the subject), identified the following enablers and inhibitors and examined their occurrence in companies at different levels of the CI maturity model of Bessant et al. (2001):
1. Management involvement and strategy,
2. Setting objectives and the need for metrics,
3. Leadership management – the continuous improvement (lean) manager,

4. Worker involvement,
5. Resources,
6. Clarification and creation of new structures,
7. Methods for expanding continuous improvement,
8. Selection of continuous improvement projects,
9. Cultural aspects,
10. Training in abilities.

The companies interviewed in the study considered these elements as necessary, thus confirming the proposals presented by literature. The relationship between enablers, inhibitors and various stages of the model proposed by J. Bessant et al. (2001) was established. Therefore, another sequence of factors enabling the implementation of continuous improvement was developed. It shows how the introduction of these factors can contribute to the development of behaviours related to different abilities.

The multitude of lists of enablers and inhibitors presented in the literature encourages their practical verification. It is an important field of research, as they have a noticeable impact on the effectiveness of the CI process implementation.

Analysis and evaluation of project management CI implementation – case study

The study aimed to analyze and evaluate the implementation of the continuous improvement process, with particular emphasis on enablers and inhibitors of CI, and the effects of the continuous improvement implementation. The subject of the research was the process of implementing the idea of continuous improvement. The author employed an idiographic approach and a research method – a case study. Thanks to the case study, the researcher can confront his reasoning with the behaviour of real participants of events and processes. According to R.K. Yina (1994, p. 23) case study, on the one hand, is empirical, because it is based on analysis and evaluation of phenomena occurring in reality, on the other hand, is reliable in relation to data collection and processing because it opens access to many information sources and allows comparison between them. The analysis used the following research techniques: documentation analysis (company website, reports), participant observation and interview. The interview was conducted with Process Improvement Manager, Lean Program Manager, and HR Manager.

The surveyed company is a medium-sized company of the TFL sector employing over 200 employees. It organizes transport for all types of vehicles for its customers throughout Europe. It also offers export sales to its customers. Thanks to the appropriate management of the fleet of vehicles and freight as well as an extensive network of partner companies, the company can collect any express delivery within 60 minutes within the European Union. Another service offered by the company is air transport ("door to door"), sea transport and storage of goods.

There were two approaches to implementing the idea of continuous improvement in the company under study. The first approach took place in 2013. At that time, the need to implement improvement measures was considered as a way to eliminate the problems that existed at the time: cost growth disproportionate to profits achieved, not cascaded goals, lack of project management, insufficient resources and competencies in management, no specific goal of action. However, in July 2013, after a long-delayed transport, a critical complaint from the most significant customer came to the company. Without the implementation of radical remedies, there was a risk of termination of cooperation in that company. After many hours of senior management talks, the decision was made to reorganize the core department – forwarding

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– with the use of Lean Management. The CI implementation project involved: General Manager, Operational Manager and Head of the Shipping Department. To a lesser extent, other managers and employees were involved – their role was mainly to attend numerous meetings. The primary process – forwarding was divided into three parts (functioning like the sockets).

This task separation resulted in a 28% savings in the costs of order processing, significantly shortened the time of introduction of new employees and improved the quality of supervision. The process-oriented organization, with only minor changes in the framework of continuous improvement, exists to this day. At that time, a standard monitoring system was created containing several basic protocols assuming separate activities, depending on the urgency of transport. Also, standardized job descriptions and competence matrices were created. Neither of these tools has been successfully implemented and has become obsolete over time. An attempt was made, also ineffective, to implement the matrix of indicators that were to cover the key processes in the company. In 2014, intensive work was also carried out on the company's first strategic plan in the company's history, which in its assumptions was to prepare the company for even more dynamic growth, including the creation of process maps, employee recognition system and elimination of waste. Unfortunately, without the support of the management board, most of the activities were not implemented, and the departure of the General Manager in 2016 made it difficult for the inexperienced team to achieve the set goals.

In retrospect, in 2013, the organization was not ready to implement continuous improvement using the lean approach. Despite the willingness and commitment of several managers, limited confidence in this type of solutions from the owner of the company and the lack of a sense of need for changes among employees led to the ineffective implementation of CI. The task put before the General Manager was to increase turnover by acquiring new clients. The way he chose to achieve the goal was, however, incompatible with the vision of the owner of the company. The General Manager believed that solid foundations should be prepared for growth: define, standardize and slim down processes, prepare products that would defend themselves with their quality – this road required time and commitment of many resources. In the owner's opinion, however, it was necessary to act quickly, intensifying sales activities.

Not without significance was the fact that neither employees nor the team involved in the CI implementation had any experience in this matter. Each meeting turned into many hours of discussions on many side topics. The inability to concentrate on the purpose of the meeting led to the fact that they often ended without any conclusions. The problem was also the excessive ambition of the team, which imposed on itself unrealistic (with the resources at hand) amount of projects. As a result, many of them were never completed and those that were implemented, and passed on to the owner of the process, eventually died or became out of date.

In 2018, the company made a second attempt to implement continuous. An employee with many years of experience and extensive knowledge about the Lean concept joined the team. In February, initial training for the management in the field of *kaizen* and Lean and the selection of a pilot area for implementation – the aforementioned forwarding process. In March, leaders and coordinators of the CI program - "leaders of change" - were trained. Team prepared designs of tables to be used during daily meetings and a system of regular meetings for managing team results was implemented. Selected people from the forwarding department underwent training for problem-solving capabilities. The CI team started to create a new set of competence matrices.

In order to increase the effectiveness of introduced changes, the following CI methods and techniques were used:

- problems based on visualization: "hour by hour" tables, process maps, one-point lessons,
- related to control: job description sheets, competence matrices,
- showing cause-and-effect relationships (problem-solving): Ishikawa diagram, 5 Why,
- related to the strengthening of strategy implementation: cascading objectives, goals created using the SMART method, key process measures (KPIs).

At the turn of July and August, a week-long *kaizen* workshop took place, where participants representing different levels and stages of the process worked to identify and eliminate waste by analysing the key customer service process. As a result, a list of dozens of mini improvement projects was born, the implementation of which lasted until the end of the year. The company created a new department – Lean and Robotics (LiR), whose role is "Building *kaizen* culture and managing activities leading to increase of the company's competitiveness (by improving efficiency, reducing costs, improving quality)". On the initiative of the employees of the LiR department, work on a "Road Map", which was meant to be an indication of the areas in which LiR can support the implementation of the strategic goals of the company, had been started. During its preparation, however, it turned out that these goals are not consistent and sometimes even mutually exclusive. After the presentation of these results the definition of "Road map" has been changed, and the management board was involved in the work in that area. In effect, the "Road map" goal is now to define the company's strategic goals and allow, with the participation of managers, to cascade them down into individual departments. What is important, this time the managers were to determine how – and how much – they can contribute to the implementation of strategic goals and the overall result was subject to negotiations. Through a cycle of workshop meetings, indicators for all revenue departments were developed. During the annual Christmas Eve meeting, strategic objectives and detailed operational objectives of individual departments were presented.

Based on the CI maturity model proposed by J. Bessant and F. Caffyn (1997), it can be stated that the company under study passed (to some extent) through the first three levels of the model. At each of these levels, the occurrence of some typical characteristic was identified, i.e.:

1st stage – "Natural"/(background CI): problem solving happens at random, no formal efforts or structure, occasional burst punctuated by inactivity and non-participation, dominant mode of problem-solving is by specialists, short-term benefits, no strategic impact.

2nd stage – "Structured CI": formal attempts to create and sustain CI, use of a formal problem-solving process, training in basic CI tools, often parallel system to operations.

3rd stage – "Goal-oriented CI": formal deployment of strategic goals, monitoring and measurement of CI.

The evolution of continuous improvement in the company under study seems to progress according to the model as mentioned above, however, only certain activities have been undertaken at individual stages. At the "structured CI" level there was no significant employee participation in CI, neither structured idea management system nor recognition system. At the "goal-oriented CI" level, there was no in-line CI system nor any cross-boundary problem-solving activities.

As has already been said, the progression from one level to the next is realized within an organization in accordance with the specific abilities acquired (Bessant, Caffyn 1997; Bessant et al. 2001). While studying the abilities of the enterprise for continuous improvement, little behaviour that supports the maintenance and development of them have been identified. In the cross-section of individual abilities, the following behaviours were observed:

1. "Getting the CI habit" (the ability to generate sustained involvement in CI): people make use of some formal problem-solving and solving cycle, people use appropriate simple tools and techniques to support CI, groups and individuals begin to use simple measurement to shape the improvement process, groups and individuals initiate and carry through CI activities

2. "Focusing CI" (the ability to link CI activities to strategic goals of the company): individuals and groups asses their proposed changes against departmental or company objectives to ensure they are consistent with them.

3. "Spreading the word" (the ability to move CI activity across organizational boundaries): people co-operate in cross-functional groups/across internal.

4. "Walking the talk" (the ability to articulate and demonstrate CI values): lack of suitable behaviours.

5. "Continuous improvement of continuous improvement" (the ability to strategically manage the development of CI): the CI system is continually monitored and developed by a designated individual, the individual responsible for designing the CI system design it to fit within the current structure and infrastructure.

6. "The learning organization" (the ability to learn through CI activity): lack suitable behaviours.

The result of this diagnosis raises some concern. For if the company does not develop proper (pro-CI) attitudes and behaviours, the organization will not have the ability to continually improve and thus to enter the next levels of CI evolution. As has been already mentioned, the success of continuous improvement depends very much on people (their attitudes, behaviours, actions).

Another issue under consideration was the determinants of CI implementation in the enterprise. The following enablers and blockages have been identified based on J. Bessant, F. Caffyn (1997) (table 3).

Table 3

Enablers and blockages of CI based on J. Bessant, F. Caffyn (1997) classification

Ability	Enablers	Blockage
Getting the CI habit	PDCA or similar structural model Training in problem-solving Facilitator training Simple vehicles, based on groups	Lack of motivation Lack of simple idea management system, based on rapid response No recognition system
Focusing CI	Focus problem-solving on strategic targets/policy development	
Spreading the word		Lack of co-operation across divisions Lack of process orientation
Walking the talk		Conflict between espoused and practiced values
The learning organization	Post-project reviews	
Continuous improvement of continuous improvement	Formal CI steering group and strategic framework Regular CI review and relaunch	

Source: own research based on the results of the case study and J. Bessant, F. Caffyn (1997)

As can be seen from the above list, there are only some of the enablers of CI identified within the company. In addition, several blockages/inhibitors of CI have are present. That might mean that the implementation of continuous improvement is at risk, and precautionary measures should be taken.

Using the classification of enablers and inhibitors of CI provided by H.R. Formento et al. (2013), which can be treated as an extension of the previous model, the following activities have been identified (or not) in the scope of continuous improvement (table 4).

When it comes to cultural determinants of CI implementation in the surveyed enterprise, it can be said that there is still a lot to do. Although the values characteristic of continuous improvement are included in the company's vision and mission, the activities related to their promotion are poorly advanced. The result is the occurrence of a few organizational behaviours that serve to shape the organization's ability to improve continuously. Respondents admit that the leaders and managers of the lowest level of leadership who have a direct influence on operational employees have a significant role to play in this respect, so this group should be particularly supported in the acquisition of the ability to carry out cultural change. The company is aware of shortcomings in this area and is successively trying to undertake further activities that build a culture of continuous improvement. At the same time, it realizes that without a strong culture of continuous improvement, it will be difficult to succeed in the area of CI. Currently, the culture of continuous improvement is the most popular at the level of behavioural and physical artefacts, i.e. presentation of the use of problem-solving tools (fish diagram, 5 Why), visualizations of CI results, meetings at boards (review of results), problem-solving sessions, improvement tables (visualizations of problems and their statuses).

By examining the perception of the work of the project team for the implementation of CI by its members, it can be concluded that all members of the team highly appreciated the team's orientation to problem-solving and focus on achieving results. In turn, mutual trust, openness to constructive criticism and involvement in design work were highly rated by Process Improvement Manager but on a medium level by Lean Program Manager. Responsibility and attention to results as well as effective communication in the team have been evaluated highly by Process Improvement Manager and as poor by the Lean Program Manager. These discrepancies in the assessment of the work of the team by their members indicate that it is still necessary to work on the team's cooperation and find reasons for the lower grades of the team's work from Lean Program Manager. The project manager (Process Improvement Manager) has been assessed relatively high. The manager received slightly lower ratings in terms of having authority among project team members as well as technical (specialist) and administrative (management) reliability. Asked about motives to work in the CI implementation team, team members jointly agreed on: the opportunity to demonstrate their initiative and independence, the possibility of personal development within the framework of the project and personal identification with the idea of continuous improvement.

Regular meetings of the project team (every two weeks) on which you can present your ideas and submit proposals for changes, were pointed as an important factor increasing the effectiveness of the project. The team members indicated that the meetings of the project team are also an opportunity to increase the team's integration. Sometimes the president of the company participates in these meetings, which underlines the importance of the project.

Table 4

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Key Components of a Continuous improvement process

Key Component	Case-study situation
Formalization & Structure	• There is no formalized CI program • CI teams have been established and functioning (they include operational employees and a moderator) • There is no formal employee suggestion system (ideas are collected as part of a solving session or brainstorming session or *kaizen* workshop).
Continuity/Duration	• There is daily visual management of results (short meetings) • Problems are solved on a regular basis • There is a CI table for reporting and monitoring problems • New CI tools are used • CI activities are transferred to new areas
Deployment/ Scope of Program	• CI projects also appear in the areas supporting the main activity • The number of employees involved in CI and the number of improvement requests reported are not measured
Training	• There is a CI training program • Conducted trainings: introduction to Lean and *kaizen*, problem-solving, visual results management • All employees were covered by training • The training is carried out by LiR and external companies
Management Commitment	• Managers identify areas for improvement • Managers are included to approve ideas for improvements • There is no gemba walking • The role of CI management is mainly about checking results (effectiveness and savings reports)
Program Coordination	• Mid-level managers of management rather do not support the work of teams and units in the implementation of CI activities. They are focused more on current operations.
Methodology & Tools	• The company does not yet have its own methodology to implement the CI and the official method of team work • Interdisciplinary CI teams are organized only during solving problem sessions • The following CI tools are used: Daily management, solving problem, Visual management, Hoshin Kanri, *kaizen* workshop, One-Point Lessons, competence matrix • The automatisation of 80% of the financial settlement process based on robotization of the process (RPA) was introduced
Performance Measurement	• Measurements of employee participation in CI activities are not yet made • The results of (effectiveness) CI activities are measured • Continuous improvement of operations was included in the KPI
Communication of Results,	• There is no reward program for activities (achievements) in the field of CI

Recognition & Incentives	• Closed events are organized, during which the results of activities of CI units and teams take place • The employees' achievements in improving the results are formally reported to all employees in the company

Source: own research based on the results of the case study

Conclusions

The most important effect of the continuous improvement implementation in the surveyed company, in the opinion of respondents, is the development of common goals, a change in the method of their determination and implementation (application of Hoshin Kanri). The company has clearly defined strategic goals until 2025. The consistently adopted assumptions (goals) in the scope of stabilizing the level of costs in relation to the profits achieved, more effective use of tools related to setting and achieving goals and supervision over ongoing projects are implemented. There is no doubt that the direction of activities adopted in 2018 is correct and the reorganization of the entire CI implementation process has a positive impact on the functioning of the entire organization. It is also worth emphasizing that CI projects also appear in the areas supporting the main activity of the company. Therefore, it is necessary to minimize diagnosed problems in order to transfer good practices and not to repeat previous mistakes.

In the first approach to the implementation of continuous improvement, the leading enablers were the determination of the General Manager and the first training and organizational solutions in the field of CI. However, they were not enough to overcome the problems (inhibitors) that appeared then, i.e.:

- incorrectly defined goals (inadequate to the possibilities) and divergent ways of reaching the goal,
- inexperienced and mentally unprepared for a change of staff (lack of awareness of CI),
- low level of knowledge of CI issues,
- lack of involvement of a larger group of people (including managers) in CI activities,
- lack of strong support from the board,
- inadequate – to conditions prevailing in the organization – selection of tools, i.e., competence matrices, which have not been used,
- the multiplicity of projects (no priorities) and as a result partial or complete lack of implementation,
- lack of continuous improvement of organizational culture,
- lack of prepared leaders (leaders).

The problems mentioned above meant that the entire CI implementation process did not go through a book. The company could not build a new culture based on solid foundations of *kaizen*. As a result, financial and non-financial costs related to a multitude of initiatives that could not be implemented were incurred. Resources have been involved in projects that have never been implemented. The entire transformation process was essentially interrupted. It was only after joining the next Lean experts in the organization in 2018 that the company reorganization process was resumed. Currently, the factors (enablers) that encourage the implementation of continuous improvement are:

- greater awareness of managers and leaders of pilot areas in the scope of CI,
- common (known to all) organization goals related to continuous improvement,
- regular meetings to verify the implemented improvements and their results (CI

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effectiveness measurement),
- involvement of the management board in analysing the results of improvements and providing feedback,
- ensuring adequate resources (i.e., assuring enough time for CI projects and training),
- consistency in the implementation of continuous improvement,
- Well-motivated and committed CI project team.

At the current stage of the transformation of the company, one also notices some disturbing symptoms (inhibitors) that may in the future result in a fiasco of the entire undertaking:
- less and less time devoted by CI leaders and coordinators to improvement activities,
- too many operational tasks,
- sudden changes in priorities, deposition (suspension) of CI activity,
- too low awareness of employees about the introduced changes,
- the resistance of employees to changes taking place,
- low employee involvement in CI activities,
- lack of openness among employees for modern technical innovations,
- low awareness of managers of the potential benefits resulting from robotization of processes (especially at the beginning of the implementation of change), lack of ideas from managers as to how to manage the time released, employees' worries about losing their job,
- poorly advanced activities in shaping the culture of continuous improvement.

The above signals may indicate that the organization described has not yet fully matured in the tasks it set for itself in the area of CI. The successful introduction of continuous improvement requires constant engagement of the employees. The recommendation is to enable bottom-up initiatives in the field of improvements via i.e., the "ideas box" or "hour for development", giving the opportunity to engage all employees in the problem solving process. Employees' resistance to ongoing changes and lack of awareness of the benefits that will result from the implemented changes may also be disturbing. In this case, the recommended action is to strengthen the role of change leaders.

The HR department has a significant role to play in this implementation of CI, which through proper creation of training policy, personal development plans, linking the employee evaluation system with the company's goals and remuneration can affect the effectiveness of the implemented changes. HR employees through cyclical activities such as webcasts, webinars or stationary meetings can broaden the employees' awareness related to the direction indicated by the company's management and reduce their resistance to the ongoing changes.

The interviews show that the specificity of the industry in which enterprise operates might lead to significant challenges in the continuous improvement application area. The problematic issues are, for example: a considerable variation in the number of orders during the week (usually large at the beginning and end, smaller in midweek – occurrence of the *mura*), changing the profile of services depending on the client's needs (problem with standardization of the service), and the difficulty in measuring the lead time of the orders (when the forwarder deals with several orders at the same time). These situations give rise to additional difficulties related to the implementation of continuous improvement, and they are a big challenge for the company.

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IMPLEMENTING AGILE PROJECT MANAGEMENT (SCRUM) IN REAL ESTATE PROJECTS

Maulik Pareliya, CEPT University, India

Abstract

At present, project management is a highly discussed topic. The way of project management methodology has not changed significantly from the 60's. in different sectors, construction market, technology, and the way project are procured today has changed. This situation leads to a problem, where a managerial perspective and how construction projects are executed has a large gap in between. This is the reason to change and looking for new project management approaches in the future.

Basically, the agile project management approach is adopted from the IT department, from where it has grown through empirical processes. It is mainly suited for complex projects, where it is difficult to specify requirement and final deliverables in advance. It is adopted by so many industries other IT department, where are able to detect the problems by repetitive tests and constant improvements. This thesis has researched, what are the opportunities and benefits to implement an agile project management approach in the construction phase (execution phase) of any building project.

There are many advantages found of implementing an agile approach to increase participation of each member of the development team in the project compared to the present situation. Moreover, it increases client's involvement and more focused employees group. On the other hand, it decreases delay, uncertainty, and risk involved during the construction phase. it is also focused on time management and regular meetings, that will be beneficial to keeping track of the project's progress.

Keywords: Agile project management, Scrum, Construction phase, Real Estate projects, Construction phase
JEL code: O22

Introduction

"Project management is today a current area undergoing intensive development."
(Tonnquist, 2006)

Project management is a key to finding the way of managing, controlling and co-ordinating any size of the projects by choosing working methods, defining project roles, simplifying project reporting and constantly following project planning from designing to completion of the project. Today, project management often affects the entire organization, be it a small company or a larger public company.

It's been half a century of managing projects with using traditional methods and on which the construction project relies. The actual way of managing projects have changed now. There is a gap between a traditional view on managing construction projects and new methods of managing projects that creates uncertainty within the company and the people working there (Owen, Koskela, Henrich & Codinhoto,2006). People today are sometimes aware that they are working in a way that does not always confuse the management view. Investigating and defining how projects are actually managed and executed today can reduce uncertainty and confusion (Streule, Miserini, Bartlomé, Klippel, & De Soto ,2016).

In the construction phase of a project, when all the things are designed and planned, a possibility of influencing design and planning is very low. Moreover, the amount of money spent increases constantly in this phase. Once the construction phase of the project starts, not recognizing the mistakes and errors may become very costly in term of time wasted and in money spent. So, it is necessary to observe these mistakes and errors to make them unrepeatable (Cervone, 2011).

Agile project management

"A traditional project manager focuses on following the plan with minimal changes, whereas an agile leader focuses on adapting successfully to inevitable changes."
(Jim Highsmith, Agile Project Management: Creating Innovative Products)

Agile project management has its roots in the software development industry, and it has developed through empirical progress. This methodology's uses are not limited to that industry. It defines values and principles, that can be adopted by other industry as well. Moreover, it includes different tools and methods of conduction a project, which will lead to follow its values and principles. The agile methodologies are widely used by the software development industry where the customer recognized his need and improving it by repeated tests (Owen, Koskela, Henrich & Codinhoto, 2006).

"Agile is a substantial and nuanced change to the way you think about doing things. It's an organizational change."
(Justin warren, PivotNine, Melbourne, Australia)

Agile project management is majorly focused on two things: Adoption to change during the task and Collaboration between people within an organisation.

Introduction to SCRUM

Initially, the scrum approach was applied to software product management. Scrum was taught first time in mid 80's of 20th century, when two Japanese professors from management practices Hirotaka Takeuchi and Ikujiro Nonaka have published an article "New production development game". They wanted to improve production processes by working with people from different areas of an organization work together as a team. These teams conduct a complete development from the beginning to end. They have argued that this had a negative impact on the productivity and delivering quality within the teams. This approach to management is called "rugby" approach. Where the team works together, passes the ball back and forth and moves as a unit. That term is known as Scrummage & from that the word "Scrum" is derived. After some years, two American software developer Jeff Sutherland and Ken Schwaber jointly represented a framework for product development at a conference held in Texas in 1995, which they called Scrum and That was mainly focused on the software industry. After successful implementation, it gained knowledge and experience to work with it in other industries (Shwaber, 2004).

A Scrum project involves a collaborative effort to create a new product, service, or other result as defined in the Project Vision Statement. Projects are impacted by constraints of time, cost, scope, quality, resources, organizational capabilities, and other limitations that make them difficult to plan, execute, manage, and ultimately succeed. However, successful implementation of the results of a finished project provides significant business benefits to an organization. It is therefore important for organizations to select and practice an appropriate project management approach. It is one of the most

popular Agile methods. It is an adaptive, iterative, fast, flexible, and effective framework designed to deliver significant value quickly and throughout a project. Scrum ensures transparency in communication and creates an environment of collective accountability and continuous progress (Satpathy, 2013).

Need for Study
There is a large number of money invested in construction projects. These projects actually shape our city and surroundings. A traditional concept of management, the responsibilities and authorities are defined in a hierarchy, so if a middle level chain is broken than the ground level subjects are failed. In agile concept, the basic belief is to keep all responsibilities & authorities on the same level such that even if there is a failure in single subject, the remaining subject can work efficiently in their sectors. The basic concept of management is that the number of people & activities to be managed are directly proportion to the no. of problems and issues to be addressed in management. Agile management could be beneficial in minimizing the delays in construction sector such as faults in execution, hoarding of technical instructions, poor planning, misconduct in material usage etc.

The purpose of this research is divided into three parts: (I) To introduce the agile project management tools to construction projects. (II) To compare data with the traditional approach of construction industry to see what benefits are there. (III) To explore what PSP Projects Pvt. Ltd. might gain by implementing agile project management (Scrum) during the construction phase.
The scope of work is limited to the construction phase of projects. It also limited itself to comparing the agile project management approach with the traditional approach of the construction industry. However, changing a system and implementing a new management method is a big issue that needs to be further explored and that is discussed briefly in this research. Following is the research question and the topic of this paper:
What are the impacts of implementing an agile project management approach (Scrum) in the execution phase of real estate projects? Following question has to be investigated to get possible answers:
What are the odds to implement Scrum in the execution phase of real estate projects?

Research Methodology
Research method for this research is consist of two parts: Questionnaire survey form and Data analysis of scheduling for chosen case studies. As a part of quantitative research, Questionnaire survey form is designed in such a way that we might get ratings on factors identified during literature survey. However, these rating shows the value which can be used as a data to evaluate performance of agile project management systems. Hence, it is necessary to attach a logical qualitative analysis for evaluation by making this research using mixed method approach. While using mixed methods, the comparison of case studies should be contrasting to get the ultimate understanding. For qualitative part, Taking into consideration two case studies of building projects of Gujarat, India, where in Scrum is being used in construction phase of the projects and one case study is selected being managed by traditional/waterfall project management in the construction phase.

PSP Projects Ltd. is a multidisciplinary construction company offering a diversified range of construction and allied services across industrial, institutional, government, government residential and residential projects in India. They provide services across the construction value chain, ranging from planning and design to construction and post-construction activities to private and public sector enterprises. Historically, they have focused on projects in the Gujarat region. Over the years, They have successfully executed a number of prestigious projects across Gujarat. More recently, they have geographically diversified their portfolio of services and are undertaking or have bid for projects pan India. Since their incorporation in August 2008, they have executed over 71 projects as of November 30, 2016 (PSP Projects Ltd, 2017).

Data Collections
Questionnare Survey Form

Questionnaire survey form is prepared based on the literature study. While doing the literature study, some of the important questions, topics and data was observed. The data observed from literature study was categorised further into topics it belongs. Based on the data observed, the entire survey form was divided into two parts: (I) Respondent's personal details and project details, (II) Scrum survey

Respondents are limited to the people working in construction industry and has knowledge about an agile project management tools or Scrum.

The most important questions was about rating factors that are identified from literature study. The reason to include these 7 factor is, I have observed some statements that are supporting the agile project management approach and these factors were completely in contrast to the methodology of traditional/waterfall project management approach during the literature study. By rating these factors, we might get results about the importance of these factors as per the users. The factors that are identified from literature study are: (I) More communication within team, (II) Participation of each member, (III) Few levels of management, (IV) Widely shared information, (V) Adaptive to change, (VI) Continuous improvements, (VII) Self-controlled teams.

Case Studies

The major reason of doing this research is to compare on-site scenario during implementation of an agile project management. As a part of quantitative research, selection of case studies was very difficult. The reason is there are only few companies in India, which are using Agile project management approach/Scrum in any phase of project. Propitiously, PSP Projects Ltd were using agile approach in some of their projects within Gujarat. Further, this research will represent project management approach in terms of progress, all data regarding project progress and schedule have been collected from respective site offices. *Table I* shows the project details and basic scrum details:

PSP Projects Ltd. is a contracting firm, therefore, execution phase was conducted by themselves on each project. From the above table, the management teams of One42 and IBIS Brigade hotel were managing their project using SCRUM in the construction phase and the development team of bSafal Seventy was managing their project by

following traditional project management approach. Number of labours and area of construction differs in terms of the scale of projects. Depend on the size of the project and development team, number of scrum master is being finalise. The ideal size of development team is 5-10 per scrum master. Whereas, planning engineers are playing the role of scrum master.

Table 1.

Project details and Scrum details

DETAIL	ONE 42 AMAYA PROPERTIES	IBIS BRIGADE HOTEL	bSafal Seventy
PROJECT DETAILS			
Location	Ahmedabad	GIFT city, Gandhinagar	Ahmedabad
Client	Farpoint Properties LLP	Brigade Group	Safal Engineers and Realties
Contractor	PSP Projects Pvt. Ltd.	PSP Projects Pvt. Ltd.	PSP Projects Pvt. Ltd.
Type of Project	12 storey Commercial towers	9 storey Hotel Building	18 storey Residential towers
Current PM methodology	SCRUM	SCRUM	Traditional/Waterfall PM
Project Start Date	28th April, 2017	30th April, 2017	8th June, 2016
SCRUM DETAILS			
Scrum Master	Planning Engineer	Planning Engineer	-
No. of Scrum Master	1	2	-
Development Team Size	10 Engineers	12 Engineers	10 Engineers
Daily Scrum meeting time	9:30 AM	9:30 AM	-
Duration of Daily Scrum Meeting	15 to 30 Minutes	15 to 30 Minutes	-
Date of Implementing Scrum	1st September,2017	12th September, 2017	-
Sprint Duration	Floor to Floor Cycle	Weekly cycle	-
Sprint Meeting time	Once in a Week	Once in a Week	-
Sprint Meeting Duration	1 to 2 hours	1 to 2 hours	-

Source: *Author construction*

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Daily scrum is the most important aspect for a systematic follow up Scrum. Sincerity and regularity is must in terms of daily scrum. One of the directors of PSP Projects Ltd. introduced Scrum to the planning head and project manager in mid 2017. The planning head and project managers were told to implement Scrum in ongoing project to see the results in terms of progress. So, after researching and knowing Scrum properly, they have short-listed two projects to implement this new methodology. Both of the projects were delayed in their initial stages. Moreover, we can see the difference between two projects in terms of documentation, reporting and for proper follow up. Both the projects had their individual daily scrum formats and sprint review methods.

Format of Daily SCRUM and Sprint Review

The format was prepared to keep track on daily scrum meetings. For One42 project situated in Ahmedabad has no such format for daily scrum meeting. On the other hand, IBIS Brigade hotel have prepared a format to document daily scrum meetings. Format is shown in *Annexure 1*. In which, the presence of each member is marked by scrum master and detail of work is being written in front of their names every day. Whereas, On One42 project, development team prepares a sprint review files which gives details about the particular sprint or duration of activity. Format of sprint review document is given in *Annexure 2*.

Data Analysis

Questionnaire Survey Responses

The questionnaire survey form was only for targeted group of people only, as mentioned in chapter *Data collection*. As very few people were aware about this topic, numbers of respondents were comparatively low. The questionnaire was sent to 35 respondents. From which, 26 people read the questionnaire, but only 23 people have actually completed the questionnaire form. Therefore, the total number of respondents are 23, resulting in a good response rate of 65.7%. Out of those 23 successful respondents, their roles on projects were, 7 project managers, 4 scrum masters, 4 planning engineer, 3 quality engineers, 3 site engineers, 1 development engineer and 1 electrical engineer.

As mentioned above, respondents were chosen as per their knowledge about an agile project management/scrum. Despite having knowledge about scrum, 3 respondents were using traditional/waterfall project management on their project. While, rest of the 20 respondents were using Scrum on their projects. Ultimately, the implementation rate of scrum is 87% and from them, **100% respondents have agreed that scrum is successfully working on their project**. They were asked to rate the success factor for scrum on their own project between 0 to 5. **The average success factor for scrum were derived from all the responses and the success factor was about 4.26 out of 5**. They also agreed to implement scrum in more projects of their organisation/company.

Development team plays the most important part in success of any project. They have to be more focused and productive towards the project. For that, scrum suggest to employ more qualified and experienced team members from various departments for better understating of project. Another important process that scrum defines is "Daily scrum meeting". Daily scrum is all about regularity, sincerity, more communication and to keep everyone updated about the project. Scrum defines the size of development team should be between 6-10 for better implementation. As per the responses, 16

respondents had the size of development team between 6-10, 5 had between 11-15, 1 for more than 15 and less than 5 each. So, 69.6% users were following ideal scrum development team size. They were also asked questions about daily scrum meetings to know the regularity of users. And the response rate was quite good as 95.7% (22) users were conducting daily scrum meeting on regular basis, majorly in the morning time. which is the best time for daily scrum meetings in construction projects.

7 Factor's Analysis

This question was focused on user's perception about these factors and they had to rate each factor. The scale ranged from 1 to 5 wherein, 1 indicates 'not at all important' and 5 indicates 'extremely important'. The outcome of the survey would highlight perspectives of individuals regarding the kind of environment the development team would like to work within. Along with that, it would also hint on the satisfactory levels of the respondents regarding the traditional project management or they want to improvise/ suggest changes in the existing management approach. Figure 1 shows a list of factors identified during the literature study.
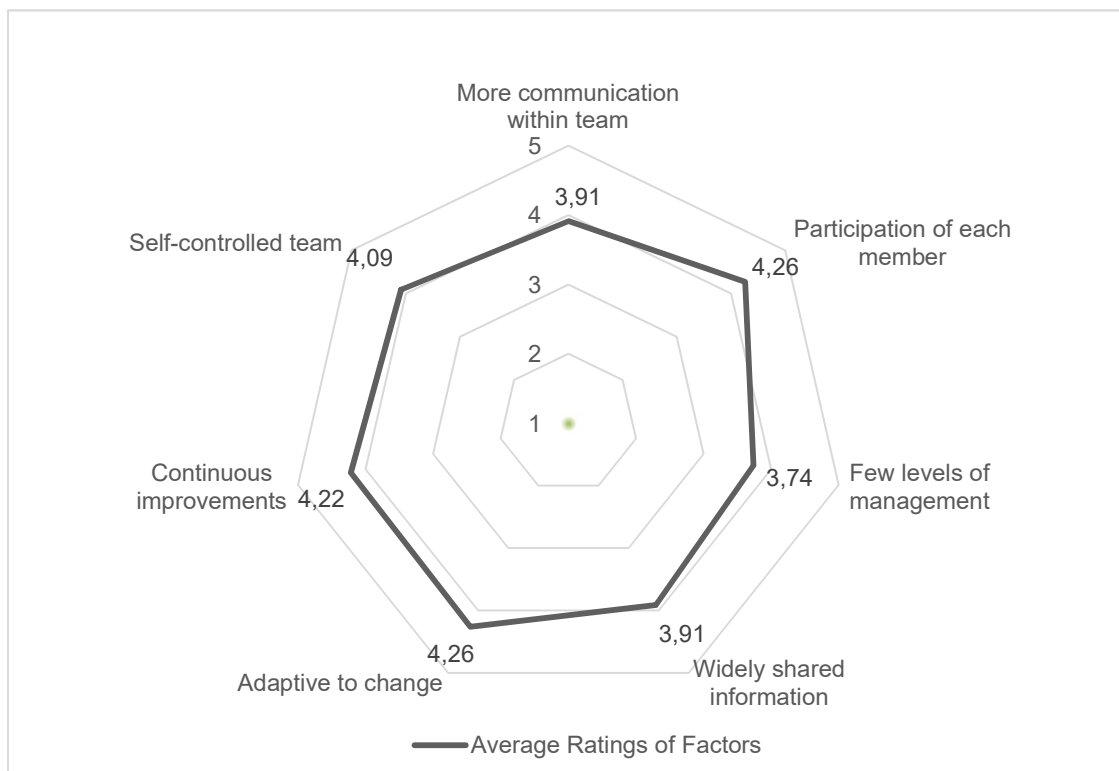

Fig.1 **Average ratings of 7 factors**

Source: *Author's construction*

Anyone can extrapolate by seeing the result of this survey, the positive responses might lead people to adopt agile approach and negative responses leads people to follow

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existing waterfall project management approach. The above figure shows the average rating that all 23 respondents gave to each factor. As per this graph, we can assume that every factor gets the ratings between 3.5 to 4.5. We can assume from the results that all the 7 factors play very important role in successful implementation of agile project management/scrum as a project management methodology in construction industry.

Analysis of Case Studies

Types of quantitative analysis to be performed on the data are : (I) Progress using SCRUM vs. Actual planned progress (Burn-Down chart), (II) How to reduce delayed work over given execution time period? (III) Comparison of Case studies in term of following methods, tasks for reducing delay and progress.

BURN-DOWN CHART

In construction industry, there are multiple ways to keep record of project progress. Generally, Planning team generate Daily progress reports and S curve graphs (Burnup charts) for scheduling. Daily progress report gives information about the progress going on projects for a particular day and S curve gives information about Planned progress to Actual progress of the project. S curve generally starts from zero to the amount of work done. So, we can know the amount of planned work to the amount of actual work done till the date. However, Scrum suggest to prepare a burndown chart.

The main function of burndown charts are as similar to S curve. Burn down chart are also prepared to keep track of planned versus actual work done on site. However, burndown chart shows the amount of work remaining over the particular time. The burndown graph is an excellent way to visualize the correlation between the work remaining at a given time and the progress of project teams in reducing that work. The intersection of a trend line for the remaining work and the horizontal axis indicates the most likely completion of the work on planned period of time. The burndown chart helps planning and execution teams with "what if" project by adding functionality and removing it from the version to get a more acceptable date or to extend the date with more functionality. The burndown graph is the collision of reality (the amount of work done and how quickly it is done) with what is planned or hoped for.

As shown in Figure 2, sprint is prepared from the Microsoft Project file. Planned data was taken from the Microsoft Project file and Actual data was taken from daily progress reports. By using given data, two lines are generated in the graph. Which are, planned burndown and actual burndown lines indicating work remaining in the project. If planned line is below actual line than the project is delayed or behind planned dates and if planned line is above actual line than the project is ahead of time or planned dates. Formulas for calculating planned and actual burndown lines are as follows:

Planned Burndown = (Total Quantity - Cumulative Planned Quantity)
Actual Burndown   = (Total Quantity - Cumulative Actual Quantity)

Fig. 2. Burndown charts for ONE42 AMAYA Properties & IBIS Brigade Hotel

Source: *Author's construction*

PSP Projects implemented scrum on two of their projects, One42 Amaya properties. Located in Ahmedabad, Gujarat and IBIS Brigade Hotel located in GIFT City, Gandhinagar, Gujarat. Scrum was introduced to the planning team in mid-august of 2017. At that time, both the projects were delayed by one and half month as per the planned schedule. In above figure, the gap between planned burndown and actual burndown is comparatively high. It was mainly due to the heavy rain conditions during the monsoon in Ahmedabad and Gandhinagar. On 1st of September, both the project teams formed a dedicated development team and started following Scrum artifacts. Sooner, they started preparing burndown chart for their projects. Regarding that, they were using the planned schedule from the Microsoft Project file comparing it to the actual progress of the site. The graphs were generated, based on the planned data and actual data entered in the excel sheet. The development teams have adopted and understood scrum very well that it was became a part of their daily routine. Fortunately, They were able to solve so many problems from the initial stage of the project. Somehow, they were about to cover up the delayed work after 6 months from starting of the project.

In above figures, we can assume that the gap between planned and actual progress is narrowing down over the time. The reason behind that was, proper follow up of scrum on both the projects. The development team have adopted scrum completely by doing daily scrum meetings and sprint retrospective meetings. They were able to solve the major problems just by conducting daily scrum meetings on the regular basis.

If we compare both the above projects to third project of PSP Projects, where development team were still using traditional approach of project management. They have faced multiple difficulties in terms of managing delayed work and communication gap within the team in compare to other two projects.

Percent Delay

Percentage delay graph was generated for a precise analysis about project progress. Percent delay is also prepared in term of reducing delay, The inclined line denotes constant reduce of percentage delay over the time to cover up the delayed work as per project completion date. Below formula is used to prepare percentage delay graph,

Percent delay(%) = 100 - (Actual Cumulative/Planned Cumulative) * 100

As shown in Figure 3, Percentage delay graph for ONE42 Amaya Properties is reducing over the time as per the estimated reduce percentage. In February end, project was facing some problems due to material unavailability and tower crane breakage. So the percentage delay line is again above the approximate reduce line.

As shown in Figure 3, Percentage delay graph for IBIS Brigade Hotel is reducing
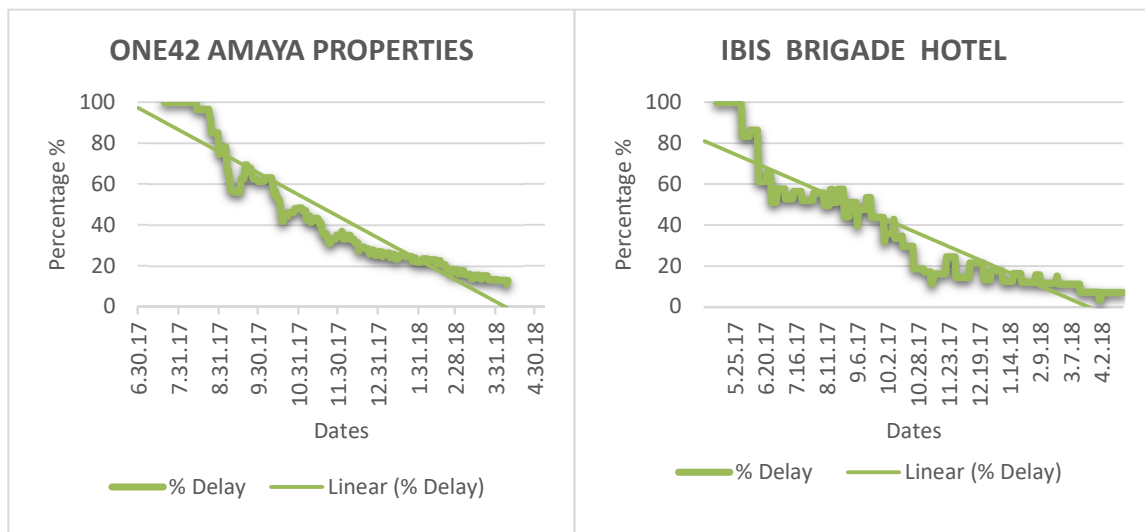
Fig.3 Percentage delay graphs for ONE42 AMAYA Properties & IBIS Brigade Hotel

over

the time nearly the estimated linear reduce. It is decreasing constantly. In the march end, the project was on the verge of reaching the same quantity as planned progress. Percentage delay graph is generated to know, the remaining amount of delay in the project and how one can reduce this delayed work over the remaining time for on-time completion of the project. By generating these graphs, any member of development team or client can see the performance of a development team and current status of projects.

Roadblocks of implementing Agile project manegement in construction industry

Everything depends on the suitability of the project. Some projects also fail because of the requirements have taken too long. Today cultural differences are the biggest obstacle to the agile management approach. There is also a risk with mindsets that the client / contractor does not want to work with Agile but wants to keep the traditional approach (Rasnacis & Berzisa, 2016).

I. **Cost of Change-** It would be relatively cheap to make changes to a project that aim to deliver quality while it would be very expensive to change it. For Example, it would be very expensive to redesign the road after laying concrete.

II. **Lack of knowledge** in construction industry.

III. **Complexity perception-** Many client/contractors finds it difficult to understand as they have to modify the mind sets of development team.

IV. **Resistance to change-** As stated before, Agile principles can be fully implemented only if all parties get focused towards one goal.

V. **Management pressure-** One of the major drawbacks of implementing Agile principles because failure or success of implementation lies largely on the management. The top management is expected to provide the necessary resources and guidance on how to implement these principles.

VI. **Time consuming-** Similar to latest new technologies or approaches of implementing a project, Agile principles can be quite time consuming especially during early stages of implementation.

Conclusions

The major advantage of implementing agile project management in construction phase of the project is to increase communication within development team. It will give them a freedom to think individually and to work as per their own. As the agile project management/Scrum follows the bottom-up project management approach, that leads lower level employees to think independently. Agile approach will also motivate their personal experience as they are given more responsibility and a higher level of authority. This will lead them to deliver work as best as possible.

Through the way of execution methodology, the client will be forced to increase their participation more or less for better delivery of work. Implementing agile project management will also result in client's satisfaction in the end of the project. This is because this approach manages the product backlog, including the customer's requirements for the project. The way Scrum approach uses time management, it will provide the industry a proven tool to track the progress and status of any type of project. It is one of the easiest to implement in compare to other tools. Since one can start with a small project and can implement it in any big or complex projects possible. And it will constantly add the improvement in current project management process and other tools.

To summarise the conclusion, the implementation of agile project management approach in construction phase of project will decrease uncertainty and risk. It will help with planning activities during the construction phase and how one can decrease delay by scheduling, using time management, daily scrum meeting, sprint retrospective meetings and increasing both employees motivation and client's involvement.

ISSUE

The construction phase is different from design phase and planning phase in some relevant way.

PROBLEM

We have to be aware that the construction phase is causing a bigger gap between employers and employees, the number of people working in this phase is much more than other phases. This workforce is also one of the least skilled workers and is among the lowest earners.

SOLUTION

The attempt to apply new management methods in construction. We are currently facing a major cultural issue that needs to change to enable education and learning, to achieve multi-skilled teams and self-management. This is an important gesture to instil a strong loyalty to workers.

Recommendations

First, I will recommend to educate more people in construction industry about agile project management tools and Scrum by organising introductory sessions and training workshops. Construction companies should educate key persons of development team like project managers and scrum masters. These roles are playing important part in development since they are the people being together can adopt a method and replace the current project management method. While implementing for the first time with Scrum/Agile project management approach, the team members should not consider this project as a trial project or pilot project. It can be an excuse for failing at the end. They may not embrace this new approach properly if they will take it as a trial project. The organisation has to say that we are going to implement Scrum properly and we are going succeed this in our projects. Any company has to start using this approach in discipline. They have to take regular follow up with daily scrum meetings and to keep burndown chart updated every day. They have to build an environment where the team can discuss and work together. There should be a white board, where all the team members can keep track of prioritized activities and tasks by using notes.

The major advantage about implementing this approach, is that anyone can start it with a small change and can adopt it as per they convenience. Other benefit is, we can improve the progress by using hybrid scrum, using scrum functions with other agile project management tools like Kanban, Lean and others.

Acknoledgement

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AN ANALYSIS OF PROJECT MANAGEMENT PROGRAMS IN THE STATE UNIVERSITY OF NEW YORK SYSTEM (SUNY)

Michael J. Littman
SUNY: Buffalo State, Fellow: Brandeis University
Ezra S. Littman
School of Architecture, SUNY Buffalo

Abstract

The Project Management Institute (PMI) estimates that 6.2 million project management positions will be created in the USA from 2010 to 2020. This points to a critical need for academic training in this field. There are a number of project management academic programs in colleges and universities throughout the United States and the world. In the State University of New York system, SUNY, project management courses can be taught online, hybrid, or face to face as part of professional development, as an individual course, as part of a certificate program, or taught as an undergraduate or graduate level program. There are a small number of each type in SUNY schools. Three recommendations are made to meet the projected need for project management trained individuals.

Introduction

Ramazani and Jergeas (2015) noted a gap between what education providers are offering and what is needed to deal with projects in today's complex work environment. Universities were established to bridge this academic preparation and skills gap by offering appropriate educational opportunities. Are universities doing this appropriately today?

According to the Project Management Institute study Job Growth and Talent Gap 2017 to 2027, (PMI, 2017), across the globe, there is a widening gap between employers' need for skilled project management workers and the availability of professionals to fill those roles.

There are several catalysts for this gap:

1) A dramatic increase in the number of jobs requiring project oriented skills.

2) Attrition rates, including professionals retiring from the workforce

3) A significant uptick in demand for project management talent, especially in rapidly developing economies such as China and India professionals. (PMI, 2017)

Purpose of the Study

The purpose of this study was to review the academic programs available in project management across SUNY Schools to see if the universities and colleges curriculum provided sufficient courses and programs to meet the future growth needs for employees with project management skills and training.

Growth in Project Management Jobs

In today's global economy, jobs have become more project oriented, as the skills used in project management expands in a variety of industries such as healthcare, information technology, and professional services. An analysis shows that the healthcare sector in the United States has a 17% growth in project oriented jobs. Manufacturing and construction are still the leading sectors for openings in project management skill areas. (PMI, 2017)

More specifically, the Anderson Economic Group (AEG) and PMI analyzed project-oriented employment opportunities and found that in the United States between 2017 and 2027, there will be an increase of 2.1 million jobs or 213,974 new jobs per year. (PMI, 2017). It was noted that project managers contribute to a nation's productivity and there is a possibility of a $22.5 billion GDP risk reduction in the US economy if project positions were not filled.

The PMI analysis of talent gap supports the issue that future demand for project managers is growing faster than demand for workers in other occupations. This leads to reviewing the opportunities, strategies, and pathways project managers can follow to be best prepared for successful employment in the field.

Project Management Education and Training: Project Management Institute

There are a number of opportunities for education and training in the area of project management. These opportunities could be through the Project Management Institute at the national, state, or local level. Many large cities in New York have chapters of PMI including Buffalo. Through specialized academic program of their own or those linked to SUNY, courses are available. The PMI states that Certified Project Management professional (PMP) may earn 20% more than those who are non-certified professionals, an added incentive.

There are educational opportunities through the Project Management Institute that provide the following training leading to the most appropriate professional certification:

Project Management Professional (PMP): The PMP is the gold standard of project management certification. The PMP validates competencies to perform in the role of a project manager leading and directing project and teams.

Certified Associate in Project Management (CAPM) is not as in depth as PMP and covers industry basics like terminology and processes of effective project management.

Program Management Professional (PgMP) is for more complex projects. It is designed for those who manage multiple, complex projects to achieve strategic and organizational results.

Portfolio Management Professional (PfMP) recognizes the advanced experience and skills of portfolio managers. The PfMP demonstrates proven ability in the coordinated management of one or more portfolios to achieve organizational objectives.

Professional in Business Analysis (PMI-PBA) highlights expertise in business analysis. It spotlights the ability to work effectively with stakeholders to define their business requirements, shape the output of projects, and drive successful business outcomes.

Agile Certified Practitioner (PMI-ACP) is for those who apply agile principles and practices on projects.

Risk Management Professional (PMI-RMP) recognizes demonstrated knowledge and expertise in the specialized area of assessing and identifying project risks along with plans to mitigate threats and to capitalize on opportunities.

Scheduling Professional (PMI-SP) recognizes demonstrated knowledge and advanced experience in a specialized area of developing and maintaining project schedules.

Project Management Education and Training: Academic Programs

There are a variety of opportunities for PMI training and possible certification available in academic settings. These include various delivery systems as well as different academic levels of professional development, of individual courses, of certifications, and of an undergraduate or graduate degree.

Delivery Systems: Academic content of project management can be taught in a face-to-face, hybrid, or online format. A face-to-face format is a typical academic structure with the students attending class while the instructor provides content material necessary to support student success. An online format allows a student to typically not attend a formal class and to complete their work through an Internet connection at their own pace and convenience. The hybrid format blends the two delivery systems so that some material is available online and some material is presented face-to-face.

Academic Levels: project management material and curriculum can be presented in a variety of ways, including as professional development, as individual courses, as a certification program, and as an undergraduate or as a graduate degree.

Professional development would be short-term programs or classes as short as 2 to 3 hours or a longer time frame of study. Individual course would typically be a three credit, 15 week course encompassing 45 hours of in-class study. A certification program could be at the undergraduate or graduate level and typically includes 12 to 15 credit hours or 4 to 5 courses. A certificate is a completed earned credential to show professional competencies in a specific content area.

An undergraduate program would include the material to gain a degree in project management, engineering, or business area. A graduate program would be for those students who have completed their undergraduate program and would include additional academic course material to gain a graduate degree.

A strong education background is important and necessary for advanced skill development and success in project management. The main goal is to increase the individual's value to an organization and their success in project management. They would gain enhanced knowledge of the conception, monitoring and tracking project costs, budgets, and scheduling, managing project human, natural, and economic resources. Strong communications skills, ethics, and leadership are also key components of a project managers' success.

For success in project management, having the necessary knowledge and skills supports achievement. Software Advice, (2018) an online resource reviews and researches project management software and technology. In an analysis of 300 current job openings for project managers, it was found that nearly 50% of the total job listings investigated required a bachelor's degree. However, in the aerospace, healthcare and IT positions, 36% would accept equivalent experience to a bachelor's degree.

Project Management Academic Programs in SUNY

New York is the fourth largest state by population size after California. Texas, and Florida. The State University of New York (SUNY) has 64 campuses and is public supported. There are 4 University Centers, 10 University Doctoral Institutes including 3 medical schools and a veterinarian school, 13 University Colleges, 7 Technical Colleges, and 30 Community Colleges. The 10 University Doctoral Institutes and 7 Technical Colleges were not included in this study.

The following is an analysis of project management in 47 SUNY campuses.

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University Centers (4):
A university center is a doctoral granting, research focused institution in SUNY.
Albany: None offered
Binghamton: Continuing Education in engineering.
Buffalo: Certification in Project Management offered as 12 week classes starting September 9, 2019. Civil Engineering course CIE 493: Project Management
Stoney Brook: Through the Center for Corporate Education, Project Management certification course are offered. There are no undergraduate or graduate courses in project management offered.
Summary of Undergraduate/Graduate Project Management
Degree: None
Courses: 1
Certification: 2
Continuing Education: 1
Universities at Buffalo and Stoney Brook offer project management certification.

University Colleges (13)
A university college is a comprehensive institution in SUNY that provides bachelor and master degree programs. Beside a selected major each student receives a strong liberal arts background.
Brockport: CIS 427: Project Management (U)
            BUS 368 Project Management (U)
Buffalo State: PSM 601: Project Management in MS in Data Analytics (G)
Cortland: none offered (has no business program)
Empire State: **Empire State College** offers a Graduate Certification in Project Management that has been reviewed and approved by the Project Management Institute (PMI). It includes 12 credits in four, three credit hour courses. These four courses are Management Information Systems. Tools and Processes in Project Management, Managerial Perspectives in Project Management, and Strategies and Tactics in Project Management. The delivery system is 100% online.
            SMT 273483: Project Management   (U)
Fredonia: BUAD 463: Information Technology Project Management (U)
Geneseo: none offered
New Paltz: BUS 458: Introduction to Project Management (U)
            BUS 580 Project Management for MBA's   (G)
Old Westbury: CS 7520: Project Management in MS in Data Analytics (G)
Oneonta: MGMT 365: Project Management (U)
Oswego: MBA 568: Project Management (G)
Plattsburgh: MIS 404: Information System Project Management (U)
            SCM 375: Project/Process Management (U)
Potsdam: MGMT 606: Project Management (G)
Purchase: Continuing Education 6 week course Project Management Applications

Summary of Undergraduate/Graduate Project Management
Degree: None
Courses: 13: 4 graduate and 9 undergraduate courses
Certification: 1

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Continuing Education 1
Empire State offers a project management certification.
Purchase offers project management through continuing education

Community Colleges (30)
The community colleges system was established as a 2 year typically publicly financed program and is sometimes called a junior college or technical college. The main focus of a community college is to provide specialized workforce employment and employee development as well as offering a 2 year Associate's Degree in a specialized academic or trade area.
The SUNY system has 30 community colleges to meet local education needs around the state.
There are four community colleges who offer a 3 credit course in project management. They are at Broome County Community College, (near Binghamton, Central New York) BIT 265: Project Management; Erie Community College (Buffalo, Western New York) BM 217 Project Management; Genesee Community College (Batavia, Western New York) BU 221: Introduction to Project Management; and Rockland Community College (Ramapo, downstate) OFT 107: Project Management.
Several community colleges including Corning, Onondaga, Tompkins/Cortland, Ulster, and Westchester offer a 35 hour project management program with preparation for the PMP exam. Ulster and Westchester offer their programs online.
Other community colleges including Adirondacks, Jefferson, Niagara, and Sullivan offer project management programs as needed. Some community colleges offer no project management programs.

Summary of Undergraduate Project Management at Community Colleges
Degree: None
Courses: 4: 4 associate level
Certification: 0
Continuing Education 6

Analysis of SUNY Project Management Data
Summary of Undergraduate/Graduate Project Management
Degree: None
Courses: 18 available: 4 graduate, 10 bachelor, and 4 associate degree undergraduate courses
Certification: 3 offered: 1 graduate, 2 undergraduate
Continuing Education: 8 programs: 2 at university centers or colleges, and 6 at community colleges

According to the above information, SUNY does not offer any graduate, undergraduate, or associate degrees in project management. There are 18 project management courses taught. Four are at the graduate level, ten are taught at the bachelor degree level, and four are taught at the associate degree level.

There are three certification programs in project management, one graduate and two undergraduate. Eight continuing education programs are offered tied into a non-credit course situation. Two were at university centers or colleges with the remaining six programs at community colleges. Since community colleges focus more on workforce development it seems appropriate for many of these programs to be provided locally, close to students.

Conclusions

SUNY offers a small mix of online and face to face courses at various levels in project management. In a large state like New York, it seems that the number of opportunities to teach project management would be higher than those found. The options available for project management education in SUNY appears to be Insufficient to meet the demand of the potential project management labor market.

Recommendations

1) Increase the offering of project management programs by establishing an undergraduate degree in Project Management through Empire State College or Open SUNY. Since Empire State has more than 30 locations across the state and Open SUNY is online, both can be used to establish a stronger Project Management academic presence in SUNY.

2) Add more individual project management course at the university centers and at the university colleges to allow students in business, in engineering, in the health sciences, and in technology to strengthen their skills and preparation for future positions.

3) Support community college specialized programs in project management to enhance workforce development and employee development.

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AGILE TRANSFORMATION CHANGES
FROM THE PERSPECTIVE OF PROJECT TEAM VALUES

Pawel Paterek, AGH University of Science and Technology, Krakow, Poland

Abstract

Software project enterprises deliver increasingly complex and custom-made software products and services. Agile methods were designed to address the challenges of dynamic and unpredictable software delivery environments to support the project team operating in these difficult work conditions. Agile Manifesto has presented four key values and twelve principles as mandatory rules. However, its implementation largely depends, in each case, on project teams and their organizational context. Implementation of the Agile method in everyday teamwork is strongly coupled with team values as well as with the whole organizational culture in a given team environment. The team values, in turn, depend on people in a team and their motivation led by autonomy, mastery and purpose.

The primary goal of this paper is to present the Agile transformation changes from the perspective of project team values.

Desk review and results of the multiple case study analysis in the companies undergoing an Agile transformation process are being presented as empirical research. The research results focus on the changes of the Agile transformation process from the perspective of project team values.

The results showed an Agile transformation impacted a project team approach to work organization and it can be assessed from different perspectives of a project team values such as, for example: courage, focus, commitment, respect, openness, feedback, simplicity, communication, visibility, honesty and even a sense of humour. Broad organizational changes are impacting not only project team values, but also agility of whole project organization and its organizational culture.

Key words: *Agile transformation, organizational change, project team, Agile values.*
JEL code: M15, O22, O32.

Introduction

Digital transformation of our life results in a rapidly growing number of IT/ICT programs and projects delivering advanced and innovative business services or products to customers and users. As the complexity, customization and rapid response expectations are constantly increasing, there is a need to search for more effective way of the project team and project organization management. The Agile project management is one of the possible responses addressing market demand and market competition, thus its popularity has arisen with a number of large-scale organizational changes through the process called Agile transformation (Gandomani, Nafchi, 2015; Dikert et al., 2016; Hoda, Noble, 2017; Denning, 2018a; 2018c).

The research results, conclusions and recommendation presented in this paper may be of value for both academics interested in Agile research studies, as well as for organization leaders who are planning or executing Agile transformation process and therefore seeking its optimization or efficiency improvements.

The primary goal of the empirical research in this paper is to respond to the research question about Agile transformation changes impacting the daily work and routines of a project team and project organization from the perspective of project team values. The empirical research results complement a review of literature on large software project organizations delivering innovative and advanced IT and ICT products and services with an Agile project

management approach. The research results showed that communication and self-organization of multidisciplinary and autonomous project team are the key changes from the perspective of project team values while the most desirable team values include: feedback, commitment, respect and openness.

A literature review and an illustrative and explanatory multiple case study analysis was used as research methods. The main limitation is the web source of the majority of acquired multiple case studies, cluttered by much information deprived of any added value from the research study perspective. The second limitation comes with a number of successful cases of the Agile transformation process with very limited information about the obstacles and issues faced on the road. The future research directions can repeat the same or similar multiple case study analysis as well as quantify the measurement of capacity for agility for a non-biased Agile transformation process assessment.

The structure of the paper is as follows: the first part discusses research results and the second part contains conclusions, proposals and recommendations. The first main chapter is also divided into subchapters presenting: a review of the literature, the methodological approach, the empirical research results and the final subchapter discusses the research results.

Research results and discussion
Agile transformation changes

The ability to adapt to unforeseen changes is called agility, and it is the evolution driver of software project organizations in their business strategies (Ganguly et al., 2009). The literature offers many variations of the agility construct analysis depending on the subject of research e.g. production agility, software development agility in the project (Sheffield, Lemétayer, 2013), knowledge management processes in terms of organizational agility (Cegarra-Navarro et al., 2016) or business and operational agility (Denning, 2018c). Here the focus is to stress the agility of a software project organization defined as its capacity to respond quickly to environmental changes and opportunities in the domain of customer responsiveness, operational flexibility and strategic flexibility (Ravichandran, 2018).

The shift from traditional project methodologies to Agile project management methodologies by implementing agility feature in project organization and therefore finally becoming Agile is the ultimate goal of each Agile transformation (Dikert et al., 2016; Denning, 2018a; Gandomani, Nafchi, 2014). Achieving a higher degree of agility means that the whole enterprise can achieve more Agile values and therefore brings the opportunity to improve its position in the rapidly changing and unpredictable marketplace (Gandomani, Nafchi, 2014; Gurd, Ifandoudas, 2014).

The Agile transformation as transition process (Fig. 1) of moving from traditional project and program management methodologies (Kozarkiewicz, 2012; Trocki, 2013; Kisielnicki, 2014) to Agile project methodologies is a complex, unique and evolutionary itself as the scope and scale of organizational changes are very extensive, always requiring synchronization and adoption to the given project organization context (Laanti et al., 2011; Gandomani, Nafchi, 2015; Dikert et al., 2016; Denning, 2018c). The agility as a feature of a project organization adds significantly to complexity as it requires adapting the Agile mindset what it *is much more important than any management methodology itself and only its full adoption may lead to a successful Agile transformation process* (Denning, 2016, p. 13-14).

The Agile transformation process (Fig. 1) requires significant changes at all levels of a project organization (Gandomani, Nafchi, 2015; Denning, 2016; 2018c; Paterek, 2018) with the

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project team as a central unit and the starting point of all the necessary changes (Gandomani, Nafchi, 2016; Denning, 2018a; 2018b). There are a limited number of comprehensive research papers devoted to the Agile transformation model at the organizational level coming from software development practice (Gandomani, Nafchi, 2015; Solinski, Petersen, 2016; Hoda, Noble, 2017; Paterek, 2017a). The Agile transition process is impacted by the number of unique issues, barriers and challenges (Dikert et al., 2016; Denning, 2016; 2018c; Paterek, 2017a) requiring a lot of long-term investment and collaboration across a variety of business units at all levels of project organization (Gandomani, Nafchi, 2015; Dikert et al., 2016; Hoda, Noble, 2017).
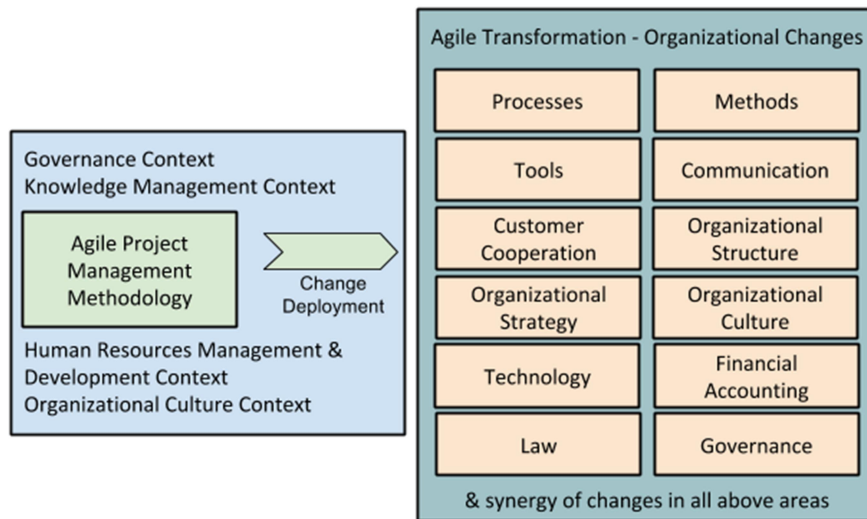
Source: P. Paterek (2018, p. 263)

Fig. 1. **The Agile transformation process**

The software project team adopting a new Agile approach to work in terms of its daily routines and activities is affected by a number of significant changes, in particular in project management processes (Cabała, 2016), practices and methods (Trocki, 2013; Kisielnicki, 2014) by shifting from its long-term execution to its short-term execution and incrementally adapted to each subsequent iteration (Solinski, Petersen, 2016; Hoda, Noble, 2017); new technologies and tools (e.g. JIRA, VersionOne) supporting these methods (Paasivaara, Lassenius, 2014); a new way of direct and frequent communication in the team, within the project organization as well as with customers or its representatives (Gandomani, Nafchi, 2015; 2016; Denning, 2018a); organizational structure, strategy and culture (Panasiewicz, 2013; Paterek, 2016; Jovanović et al., 2017; Wirkus, Zejer, 2017) adapted to self-organized and autonomous project team management with a focus on Agile Manifesto values and principles; short-term budgeting and financial accounting (Paterek, 2017a); contracts, law and legislation aspects, in particular these regarding management decisions in public and government organizations (Mergel, 2016; Bojar et al., 2018).

The project team Agile transition process (Jovanović et al., 2017; Denning, 2018a; 2018b) is also specific for each individual context of the project organization (Cabała, 2016; Hofman, 2018). The most important contextual enablers of the Agile transition process from the

project team and project organization perspective are: knowledge management processes and training (Spałek, 2013; Wyrozębski; 2014; Gandomani, Nafchi, 2016; Paterek, 2017b), human resources management and development (Dikert et al., 2016; Denning, 2018b), organizational culture (Paterek, 2016; Solinski, Petersen, 2016; Hoda, Noble, 2017) and governance of the entire project organization in all its aspects not only from project management methodology (Kuura, Blackburn, Lundin, 2014; Joslin, Müller, 2016).

The Agile transformation process is complex due to scaling required in large organizations as it often faces barriers and limitations when integrating with the existing project team's (Gregory et al., 2016) and the organization's governance, subjective measurement of its results (Gandomani, Nafchi, 2014) and very long period of its deployment (Laanti et al., 2011; Denning, 2016; Dikert et al., 2016). However, the results of investment and troubleshooting of these problems are rewarded by an Agile organization that is capable of delivering an instant, intimate, frictionless value on a large scale (Denning, 2018a), including a value for satisfied teams and their members (Laanti et al., 2011).

Project team values

Project management practice offers many different perspectives on Agile project team values that mature team should follow as the Agile mindset is needed for constant and continuous improvement of its performance. The first and the most popular one is coming from the Scrum Guide (Schwaber, Sutherland, 2017) and it is made up of five core values: courage, focus, commitment, respect and openness which, in turn, are based on three pillars of empiricism: transparency, inspection and adaptation (Scrum.org, 2019):

- **Courage** means the team members are able to do the right things and work on even the most complicated problems to solve it;
- **Focus** denotes that the whole team is doing sprint planned activities aimed to accomplish the sprint goal at the end of the iteration;
- **Commitment** is coupled with focus as all team members personally declare to achieving the sprint goal at the end of the iteration;
- **Respect** means all team members are equally important and respect each other independence and capability in terms of knowledge, experience and skills;
- **Openness** is an attitude of the team to be willing to hear and collaborate with each other team member as well as with customer or other stakeholders.

On the top of above five, some of the practitioners expose the additional ones, which are:

- **Visibility** (transparency) which is the availability of an actual state of product development to all interested stakeholders; however, the details are still in team ownership;
- **Humour**, as it is assumed that everyone is always doing the best he/she can, everyone needs the sense of humour related to laugh or cry;
- **Proactivity** is simply being responsible for our decisions (Covey, 1989) and guide decisions by our values, carefully selected and internalized;
- **Honesty** to yourself and each other;
- **Empathy** understood as really knowing each other, encourages helping each other, develops respect and common goals with other team members;

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- **Creativity** means to be open to new ideas, creative problem solving, build on other's ideas, navigate future challenges;
- **Fun**, in other words, means people can be themselves in a given team, they can be relaxed, enjoy their work, have job satisfaction, build a trust;
- Team Collaboration; Accountability; Quality; Energy; Passion; Technical Competency (Craftsmanship).

The second one set is coming from XP (eXtreme Programming) core values (Beck, 1999):

- **Communication** should be verbal and direct as much as it is possible in order to faster establish expectations, requirements, solutions, goals and vision related to the developed product;
- **Simplicity** means to deliver the simplest solution first and refactor it later according to the expectations coming from the feedback loop;
- **Feedback** is about both giving and receiving some kind of assessment or payback information to each other and it creates a mature Agile mindset within the team;
- **Courage** is very similar to Scrum value denoting brave in doing everything to accomplish the planned work as well as to communicate and accept the feedback;
- **Respect** is also very similar to Scrum value means respect for yourself and each other in terms of different levels of knowledge and experience.

Similar to the agility construct, Agile team values are not easy to measure in quantitative terms; however, as the process is empirical, there is a need to create at least some form of a subjective measurement. The success of introducing any Agile initiatives or changes in team behavior or attitude depends on measuring the delivered value or outcome – otherwise, it is nothing more than intuition and assumption (Scrum.org, 2018). Evidence-based management allows for converting the principles based on the best evidence into organizational practices or conscious organizational decisions by using social science and organizational research (Rousseau, 2006). The empirical process requires assessing every proposed change in terms of the evidence of its efficacy and even if an experiment fails, it is important to learn a lesson from it (Pfeffer, Sutton, 2006). The Evidence-Based Management (EBM) is an approach proposed by Scrum.org (2018) in order to quantify the value delivered to the customer as the evidence of organizational agility based on empirical evidence, logic and insight, including the measure of employee satisfaction with an indicator used in the process.

Methodology approach

The main goal of the empirical research in this paper is to present the Agile transformation changes from the perspective of the project team values. The research population is defined as large software project enterprises adopting or deploying the Agile project management methodology in order to faster deliver new, advanced and innovative business services and products to their customers and users. The majority of analysed Agile transformation cases (> 30%) took place in the software and telecommunication enterprises in large IT/ICT departments or even at the level of whole enterprises.

An illustrative and explanatory multiple case study analysis was applied as a research method (Jemielniak, 2012, p. 14; Kozarkiewicz, 2012, p. 202; Babbie, 2014; p. 324). The primary goal of the multiple case study analysis with the intentional selection was to answer research questions and fill an epistemological gap regarding wide-scale organizational project management changes both in terms of project management methods applied by enterprises as

well as changes related how the work of project teams is organised and the values they represent. The research question, however, is limited to the project teams participating in complex IT and ICT program and projects. The triangulation method was applied to strengthen the quality and deliver different perspectives of this empirical research (Jemielniak, 2012, pp. 182-183; Babbie, 2014, p. 121). The triangulation method resulted in multiple case studies sources – different enterprises, consultants and authors as well as with the number of methods applied to gather all of them. Most of the case studies were collected by the search through the existing Internet repository. Documents created by multiple authors and consultants (informant's triangulation) came from 12 consultant groups (source's triangulation). Two case studies came from standardized and unstructured interviews (Jemielniak, 2012; Babbie, 2014) with an experienced Agile coach and the last one comes from the pool of the author's own observations.

The significant limitation of this research study is the web source of the most of multiple case studies. Case studies retrieved from the web documents contain mainly the description of successful transformation processes (probably for the marketing purpose of some consultant) and also provide a very limited number of details important to this research. Discerning interpretation of each case study and the author's experience from practice allows extracting as many details as possible from the context of these descriptions, however, in the same time it can bias to incorrect or subjective author's interpretations. Future research studies may be repeated on the same or similar multiple case studies by several researchers to bring some interesting comparisons and conclusions.

Empirical research results

The empirical research results presented in the paper come as a part of the more comprehensive research study regarding the Agile transformation, partially presented in previous papers (Paterek, 2017a; 2017b; 2018); however, without the project team's specific changes and conclusions regarding team values.

The most important aspects of presenting results are organizational changes (Fig. 2 and Fig. 3) from the project team's perspective and the impact on their values (Tab. 1) resulting from Agile transformation process deployment or adoption. An individual case study assessment of each organizational change affected daily work of the project team and routines were as follows:

- **Communication** – it affected almost all cases (85%) and it has introduced a more direct, face to face communication inside the project team among their members, as well as with outside interfaces – e.g. with other cooperating project teams, with customers and users and with other business units within the project organization;
- **Teams Cooperation & Collaboration** – it was a significant factor (71%) as it has introduced a much closer team collaboration than before the transformation process in terms of shared job activities of two or more team members; significantly more tacit knowledge and experience-sharing during daily routines, cutting down the feedback loop and enabling more creativity and experiments;
- **Friendly Work Environment** – it was changed in more than half of the cases (53%) by forming constant teams working together through a long period of time which facilitated teamwork and enhanced communication;
- **Self-Organization** – it was affected in nearly the half of the analysed cases (47%) as it is not easy to deploy; however, it is necessary to continuously drive the project team to

be self-organized and autonomous in order to deliver a product increment on a regular basis;

- **Employees Initiatives & Intrinsic motivation** – it was affected in almost half of the analysed cases (45%) and it is probably an indirect effect of a friendly work environment that allowed team members to take new initiatives, commitments, become creative and proud of their performance and the job itself;
- **Multidisciplinary Teams** – introduced in a number of project teams; however, it was a complicated challenge for most project organizations as it impacted significantly their organizational structure; introduction of a skill set diversity in project teams allowed for more autonomy and self-organization of the team as well as for more creativity in designing solutions;
- **Customer Cooperation** – it was necessary to enhance team communication and collaboration with the customer, either directly (the preferred approach) or indirectly (e.g. with a customer project team representative) to shorten the feedback loop and to reduce product increment delivery time;
- **Business Cooperation & Collaboration** – it was changed similarly to cooperation and collaboration with the project team who needed to enhance communication, shortening the feedback loop with other business units of project organization, e.g. these responsible for HRM/HRD, budgeting and accounting, strategic decisions, law and legislation aspects; logistics and marketing;

Fig. 2 presents the weighted results defined as a percentage share of each organizational change in all the organizational changes identified within the analyzed multiple case studies.
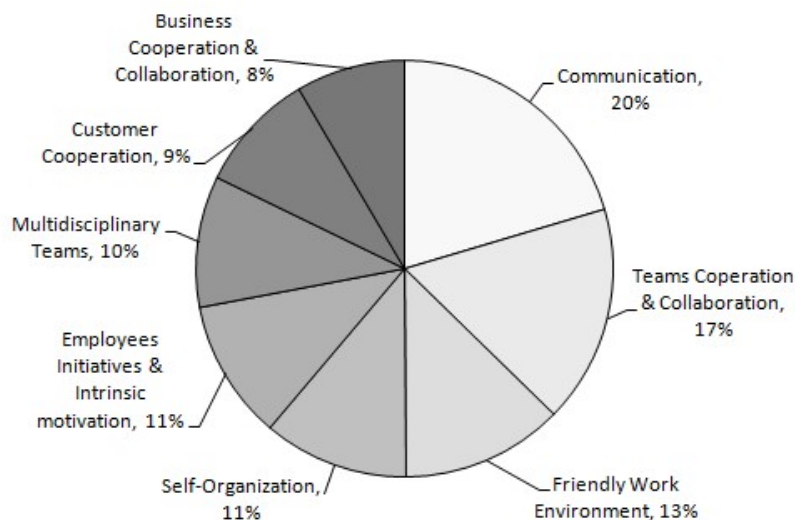
Source: made by the author
Fig. 2. **Organizational (weighted) changes in the Agile transformation process**

Fig. 3 presents the same results but from a different (non-weighted) perspective. It indicates a percentage share of each one organizational change in the entire analyzed multiple case studies.
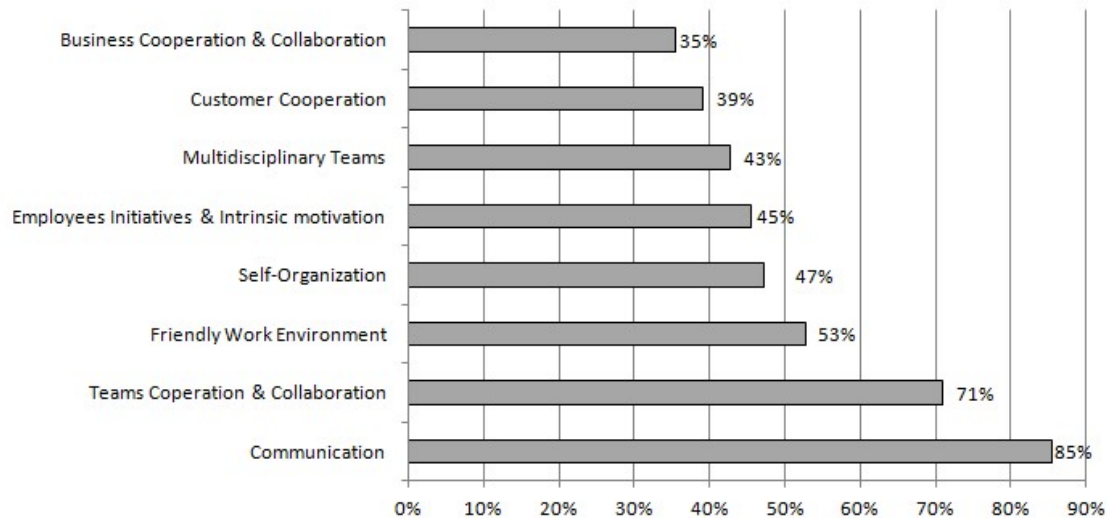
Source: made by the author

Fig. 3. **Organizational (non-weighted) changes in the Agile transformation process)**

Tab. 1 presents the author's own assessment of the impact of the organizational changes on the project team's values identified during the Agile transformation process deployment based on multiple case study analysis. Changes in the organizational communication affected most (11 out of the total of 15) identified Agile project team values. Feedback and communication values were mostly (by 7 organizational changes) impacted by all the identified organizational changes.

Table 1

Organizational changes in the Agile transformation from the perspective of project team values

	Courage	Focus	Commitment	Respect	Openness	Visibility	Humour	Proactivity	Honesty	Empathy	Creativity	Fun	Communication	Simplicity	Feedback
Communication	X		X	X	X	X	X		X	X	X		X		X
Teams Cooperation & Collaboration	X	X		X	X					X	X		X		X
Friendly Work Environment				X	X		X		X	X		X	X		X
Self-Organization	X	X	X			X		X			X		X	X	X
Employees Initiatives & Intrinsic motivation	X		X					X			X	X		X	
Multidisciplinary			X	X	X	X					X		X	X	X

Teams														
Customer Cooperation	X	X	X	X				X				X		X
Business Cooperation & Collaboration	X	X	X	X	X							X		X

Source: author's calculations

Fig. 4 presents an Agile readiness protocol (Panasiewicz, Paterek, 2017) that enables the preliminary assessment of project team and project organization to transformation deployment. This tool provides an assessment of four areas of the project team and project organization management readiness for adopting Agile, namely: governance, human resources management & development, knowledge management and organizational culture. Positive answers to all the readiness protocol questions (Fig. 4) decrease the risk of an unsuccessful or abandoned transition, otherwise there is a risk for superficial deployment – it is "pseudo-Agile" as all artefacts are indicating a new approach, but the Agile mindset is not built in or abandoned deployment – both the old way of governance and the old mindset are maintained (Panasiewicz, Paterek, 2017).
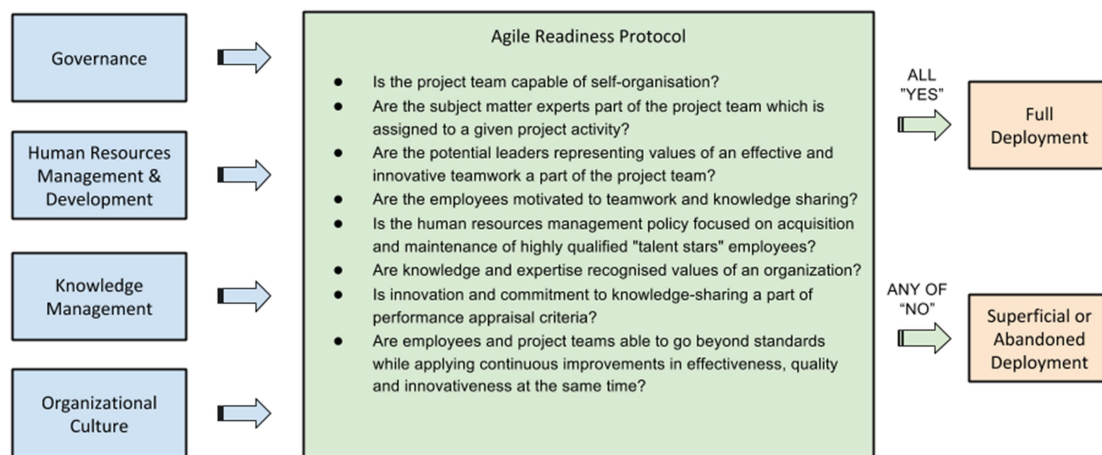
Source: P. Paterek (2018, p. 265)
Fig. 4. **Readiness protocol of the Agile transformation deployment**

The future research opportunity for the above-described tool is to convert or add the questions that deliver indicators for the quantitative assessment of impact to project team values affected during introducing the Agile transformation team and organizational changes (Tab. 1).

Results discussion
The author's empirical research study presented organizational changes of the Agile transformation impacting the project team as well as a whole project organization (Fig. 2 and Fig. 3) and also the impact of these changes on the project team values (Tab. 1) as a response to the research question of this study.

The first key finding from both perspectives, the organization's method of teamwork as well as Agile team values, is a change in the communication towards close, means more direct, face to face communication, as it enables and enhances cooperation and collaboration within the

project team as well as with customers, users, other project teams and business units of a large software project organization (Gandomani, Nafchi, 2015; Dikert et al., 2016; Denning, 2018a; 2018c). The above changes in communication facilitate an increase in nearly all the values identified for the project teams (Tab. 1). The second key finding from both perspectives i.e. from the perspective of project team changes as well as from the project team values' perspective, is the ability of a multidisciplinary project team to self-organize, assuming it possesses a given level of autonomy from its organization (Gandomani, Nafchi, 2015; Dikert et al., 2016; Hoda, Noble, 2017; Denning, 2018a; 2018c). It is crucial for a successful deployment of Agile transformation (Laanti et al., 2011; Solinski, Petersen, 2016) and also for all the team values related to the team focus and commitment to deliver valuable, regular and incremental product deliverables (Tab. 1).

From the perspective of Agile project team values, the key ones are (Tab.1): a feedback loop as it is the driver or enabler of an effective communication inside and outside a project team and three values coming from the Scrum method: commitment, respect and openness, as they allow to integrate and consolidate project team members as a one team responsible and accountable for delivered results and solutions. In order to reach these values in the project team, it is necessary to provide enough leadership support, establish correctly roles and responsibilities in the Agile transformation process (Dikert et al., 2016; Gandomani, Nafchi, 2016; Jovanović et al., 2017; Denning, 2018b).

From the holistic and the system perspective approach note that the whole Agile transformation process and identified organizational changes (Fig. 1, Fig. 2) are unique for a given project team and project organization context, in particular in terms of delivery of project team values (Tab. 1) which strongly relate to the Agile mindset in a given project organization (Gandomani, Nafchi, 2014; Denning, 2016; 2018a; Ravichandran, 2018). The most important project team's enablers for Agile transformation changes are related to: human resources management & development (Gandomani, Nafchi, 2016; Denning, 2018b), organizational culture (Gandomani, Nafchi, 2015; Paterek, 2016; Hoda, Noble, 2017), knowledge management (Gandomani, Nafchi, 2016; Paterek, 2016, Paterek, 2017b) and overall project organization governance (Kuura, Blackburn, Lundin, 2014; Gregory et al., 2016; Joslin, Müller, 2016).

The opportunity for future research studies is in the quantitative measurement of the agility degree (Gandomani, Nafchi, 2014) to provide a better assessment of Agile transformation process changes as it is still a more subjective or perceived assessment. Another interesting future research opportunity is a quantitative measurement of team values together with its dynamics, e.g. similar to the Evidence-Based Management (EBM) tool proposed by Scrum.org (2018) or a modified version of Agile Readiness Protocol (Panasiewicz, Paterek, 2017).

Conclusions

The ultimate goal of each Agile transformation is adopting the agility feature in project organization and eventually becoming Agile. Owing to increased agility, a project team as well as a whole project organization, can achieve more Agile values and eventually adopt the Agile mindset.

The following key conclusions are the main research findings:

1. The key Agile transformation changes in a large project organization have a significant impact on a daily teamwork and routines and are related to communication and self-organization of a multidisciplinary and autonomous project team.
2. The right feedback as well as commitment, respect and openness are the most important Agile project team values coming from the organizational changes introduced by Agile transformation process.
3. From the holistic perspective, it is mandatory to investigate, identify and address project team and project organization context in terms of human resources management and development, organizational culture, knowledge management and overall project organization governance in order to adjust Agile transformation changes correctly.

The key proposals and recommendations are as follows:

1. As the Agile transformation process is complex and requires a considerable investment of organizational resources it is recommended to investigate, analyse and identify guidelines and practices to address changes related to the project team's communication and self-organization.
2. In order to establish a proper Agile mindset in a team or organization, it is recommended to find a quantitative measurement of the degree of agility (e.g. through assessment of the Agile project team values) and find a way to measure the effectiveness of Agile transformation process changes and its dynamics in a longer timeframe.
3. The Agile transformation process is somehow unique for each team and for each project organization and thus it requires investigating, identifying and addressing project team and project organization contextual enablers, e.g. these related to knowledge management processes or organizational culture challenges.

The modern program and project management remains in need of further comprehensive studies as well as some empirical research in the project management practice as we now live in the era of digital transformation occurring in each area of our life. Agile project management is one of potential responses to the challenges of IT/ICT project management; however, an Agile mindset is not easy to adopt because of to its subjective and imperceptible nature.

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HOW INCREASING PROJECTIFICATION AND TEMPORALITY HAS CHANGED THE WAY WE LOOK AT PROJECT MANAGEMENT OFFICES - A SYSTEMATIC LITERATURE REVIEW

Peter Kaul, Skema Business School, Lille, France
Robert Joslin, AIPMO SBS Swiss Business School, Zurich, Switzerland

Abstract

Increasingly, projectification and temporality forces project-based organizations to rethink how to set up a sustainable environment that supports projects being likewise able to deal with ongoing organizational changes due to varying needs over time. Project management offices (PMO) can help organizations to increase project-related success and organizational performance. However, PMOs are still underresearched which is why a comprehensive review of our current understanding is required.

This paper examines how the research into PMOs in organizations has evolved over time, seeks to find patterns in the different themes of research covering the past 20 years. A systematic literature review is conducted into the body of literature of PMO research with the specific focus on PMO success. The review provides the reader with a structured overview and insights about the main phases and themes that were researched. whilst raising and answering pertinent questions during the review of the body of literature.

The motivation for this study is to provide clarity to divergent knowledge about PMO design structures and what is considered best-suited to support projects in environments of temporality.

The study result reveals four major clusters of research: the early years phase was followed by (1) the first cluster which was concerned with PMO roles, value, maturity and leadership. (2) The second cluster included strategic fit, organizational dependencies and context and causes for PMO reconfiguration followed by (3) cluster three which covered project-based organizations and organizational design. (4) Finally, cluster four examined services, outcomes, structure and impact of PMOs. All four clusters cover specific and related themes and perspectives. Surprisingly, the environmental/organizational perspective appears twice (cluster two and three), however, the focus is different since the understanding has evolved over time.

The findings demonstrate how our understanding of PMOs has evolved over time. where there is a shift in research focus from a reductional, functional perspective to an organizational and service-oriented perspective. However, the study also reveals a number of gaps and questions to be addressed.

The implications for academia are the contribution to a systematic understanding of PMOs, the major research clusters and the identification of research gaps. The practical implications consist of a structured and condensed overview as well as insights into the body of literature about PMOs.

Keywords: *PMO, success, value, governance, organizational design*
JEL Code: M, M00

Introduction

This paper examines PMOs in project-based organizations (PBO) with the specific focus on PMO success. PBOs are defined as organizations or firms in which "the majority of products made or services supplied are against bespoke designs for customers" (Turner & Keegan, 2001, p. 256). PMO success is still under investigation, first papers highlight the multifaceted character of PMO success where the outcome inludes performance objectives, benefits and (perceived) value over time (figure 1).
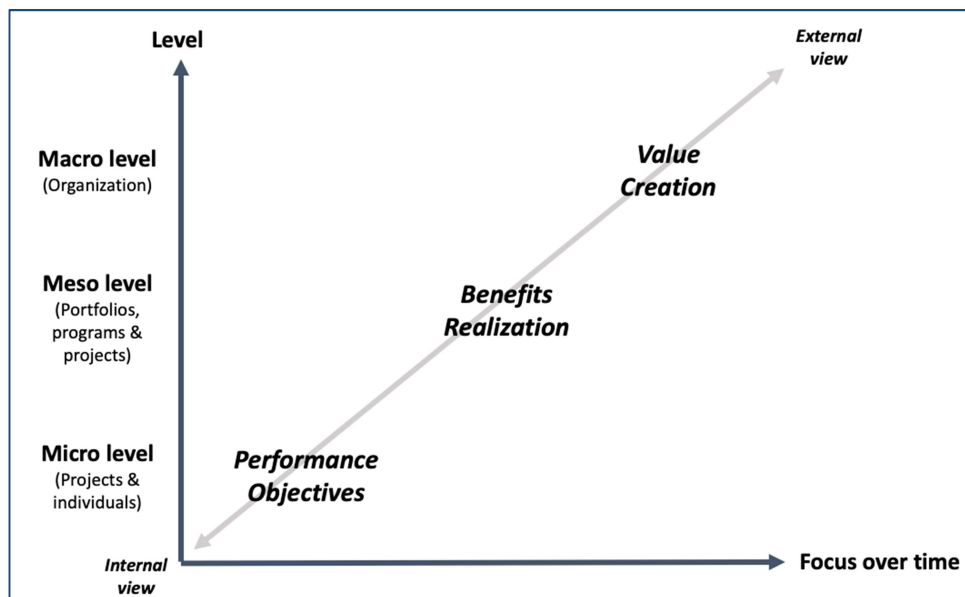
After: Kaul & Joslin (2018)

Fig. 1 **Levels of PMO Success**

This systematic literature review analyzes selected literature from 1999 to March 2019 to find out key areas of research and discusses key findings. Successful PMOs are located in their organizations and contribute in many different ways to organizational success. It is therefore of particular importance to examine and discuss organizational project management in PBOs (Aubry, 2018; Crawford, 2018; Müller, Drouin, & Sankaran, 2018), however, respective literature and research is still scarce (Miterev, Mancini, & Turner, 2016). This paper follows the recent call for more "Type 3" research on project level by going beyond traditional project research. It attempts to increase our understanding of organizations and project organizing practices more generally (Geraldi & Söderlund, 2018). This paper examines how the understanding of PMOs has evolved over the last 20 years with a specific focus on PMO success. The research gap consists of the lack of understanding of how to set up and develop successful PMOs in PBOs to increase the likelihood of organizational success.

The respective research questions are formulated as follows:
- RQ1: What are the main areas of research into PMOs, how and why did the emphasis change over the past 20 years?
- RQ2: How has the understanding of PMOs evolved within the last 20 years?

- RQ3: Which are the open topics that still need to be addressed?

The study applies systems theory as theoretical lens and adopts critical realism as underlying philosophy, since the focus lies on exploration and explanation of structures and mechanisms (Bhaskar, 2016). The unit of analysis is the PMO within an organizational context.

The implications for academia are the contribution to a systematic understanding of PMOs, the major research clusters, common and related themes, and the identification of research gaps. The practical implications consist of a structured and condensed overview as well as insights into the body of literature about PMOs.

The paper is structured as follows: After the introduction, the applied research method is explained followed by a literature review which discusses the different identified research clusters. The results are discussed in the light of the literature body to answer the research questions. Finally, the conclusion explains strengths and limitations of the study and proposes recommendations for further research.

Research method

A critical realism stance has been applied in this paper according to Bhaskar (2016). The systematic literature approach has been chosen to identify, evaluate and synthesize existing literature (Petticrew & Roberts, 2006), to avoid bias (Hirsch, 2005) and to ensure methodological scrutiny (Tranfield, Denyer, & Smart, 2003). The underlying principles of this systematic literature review comprise replicability and maximized internal as well as external validity (Tranfield & Denyer, 2009). The five process steps applied according to Tranfield & Denyer (2009) and Colicchia & Strozzi (2012) are the following:

1. Papers were searched using the key words PMO, project management, governance, organization, success, roles, functions and typology in multiple variations.
2. The selection of papers were refined according to the research questions (main quality criteria were journal rankings, citation index, and author reputation).
3. Articles published between 1999 and 2019 were selected mainly from the journals focused on project management (International Journal of Project Management, Project Management Journal, International Journal of Managing Projects in Business). Where appropriate, further journals and conference proceedings were also used based on professional judgement (Tranfield & Denyer, 2009).
4. In total, 563 papers were identified during the initial selection. The publications were analyzed and then divided into core and secondary papers. The final list of core literature used in this research contains 125 papers.
5. Analysis and synthesis: A phased-based analysis was used to examine the main themes covered by the papers from 1999 to present. The final papers have been analyzed in terms of research focus. Key words were noted to facilitate the grouping of the papers. To identify different research themes, the papers have been tagged differently four times applying different grouping criteria until no major grouping difference could be identified. The final grouping identified an early years phase followed by four major clusters of research which are presented and discussed in the following section. The detailed analysis can be found in the appendix at the end of this paper.

Results

General findings and early years` research

This literature review about PMOs covers a time span of twenty years from 1999 until March 2019. The grouping process of the papers revealed five different clusters of research, the early years phase followed by four different clusters (table 1). In the early years (1999-2008) research focus was mixed. Some researchers concentrated on examining PMOs as a phenomenon by analyzing PMO roles and the services they offer (Aubry, Hobbs, & Thuillier, 2006; Crossan, Lane, & White, 1999; Desouza & Evaristo, 2006; Dinsmore, 1999; Jugdev & Müller, 2005; Julian, 2008; Kogut, 2000; Kwak & Dai, 2000; Turner & Keegan, 2001; Walker & Christenson, 2005; S. Ward & Chapman, 2003). Another significant research theme was dealing with the question of which competences might be required (L. H. Crawford, 2005; Hill, 2004; Moore, Cheng, & Dainty, 2002; Westera, 2001) and which leadership style best supports project management (PM) activities (Müller & Turner, 2007; Prabhakar, 2005). Finally, the first researchers investigated the strategic fit of PMOs with their organizations and tensions between them (Aubry, Hobbs, & Thuillier, 2007; Hobbs, Aubry, & Thuillier, 2008; Mengel, Cowan-Sahadath, & Follert, 2008; Pettigrew, Woodman, & Cameron, 2001).

This phase was followed by four major research clusters (groups of themes in papers that exceeded the average number of publications in each group), namely:

- Cluster 1: PMO characteristics, roles and functions (2007-2011).
- Cluster 2: Organizational context of PMOs, tensions and causes of reconfiguration (2009-2012).
- Cluster 3: Project-based organizations and organizational design aspects (2016-today).
- Cluster 4: PMO services, performance and structure (2010-today).

Table 1:

Clusters of research into PMOs

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
Cluster 1			1	1		1	2	1	4	3	3	2	8		1	1	2	2	1	2		35
Cluster 2	2		1		1		1		1	2	8	5	2	3	1	1	2					30
Cluster 3																1		2	3	6		12
Cluster 4		2	1				1	2	1	1		5	1	2	6	3	7	6	3	3	4	48
Grand Total	**2**	**2**	**3**	**1**	**1**	**1**	**4**	**3**	**6**	**6**	**11**	**12**	**11**	**5**	**8**	**6**	**11**	**10**	**7**	**11**	**4**	**125**

This paper presents and discusses the four identified clusters in the following sections.

Cluster 1 – Characteristics of PMOs (2007-2011)

The earliest cluster of papers is concerned with the four research topics PMO roles, leadership, organizational value and maturity (table 2). Within this cluster, researchers mainly seek to understand what characterizes PMOs by looking at their roles, contribution and the respective outcome.

Table 2

Cluster 1 research topics

Themes	Number of papers
PMO Roles	9
Organizational value	7
Maturity	1
Leadership style	3

Looking at PMO roles, organizational learning and knowledge management as a predictor for PMO performance and as important link between the temporary part of an organization (projects) and the permanent part (line organization) has been addressed frequently (Hobbs & Aubry, 2011; Lindner & Wald, 2011; Sokhanvar, Trigunarsyah, & Yarlgadda, 2011), Another aspect consists of portfolio management, a strategic task that links organizational strategy to the programs (group of related projects) and projects of an organization (J. K.Crawford, 2011; Crawford & Cabanis-Brewin, 2011): Müller and colleagues further differentiate between PMOs that are either project execution-oriented (control of PM compliance, standards, project and project staff performance) or strategy-oriented, e.g. portfolio control such as selection, reporting and decision making (Müller, Martinsuo, & Blomquist, 2008). Hobbs and Aubry highlight that existing PMO typologies are not empirically validated and propose that a set of characteristics such as organizational context, mandate or authority should serve as the basis for types of PMOs (Hobbs & Aubry, 2008a). Finally, the contribution of PMOs to innovation and entrepreneurship was researched highlighting the potential value PMOs could provide (Cooke-Davies, Crawford, & Lechler, 2009a). It was suggested to involve PMOs as drivers of innovation processes e.g. as coaches, facilitators, groups, boards, innovation strategy, innovation process, coordinators for strategy and process implementation, idea management software systems, idea campaigns, specialized task forces for supporting executives and the staff, and challenge-driven idea generation processes (Artto, Kulvik, Poskela, & Turkulainen, 2011).

Organizational value that PMOs provide is the second research topic of cluster 1. Thomas & Mullaly highlight the difficulty of and little consensus about how to create value for organizations. They propose to measure performance differences (Thomas & Mullaly, 2007), similar to Lepak, Smith, & Taylor (2007) However, in a later paper, they address the distinction between tangible and intangible value (Thomas & Mullaly, 2008). Possible divergent interests of business units and PMOs has been examined several times and revealed a lack of information and collaboration as well as different perceptions about what needs to be done (Aubry, Hobbs, & Thuillier, 2009; Hobbs & Aubry, 2008b). Some researchers already conclude that PMOs must not been seen isolatedly highlighting co-existing values within the organization (Aubry et al., 2009), dependent on context and PMO roles (Aubry, Richer, Lavoie-Tremblay, & Cyr, 2011).

The third theme is concerned with maturity. In contrast to focusing on values, the notion of authentic leadership is introduced and maturity of leadership is suggested by distinguishing between foundational, nascent, developing and mature leadership (Lloyd-Walker & Walker, 2011).

The last theme in this cluster deals with leadership. In general, a leadership style is suggested which is able to cope with both the organization`s administrative structure as orientation and its adaptive capacity to enhance overall flexibility and effectiveness (Uhl-Bien, Marion, & McKelvey, 2007). Müller and Turner remark that literature concentrates on tools and techniques rather than leadership styles proposing a differentiation between application area, project complexity, project importance, contract type or lifecycle stage (Müller & Turner, 2010b, 2010a).

Cluster 2 – Context of PMOs (2009-2012)
The second cluster of papers deals with the fit between PMOs and their organizations, dependencies and context. Another main focus consists of research into the organizational

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causes of reconfiguration of PMOs (table 3). Within this cluster, researchers concentrate on the interplay and dependencies between PMOs and organizations.

Table 3

Cluster 2 research topics

Themes	Number of papers
Strategic fit	3
Success criteria	1
Dependencies	3
Organizational context	6
Causes for reconfiguration	5

Strategic fit between PMOs and their organizations was addressed by three papers looking at different perspectives as key drivers (Cooke-Davies, Crawford, & Lechler, 2009b), a positive value direction (Mullaly & Thomas, 2009) and the lack of consensus in this field (L. H. Crawford & Helm, 2009).

Ika examined the construct of success and differentiates between project success and project management success. He concludes that both, short- and long-term criteria and perspectives are required (Ika, 2009).

Dependencies were addressed from different angles: from a stakeholder perspective by differentiating between projects and project management (Li Zhai, Xin, & Cheng, 2009), by identifying 34 challenges out of which the three most important ones were rigid corporate culture and failure to manage organizational resistance to change, lack of experienced project managers and PMO leadership, and lack of appropriate change management strategy (Singh, Keil, & Kasi, 2009). An interesting aspect was provided by Hurt and Thomas who suggest an inflection point of value, a U-shaped relationship of PMO value creation and time. They conclude that over time new visions and goals need to be developed (Hurt & Thomas, 2009).

The organizational context of PMOs has been examined frequently. It is concluded that organizations of PMOs as mostly project-based or project oriented (Aubry, Hobbs, & Müller, 2010). PMOs as part of a power system and politics in organizations are organizing for innovation as well as projects (Aubry, 2011). The variety of objectives, priorities and relationships and constant change is also confirmed by Petit (2012) suggesting continuous oversight and alignment. Internal and external issues and events moderated by organizational context lead to frequent changes of PMO roles but might also lead to increased project management and business performance and maturity explain Aubry, Hobbs, Müller, & Blomquist (2011). Furthermore, papers addressed different kinds of organizational complexity (Turner, Müller, & Geraldi, 2012) and corporate governance shifts due to new market expectations (Müller & Jugdev, 2012).

Research into causes for PMO reconfiguration was dominated by examining how PMOs are embedded in their host organizations and how they are exposed to constant changes and transitions (Aubry, Müller, Hobbs, & Blomquist, 2010;. Crawford, 2010; Pellegrinelli & Garagna, 2009). Aubry et al. found that PMOs and their structures alternate between phases of tensions and relative stability (Aubry, Hobbs, Müller, & Blomquist, 2010). To cope with changes, PMO autonomy is important, a lack of PMO autonomy and PMO mandate may result in serious tensions, conclude Hobbs & Aubry (2010).

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Cluster 3 – Organizational design (2016-now)

The third cluster of papers covers research the context of project-based organizations and from an organizational design perspective (table 4). It started in 2016 which indicates that it is the youngest and most current research theme. Literature and research of this cluster has replaced the ones from cluster two by lifting the perspective on a higher level, an organizational design perspective.

Table 4

Cluster 3 research topics

Themes	Number of papers
Context of projects-based organizations	7
Organizational design	4

The context of project-based organizations is the research focus of most of the papers of cluster 3. Similar to earlier papers, it is concluded that organizations of PMOs are mostly project-based or project oriented organizations (Miterev et al., 2016). This type of organization may be conceptualized as interplay of the three segments values, structures, and people, suggest Gemünden, Lehner, & Kock (2018). One recent contribution about PMOs was provided by Bredillet and colleagues. Their paper conceptualized PMOs as collections of routines whereby the PMO evolves over time to adapt to organizational context influence (Bredillet, Tywoniak, & Tootoonchy, 2018). The inter-organizational network was the unit of analysis Matinheikki et al. who explain that this network can be managed for value creation in the front-end of projects (Matinheikki, Artto, Peltokorpi, & Rajala, 2016). Another important research field deals with governance, e.g. the relationship between governance and success (Müller, Zhai, & Wang, 2017) and multi-level project governing (Brunet, 2018). Finally, it is suggested that future research in the realm of practices, projects and portfolios in project-based organizations should be conducted in the field of practices and tools, leadership and dynamic capabilities (Clegg, Killen, Biesenthal, & Sankaran, 2018).

The second pillar in the third cluster consists of research papers focusing organizational design which has been revealed to be an ongoing process (Aubry & Lavoie-Tremblay, 2017). Instead of looking at organizational units like a PMO isolatedly, this research theme applies a more holistic approach by analyzing organizational motives and structures (Hepworth, Misopoulos, Manthou, Dyer, & Michaelides, 2017). To facilitate understanding of organizations in a structured approach, new models and frameworks have been proposed recently, e.g. a model for organizational project management, a structured approach to capture structure, motives and activities in organizations (Müller et al., 2018) and a conceptual framework that is determined to show that governmentality, governance and organizational design as a whole is essential to an understanding of organizational project management (Simard et al., 2018).

Cluster 4 – Service-orientation (2010-now)

The fourth cluster of papers is concerned with the four research topics measurable outcomes, PMO impact, PMO structure and PMO services (table 5). Within this cluster, researchers seek to understand which structure and, in particular, which services generate a favorable outcome. It is the largest cluster with the longest time span of nine years.

Table 5

Cluster 4 research topics

Theme	Number of papers
Measurable outcomes	6
PMO impact	1
PMO structure	2
PMO services	31

Research in this cluster can be divided into two groups. The first group looks into the contribution of PMOs in terms of measurable outcomes and PMO impact. The second group analyzes structures and services PMO provide. Aubry et al. point out that PMOs provide tangible benefits to the organization such as project success and customer benefits (Aubry & Hobbs, 2010). Performance was analyzed by Biedenbach & Müller who stress that evaluating performance requires a definition of performance and its context (Biedenbach & Müller, 2012).

Additionally, innovative performance aspects e.g. slack, innovativeness, and ambidexterity of PMOs should be considered (Müller, Glückler, & Aubry, 2013). On portfolio level performance results in enhanced project visibility, transparency in portfolio decision making and predictability of project delivery (Patanakul, 2015), on program and project level performance may be supported by a governance framework with the three dimensions efficiency, legitimacy and accountability (Brunet & Aubry, 2016). Recent researchers pointed out that project success cannot be assessed merely in terms of goals reached at the time of project completion but also in terms of benefits compared to costs and value achieved over the project lifecycle compared to original value expectations of various stakeholders (Martinsuo, Klakegg, & van Marrewijk, 2019).

The theme of impact of PMOs was examined by Kutsch et al. They suggested that PMOs might not always have a direct impact on project success and assume that it depends on the satisfaction of its service users (Kutsch, Ward, Hall, & Algar, 2015).

Several researchers looked at structural elements that are associated with PMOs. An organizational perspective was taken by Tsaturyan & Müller who explain that networked PMOs require both formal (regulative) and informal (relational) networks which requires additional PMO characteristics. PMOs act as loosely coupled systems consisting of structural, procedural, relational and regulative dimensions (Tsaturyan & Müller, 2015). Others investigated PMOs as organizational units and tried to identify different types of PMOs. However, since 47 different types were proposed, it might be at least questionable if this helps practitioners (Monteiro, Santos, & Varajão, 206).

The largest research theme in cluster four consists of research into services PMOs provide. Knowledge management, acting as knowledge broker and gathering lessons learned was addressed frequently (Atencio, 2013; Dutton, Turner, & Lee-Kelley, 2014; Eriksson & Leiringer, 2015; Gemünden, 2016; McClory, Read, & Labib, 2017; Müller, Glückler, & Aubry, 2013; Nadae, Carvalho, & Vieira, 2015; Paton & Andrew, 2019; Pemsel & Müller, 2012; Pemsel, Müller, & Söderlund, 2016; Pemsel & Wiewiora, 2013; PMI, 2015; Sokhanvar, Matthews, & Yarlagadda, 2014). Sokhanvar et al. point out that knowledge management should be part of PMO roles from the first setup onwards. However, the role of knowledge has not yet been addressed in PMO maturity models, emphasis on the improvement of knowledge capturing practices and processes is therefore required (Sokhanvar et al., 2014). Other identified themes include governance in different environments (Brunet & Aubry, 2016), managing and preparing

stakeholders for risky and uncertain situations (de Bakker, Boonstra, & Wortmann, 2010; Derakhshan, Turner, & Mancini, 2019), interaction with project participants (Albrecht & Spang, 2014), resource management (Joslin & Müller, 2016) and team building (Gren, Torkar, & Feldt, 2017), coordinator and trainer roles of PMOs (Otra-Aho, Arndt, Bergman, Hallikas, & Kaaja, 2018; Riis, Hellström, & Wikström, 2019), PMOs in the research context of universities (Wedekind, Llp, & Philbin, 2018) and benefit management (Musawir, Serra, Zwikael, & Ali, 2017). Besides concrete services PMOs may provide, several papers addressed the contribution of PMOs more generally. Empowerment, role significance and role clarity was proposed as favorable precondition for successful task execution (Jonas, 2010). Ward and Daniel suggest the involvement of PMOs along all phases of projects concentrating on the review of benefits and changes as well as on the monitoring process (Ward & Daniel, 2013). Roles as a set of mutual expectations e.g. serving, controlling, partnering or a blend of more than one role were identified by Müller, Glückler, Aubry, & Shao (2013) highlighting that it is still difficult to typify PMOs under one single set of activities. Contradictions were also discussed by Aubry who points out that PMOs supportive role are likely to serve as predictors for project and business performance (Aubry, 2015). In terms of measurable contribution it is not only necessary to define indicators for organizational performance (Aubry & Hobbs, 2010; Hobbs & Aubry, 2010) or return on investment metrics (Kerzner, 2011). It is of utmost importance to align measurement and the services PMOs provide e.g. PMO services related to cost performance (Carvalho, Barbalho, Silva, & Toledo, 2018).

Discussion

The literature review of 125 papers from 1999 to March 2019 revealed the main areas of research. Remarkably, the research focus has changed during the years. In the early years research was conducted in diverse areas. Then It started from a functional perspective (cluster 1) and covered topics e.g. how PMOs are structured and how they operate, became broader (cluster 2 and 3) considering organizational dependencies and organizational design, and finally resulted in a service-oriented perspective (cluster 4). Cluster 3 and 4 research is still ongoing.

Figure 2: Perspectives per research cluster
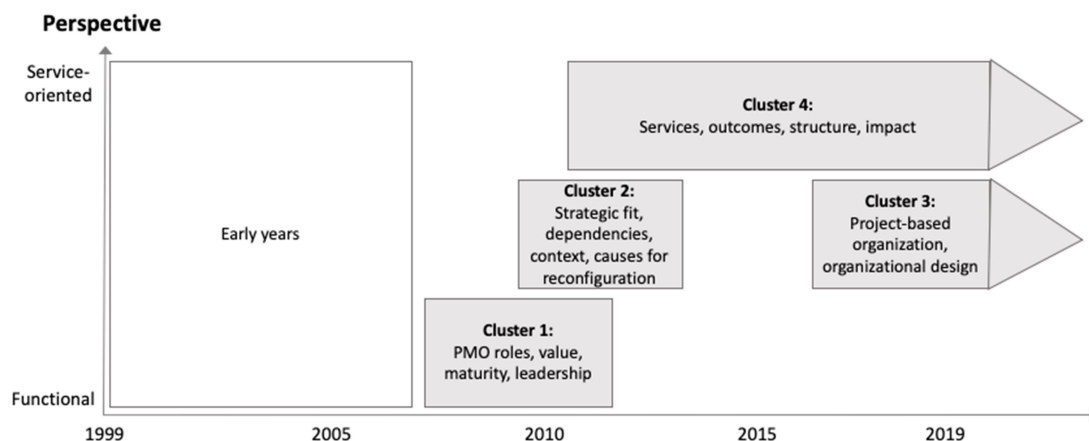
It is necessary to examine the different phases, clusters and themes of PMO research to understand how our understanding has evolved. Especially in the early years and in cluster 1

and 2, research was not able to provide sufficient answers for PMO success. Researchers during that time were attempting to get an understanding of what is a PMO, what it consists of and what it is doing? (cluster 1). Later, the focus changed because of a better understanding that PMOs should not be analyzed in isolation due to their organizational dependencies (cluster 2). The discussion around services PMOs provide and how these are related to successful outcome started almost ten years ago and it is still not finalized (cluster 4). However, it has become a discussion of measurable contribution, so the focus has changed from a reductional, functional to an organizational and service-oriented perspective. This shift is accompanied by another shift in PMO research from a problem-oriented view (organizational dependencies and causes for reconfiguration) in cluster 2. The most recent discussion (cluster 3) includes aspects like governmentality, governance, organizational design and organizational project management (Müller et al., 2018; Simard et al., 2018) which means it takes the whole organization into account including their organizational units and examines the interaction activities and mechanisms between the permanent part of the organization (line organization) and the temporary parts (programs and projects). This is in line with other researchers who revealed that organizational project management gains predominant importance since today`s organizations increasingly transform into/appear as project-based organizations (Kwak, Sadatsafavi, Walewski, & Williams, 2015; Miterev et al., 2016; Packendorff & Lindgren, 2014).

Organizational project management has emerged from organizational theory and is defined as "the integration of all project management-related activities throughout the organizational hierarchy or network" (Turner & Müller, 2017, p. 10). To understand project-based organizations better, models and frameworks have proven to be helpful (Kaul & Joslin, 2019). Table 6 provides a synthesis of the literature review discussed in the previous section and outlines the main themes, the unit of analysis and the perspective research has taken within the proposed clusters.

Table 6

Synthesis of the literature review

Research focus	Cluster 1 2007-2011 Characteristics	Cluster 2 2009-2012 Context	Cluster 3 2016-now Organizational design	Cluster 4 2010-now Service-orientation
Themes	• PMO roles (9) • Organizational value (7) • Maturity (1) • Leadership style (3)	• Strategic fit (3) • Success criteria (1) • Dependencies (3) • Organizational context (6) • Causes for reconfiguration (5)	• Context of project-based organization (7) • Organizational design (4)	• Measurable outcomes (6) • PMO impact (1) • PMO structure (2) • PMO services (31)
Unit of analysis	PMO as phenomenon	PMO and its context	Project-based organization	PMO and its contribution to organizational success
Perspective	**Inside-out:** PMO as organizational unit	**Outside-in:** PMO and its organizational dependencies	**Outside-in:** Project-related structure and capabilities from organizational perspective	**Inside-out and outside-in:** PMO service perspective

It is worth noting, that the perspective has changed significantly. Cluster 1 followed an inside-out or functional approach by looking from the PMO to the outside, cluster 2 and 3 take the

opposite approach, they examine PMOs from an outside-in perspective. In cluster 4, both perspectives could be identified, inside-out (discussion of services PMOs may provide) as well as outside-in (impact and measurable outcome of successful PMOs).

The suitability and necessity to concentrate on cluster 3 and 4 research jointly has been confirmed several times by academia (Aubry, 2018; L. H. Crawford, 2018; Simard, 2019) as well as by leading practitioners (Mark Price Perry, 2017).

In summary, this literature review reveals the major clusters and themes of research into PMOs and PMO success. Patterns and trends could be detected, however, there is still room for more research into PMO success. Missing definitions and terminology variances are some of the most obvious signs. To make PMOs and their organizations more successful and sustainable, this needs to be overcome to cope with increased projectification (Jensen, Thuesen, & Geraldi, 2016) and temporality (Simard et al., 2018).

Conclusions

This paper seeks to investigate how the understanding of successful PMOs has evolved over the last 20 years. A comprehensive systematic literature review has been conducted with a specific focus on PMO success. Out of 563 related scientific papers, 125 papers have been analyzed, grouped and discussed.

To answer the first question, four main clusters of research have been identified and proposed reflecting common and related themes:

- Cluster 1: PMO characteristics, roles and functions (2007-2011).
- Cluster 2: Organizational context of PMOs, tensions and causes of reconfiguration (2009-2012).
- Cluster 3: Project-based organizations and organizational design aspects (2016-today).
- Cluster 4: PMO services, performance and structure (2010-today).

The emphasis has changed from considering the PMO as organizational unit to looking at organizations and its project management capabilities more holistically.

The understanding has evolved over the last 20 years from a reductional, functional view (cluster 1) to an organizational view (cluster 2 and 3) and finally to a service-oriented view (cluster 4). Research in cluster 3 and 4 is still ongoing. This answers RQ2.

To answer the last question, this paper suggests areas of obvious gaps and misalignments future researchers may want to look at. Many topics are still open and need to be addressed. The main questions that remain unanswered to date are the following:

1. It still remains unclear for a project-based organization how to become more mature in terms of organizational project management. Current maturity models have proven to be misleading since they do not cover the whole range of PMO services nor do they consider PMOs and their organizations jointly (Kaul, Joslin, & Brand, 2018).
2. The literature review reveals many aspects PMOs are dealing with and the close relationship between PMOs and their organizations. It is at least remarkable that, after 20 years of research into PMOs, it still lacks an understanding of what makes a PMO successful. Neither is there a commonly agreed definition of PMO success nor is it clear which PMO services (may be direct or indirect contributions) are closely related to which successful outcomes. In addition, it is still unclear what constitutes the enablers of PMO success (Kaul & Joslin, 2018, 2019). Applying organizational models and more qualitative research, e.g. case studies are required to provide answers to those questions

as proposed by recent papers (Kaul & Færge-Broberg, 2019; Miterev, 2017) to examine the interplay between PMOs and their organizations.

3. The question whether an organization requires a single PMO or multiple ones lacks an answer. The existence of networks of PMOs has been detected and researched (Matinheikki, Artto, Peltokorpi, & Rajala, 2016; Tsaturyan & Müller, 2015), however, the criteria have not been determined yet which leaves practitioners with uncertainty about when and how to consider multiple PMOs in their organizations.

4. It is also not clear how to compare PMOs since there are hundreds of different services accompanied by ongoing organizational changes. Should a comparison of PMOs be conducted using an organizational structure or from a service perspective? A combination of cluster 3 and 4 research might provide suitable answers in the future.

The strength of this paper lies in its structured approach. First, literature was gathered systematically. Then it was grouped into clusters of related literature and themes. The four clusters have been discussed and it could be demonstrated how the understanding evolved over the last 20 years.

As every paper, this research provides limitations. The first one is the paper selection and the key words that were used to identify the literature. However, this research followed recommendations from leading authors to ensure high quality and a transparent selection process. A second limitation consists of the grouping of the papers into four clusters. Although the grouping process has been performed several times to ensure consistency, it remains subjective in nature. It is not unlikely that other researchers would have grouped the papers differently. However, by the means of grouping the literature into four clusters, the evolving understanding of PMOs could be demonstrated and discussed consistently.

It is suggested that future research looks at the open questions raised to close some of the obvious gaps this paper reveals.

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Appendix

	Cluster 1 2007-2011 Characteristics	
PMO roles	Hobbs & Aubry (2011)	Organizational learning roles as strong predictors of PMO performance; neither monitoring nor strategic activities provide positive contribution to PMO performance
	Crawford, J. K. (2011)	PMOs can improve the entire management of an organization through the strategic task of project portfolio management; PMO can link corporate strategy to the programs and projects of an organization.
	Crawford, J. K., & Cabanis-Brewin, J. (2011)	PMOs can improve the entire management of an organization through the strategic task of project portfolio management; PMO can link corporate strategy to the programs and projects of an organization.
	Müller, R., Martinsuo, M., & Blomquist, T. (2008)	PMOs either project execution-oriented (control of PM compliance, standards, project and project staff performance) or strategy-oriented, e.g. portfolio control such as selection, reporting and decision making
	Sokhanvar, S., Trigunarsyah, B., & Yarlgadda, P. K. (2011)	KM part of PMO roles from the first setup onwards of a PMO; role of knowledge has not yet been addressed in PMO maturity models; emphasis on the improvement of knowledge capturing practices and processes
	Lindner & Wald (2011)	PMOs are able to ensure continuity and professionalism supporting individuals to participate in knowledge management activities which serves as a link between the temporary and the host organizations
	Artto, K., Kulvik, I., Poskela, J., & Turkulainen, V. (2011)	PMOs involved in and driver of innovation processes e.g. as coaches, facilitators, groups, boards, innovation strategy, innovation process, coordinators for strategy and process implementation, idea management software systems, idea campaigns, specialized task forces for supporting executives and the staff, and challenge-driven idea generation processes
	Cooke-Davies, T. J., Crawford, L. H., & Lechler, T. G. (2009)	PMOs can be of value for innovation and entrepreneurship
	Hobbs, B., & Aubry, M. (2008)	Existing typologies are not empirically validated; set of characteristics such as organizational context, mandate or authority should serve as the basis for types of PMOs
Organizational value	Hobbs, B., & Aubry, M. (2008)	Possible divergent interests of business units and PMOs on strategic, portfolio level but also on project level due to a lack of information and collaboration, different perceptions about project health or the wish for more flexibility instead of standards
	Aubry, M., Hobbs, B., & Thuillier, D. (2009)	Possible divergent interests of business units and PMOs on strategic, portfolio level but also on project level due to a lack of information and collaboration, different perceptions about project health or the wish for more flexibility instead of standards
	J. Thomas & Mullaly (2008)	Tangible and intangible value
	Hobbs & Aubry (2007)	Significance of PMOs in cultural sense; PMO giving guidance and orientation
	Lepak, Smith, & Taylor (2007)	Little consensus about how to create value for organizations; propose recognizable performance difference; alignment with social and cultural context
	Thomas & Mullaly (2007)	Little consensus about how to create value for organizations; propose recognizable performance difference; alignment with social and cultural context
	Aubry et al. (2009)	PMOs cannot be considered as isolated islands; coexisting values within the organization
	Aubry et al. (2011)	PMOs are subject to a pluralism of values on performance dependent on their context and roles
Maturity	Lloyd-Walker, B., & Walker, D. (2011)	Maturity of leadership: foundational, nascent, developing and mature leadership; notion of authentic leadership
Leadership style	Uhl-Bien, M., Marion, R., & McKelvey, B. (2007)	Propose a leadership style which copes with both the organization`s administrative structure as orientation and its adaptive capacity to enhance overall flexibility and effectiveness
	Müller, R., & Turner, J. R. (2010)	Literature concentrates on tools and techniques rather than leadership styles; differentiation between application area, project complexity, project importance, contract type or lifecycle stage
	Müller & Turner (2010)	Leadership competency profiles depend on project type; indicates that PMOs in charge of project management-related activities might have to adapt leadership style and leadership development according to the specific organizational and project context as contingency theory suggests

	Cluster 2 **2009-2012** **Context**	
Strategic fit	Cooke-Davies et al. (2009)	Different perspectives as key drivers; PM and strategic direction; strategic fit
	Mullaly & Thomas (2009)	Strategic "fit" based on contingency theory; positive "value" direction
	L. H. Crawford & Helm (2009)	Little consensus about how to create value for organizations; propose recognizable performance difference; alignment with social and cultural context
Coexisting values	Aubry et al. (2009)	Coexisting organizational values due to unstable nature of innovation and change
Success criteria	Ika (2009)	Differentiate between project success and project management success; short- and long-term criteria and perspectives needed
Dependencies	Li Zhai, Xin, & Cheng (2009)	Differention between value of projects and value of project management
	Singh, Keil, & Kasi (2009)	34 challenges: resources, stakeholder commitment, mandate, context, culture, project management issues, PMO value
	Hurt & Thomas (2009)	Suggest inflection point of value, U-shaped relationship of PMO value creation and time; develop new visions and goals needed
Organizational context	Aubry, M., Hobbs, B., & Müller, R. (2010)	Organizations of PMOs as mostly project-based or project oriented organizations
	Aubry, M. (2011)	Duality of organizing for innovation as well as projects; PMO as part of the power system and politics
	Petit, Y. (2012)	PMOs deals with variability of objectives, priorities and relationships between project parties; constant change which requires continuous oversight and alignment
	Turner, J. R., Müller, R., & Geraldi, J. G. (2012)	Different kinds of project complexity; Complexity of faith (dealing with high uncertainty within projects), complexity of fact (structural complexity in projects) and complexity of interaction (relationship and organizational change).
	Aubry, M., Hobbs, B., Müller, R., & Blomquist, T. (2011)	PMO transition are caused by internal and external issues and events moderated by organizational context and change of PMO roles leading to increased project management and business performance and maturity
	Müller & Jugdev (2012)	Differentiation between success factors and success criteria; corporate and governance shifts due to new market expectations; subjectivity
Causes for reconfiguration	Aubry, M., Hobbs, B., & Thuillier, D. (2009)	Organizational tensions primarily drive PMO reconfiguration; organizational politics and power are of predominant importance
	Aubry, M., Hobbs, B., Müller, R., & Blomquist, T. (2010)	PMOs are embedded in host organizations exposed to constant changes and transitions; tensions with the host organization and the roles the PMOs
	Crawford, L. (2010)	PMOs are embedded in host organizations exposed to constant changes and transitions; tensions with the host organization and the roles the PMOs
	Hobbs, B., & Aubry, M. (2010)	PMOs work autonomously; Lack of PMO autonomy and PMO mandate may result in serious tensions
	Pellegrinelli, S., & Garagna, L. (2009)	PMOs are embedded in host organizations exposed to constant changes and transitions; tensions with the host organization and the roles the PMOs
	Aubry, M., Hobbs, B., Müller, R., & Blomquist, T. (2011)	PMOs work autonomously; PMO autonomy and PMO mandate may result in serious tensions
	Aubry, M. (2011)	Organizational tensions primarily drive PMO reconfiguration; organizational politics and power are of predominant importance
	Aubry, M., Müller, R., Hobbs, B., & Blomquist, T. (2010)	PMOs and their structures alternate between phases of tensions and relative stability

	Cluster 3 **2016-now** **Org. design**	
Co-evolvement	Bredillet, C., Tywoniak, S. & Tootoonchy, M., (2018)	Co-evolvement of PMOs
Context of project-based organization	Miterev, M., Mancini, M., & Turner, R. (2016)	Organizations of PMOs as mostly project-based or project oriented organizations
	Müller, R., Zhai, L. & Wang, A., (2017)	Relationship between governance and success
	Gemünden, H.G., Lehner, P. & Kock, A. (2018)	Cconcept of the project-oriented organization consisting of the three segments values, structures, and people
	Clegg, S. et al. (2018)	Discusses new trends including various aspects of practice, including its discursivity, representation, dynamic capabilities, leadership and materiality.
	Bredillet, C., Tywoniak, S. & Tootoonchy, M. (2018)	Why and how do project management offices change - PMO and PfM co-evolve over time to adapt to organizational context influence
	Brunet, M., (2018)	Multilevel project governing
	Matinheikki, J. et al. (2016)	Iidentification of four activities and five network attributes that explain how inter-organizational network can be managed for value creation in the front-end of projects
Organizational design	Aubry, M. & Lavoie-Tremblay, M. (2017)	Organizational design as an ongoing process
	Simard, M., Aubry, M. & Laberge, D. (2018)	Conceptual framework that shows that governance, organizational design and governmentality are all essential to an understanding of projects
	Müller, R., Drouin, N. & Sankaran, S. (2018)	Model for Organizational Project Management
	Hepworth, A. et al. (2017)	Organisational structure that is more suitable to adopting ad- hoc approaches for project portfolio management

	Cluster 4 2010-now Service-orientation	
Measurable outcomes	Aubry, Müller, et al. (2010)	Benefit of PMOs results in measurable results .g. project success, customer benefit
	Biedenbach & Müller (2012)	Evaluating performance requires definition of performance and its context
	Müller, Glückler, & Aubry (2013)	Consider innovative performance aspects e.g. slack, innovativeness, and ambidexterity of PMOs
	Patanakul (2015)	Project portfolio management performance; results in enhanced project visibility, transparency in portfolio decision making and predictability of project delivery
	Aubry & Brunet (2016)	Enhanced project and project management performance through governance framework (with the dimensions of efficiency, legitimacy and accountability)
	Martinsuo, M., Klakegg, O.J. & van Marrewijk, A. (2019)	Project success, therefore, cannot be assessed merely in terms of goals reached at the time of project completion but also in terms of benefits compared to costs and value achieved over the project lifecycle compared to original value expectations of various stakeholders.
PMO impact	Kutsch et al. (2015)	PMOs might not have a direct impact on project success; depends on satisfaction of its service users
PMO structure	Tsaturyan, T., & Müller, R. (2015)	Multiple networking PMOs require both formal (regulative) and informal (relational) networks, they require additional characteristics. PMOs act as loosely coupled systems "consisting of structural, procedural, relational and regulative dimensions"
	Monteiro, A., Santos, V., & Varajão, J. (2016)	47 different PMO types discovered

	Cluster 4 2010-now Service-orientation	
	Jonas (2010)	Empowerment, role significance and role clarity as contributor to portfolio management success; encouragement and empowerment exert a positive influence on portfolio management roles whereas intervention is likely to provide a negative moderating impact between task execution and portfolio management success.
	Bakker et al. (2010)	Actively managing and preparing stakeholders for risky and uncertain situations
	Müller, R., Glückler, J., Aubry, M., & Shao, J. (2013)	Roles as a set of mutual expectations, serving, controlling, partnering or a blend of more than one role, difficult to typify PMOs under one single set of activities
	Albrecht, J. C., & Spang, K. (2014)	Interaction with project participants require a certain level of maturity
	PMI (2015)	PMOs can be successful advocates for knowledge transfer
	Aubry (2015)	PMOs supportive role are likely to serve as predictors for project and business performance; describe also situations when support exerts a negative impact or does not help
	Joslin, R., & Müller, R. (2016)	PMOs as steward or broker, both necessary to manage the internal and external project management-related activities. The role of a broker consists of liaising with the client and of investigating resources for the client whereas the steward`s interest is to deliver the project by assembling the needed resource.
	Paton, S. & Andrew, B. (2019)	PMO can provide continuity across phases by maintaining coherence of purpose, process, and method, and integrity of knowledge to enhance the performance of both the pre- and post-gap phases of the product lifecycle
	Riis, E., Hellström, M.M. & Wikström, K. (2019)	PMO's coordinator and trainer processes have a positive association with project performance
	J. Ward & Daniel (2013)	Involvement of PMOs along all phases of projects concentrating on the review of benefits and changes as well as on the monitoring process
	Spalek (2013)	PMOs exert risk management; question of maturity of PMOs exerting successful risk management since it requires a certain amount of knowledge, experience and thus maturity
	Pemsel, S., & Wiewiora, A. (2013)	PMOs should act as knowledge brokers providing standards, support, PM consulting, training, support of networks
	Dutton, C., Turner, N., & Lee-Kelley, L. (2014)	Capturing post-project lessons learned knowledge without context not sufficient; informal, intuitive and reflective learning approach more favourable to prevent projects from committing repeated mistake.
	Nadae, J., Carvalho, M. M. de, & Vieira, D. R. (2015)	PMOs should act as knowledge brokers providing standards, support, PM consulting, training, support of networks
	Carvalho, V.G. et al. (2018)	PMO functions related to cost performance
	Otra-Aho, V.J. et al. (2018)	PMO's coordinator and trainer processes have a positive association with project performance
	Wedekind, G.K., Llp, Y. & Philbin, S.P. (2018)	Shows how a university-based project management office can provide focused support across the entire grant project lifecycle within a European research context
	Gren, L., Torkar, R. & Feldt, R. (2017)	Investigate how building agile teams is connected to group development
	Aubry, M., & Brunet, M. (2016)	Propose categorization of PMOs based on project types e.g. in an engineering and construction project with strong project management practices in place might require less governance and controlling than PMOs dealing with new business processes and new product development where at first instance formal training and coaching in terms of monitoring and control mechanisms is needed
	Aubry & Hobbs (2010)	Develop and classify 79 unique indicators to assess the contribution of PMOs to organizational performance
	Kerzner (2011)	Creation of metrics (return on investment metrics) to quantify PMOs` contribution to organizational performance; Identifying information requirements followed by the creation of indicators and their measurement
	Hobbs & Aubry (2010)	Indicators to assess the contribution of PMOs to organizational performance
	Musawir, A. ul et al. (2017)	Effective project governance improves project success both directly and through an enhanced benefit management process.
	Derakhshan, R., Turner, R. & Mancini, M. (2019)	Project governance and stakeholders
	Pemsel, S., & Müller, R. (2012)	Contingency view of knowledge governance is required to understand and determine the knowledge governance strategy in structurally complex project-based organizations; success of e.g. knowledge brokering however is dependent on the recipients` requirements and expectations
	Müller, R., Glückler, J., & Aubry, M. (2013)	Success of e.g. knowledge brokering is dependent on the recipients` requirements and expectations; Controlling, partnering and serving roles of PMOs
	Sokhanvar, S., Matthews, J., & Yarlagadda, P. (2014)	KM part of PMO roles from the first setup onwards of a PMO; role of knowledge has not yet been addressed in PMO maturity models; emphasis on the improvement of knowledge capturing practices and processes
	Eriksson, P. E., & Leiringer, R. (2015)	Mutual knowledge sharing between PM and PMO as precursor for developing organizational knowledge governance structures
PMO services	Pemsel, S., Müller, R., & Söderlund, J. (2016)	Contingency view of knowledge governance is required to understand and determine the knowledge governance strategy in structurally complex project-based organizations; success of e.g. knowledge brokering however is dependent on the recipients` requirements and expectations
	Ekrot, B., Kock, A., & Gemünden, H. G. (2016)	Formal lessons learned systems to increase PM competence retention
	McClory, S., Read, M. & Labib, A. (2017)	Inclusion of knowledge management and organisational learning through projects as core aspects of the process, from both individual and organisational perspectives

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ADAPTION OF SELECTED PMBOK PROCESSES TO FIT SCRUM DEVELOPMENTS

Philipp Rosenberger, FH Campus Wien;
József Tick, Óbuda University

Abstract

Project managers managing agile developed IT projects often find themselves in difficult situations. Their frameworks, like PMBOK project management framework of PMI Organizations, demand a deep level of planning, control and active management. On the other side, agile development frameworks like SCRUM demand self-management, flexibility and appreciate change. This article proposes solutions for five PMBOK processes that have been identified as critical in SCRUM development environments in the previous publication Suitability of PMBOK 6th edition for agile-developed IT Projects, by Rosenberger and Tick. The process of "Manage project execution" is adapted by introducing Strike Events; "Work Breakdown Structure Plan creation" and "Scheduling" processes are changed by dividing large backlogs into phases and break down individual phases into Macro and Micro level planning; "Cost Estimation" processes uses velocity of development teams as planning reference; "Developing and Managing Teams" is adapted by introducing the project manager as SCRUM master and if needed apply again the Strike System in case of serious problems. These proposed solutions adapt the classical PMBOK project framework to cope with SCRUM developed project to an "Agile IT Project Management Framework". These process specific solution results are based on literature research. The actual applicability in agile developed projects and adaptations will researched and applied in a following step of this research topic towards the way of creating an optimized, tailored agile IT project management framework.

Key words: *SCRUM, IT-Project Management, Agile, PMBOK*
JEL code: M15 (IT-Management)

Introduction

Published in 2001 the agile manifesto (*Agile Manifesto*, 2001) provided the basis for SCUM framework of agile development in IT projects. The goal was to make development processes more flexible and to achieve early results for customer feedback. But the SCRUM framework as defined in the SCRUM Guide (*SCRUM Guide*, 2017, Schwaber K.& Sutherland) describes only an agile process of software development. It was not meant to be seen as a project management approach.

But in reality, SCRUM is often used as a "agile project management" framework. By adopting agile tools and methods, or sometimes even just terminologies used in SCRUM organizations pretend to use agile project management approaches, without even deeply understanding the real nature of agile project management. However, these organizations are not be blamed. There is no real finalised "agile IT project management" framework existing at the moment. There are classical project management frameworks like PRINCE2 (*Prince 2 Handbook*, 2017, Axelos Global Best Practice) or PMBOK (*PMBOK-Guide) – Sixth version*, 2017, Project

Management Institute, Pennsylvania, USA) of PMI organization. And then there are agile development models like SCRUM, which are used in classic project environments.

So when agile IT project management is defined as classical project management, including an agile development approach, problems can develop due to the fact that these two frameworks focus sometimes on completely different values. This cultural inaptitude, often results in decreased overall project success, problems in communication and understanding of project participants.

Basis and approach for this research

This article sets up the basis for an adapted PMBOK project framework specially focussed on agile, with SCRUM, developed IT projects. PMI organisation already took a first step in this direction by adding an "agile guideline" document to its newest sixth version of the PMBOK framework. But this guideline is only an introduction in agility and agile methods and tools. It does not change the processes defined in PMBOK as such.

To now to completely redefine the PMBOK processes and make them suitable for SCRUM developed IT projects two steps need to be taken:

1) Critical areas of the PMBOK processes have to be defined.
2) Solutions regarding these areas have to be investigated, analysed and evaluated

The first step of identifying critical processes has already happened. In the IEEE publication "Suitability of PMBOK 6th edition for agile-developed IT Projects" (Rosenberger P. & Tick J ,2018) five processes have been identified to cause problems:

- Manage project execution
- Develop project structure plan
- Develop project schedule
- Estimate and define costs based on requirements
- Develop and manage team

This article now uses these identified critical areas as starting point and proposes approaches to be integrated into the existing PMBOK framework. These proposed solutions are based on existing tools and methods identified by literature research and followed by an assessment of applicability using a KPI evaluation. Please note, that the last step of proofing the applicability of the proposed solutions via an large scale online survey is yet not finalised and therefore not part of this article.

Solution proposal for PMBOK process "Manage project execution"

In traditional project management according PMI, a project manager is responsible for managing the project team and its execution(*PMBOK-Guide) – Sixth version*, 2017, Project Management Institute, Pennsylvania, USA). SCRUM, as a contrast, demands strict self-management of the development team (*SCRUM Guide*, 2017, Schwaber K.& Sutherland). Only the team itself takes care about delivering quality results. Often these self-managing development teams are even protected from any disturbance or influence by a SCRUM Master. This difference shows the gap between the two frameworks. The agile project manager has to take overall responsibility of the project and the product, but is not allowed to actively manage the execution in regards of programming done by the agile development team.

Three different solution approaches have been investigated and will later be evaluated using suitable KPIs:

1) Strike System

Lewthwaite (Lewthwaite, J., 2006) defines a "Strike" as a proactive intervention of a project manager overruling the self-management of SCRUM development teams. This overruling once started lasts the rest of the ongoing sprint. Trigger for such shifts in responsibilities need to be substantial because strikes completely undermine agile culture of self-management and trust. Trigger of such strike events need to be defined in detail to create a common understanding and avoid negative personal feelings as much as possible. Strikes could for example be triggered by:

- SCRUM Master intervention
- Danger of non-deliverable increments at the end of a sprint
- Extreme delay visualized in burndown charts
- Extreme bottle necks visualized on KANBAN boards,
- Great changes in effort estimations of user stories during a sprint in comparison to estimations in sprint planning meetings.

The strike system is therefore a kind of "Management by Exception" methodology.

2) Indirect Management by Backlog

Lewthwaite (Lewthwaite, J., 2006) mentioned regarding large scale IT projects that roll like a product manager or project manager acting outside a SCRUM development team can manage project execution indirectly by influencing the product backlog. These roles can change the completeness of user stories and priorities of user stories. With these tools, they can indirectly decide what will be developed next.

3) Traditional project management of chosen SCRUM artefacts

Pichler (Pichler, R., 2007.) suggests allowing switching specific SCRUM artefacts or epics from an agile towards a traditional project approach like waterfall. By doing so, a project manager can actively and directly manage the execution of this artefact. It needs to be mentioned, that keeping a well-functioning agile culture alive could get much harder by such interferences. Additional agile tools and methods like daily stand-ups and retrospectives can and should be kept alive, even in these "traditional managed islands".

After presenting three possible solutions based on literature research a most suitable solution needs to be chosen by application of a pointing system measuring PMBOK in regards of several related success criteria. Points will be assigned based on the applicability of success criteria in regards to PMBOK integration of solution approaches in such way:

- Easy to be integrated into PMBOK processes: 2 points
- Possible but not easily to be integrated into PMBOK processes: 1 point
- Hardly to be integrated into PMBOK processes: 0 points

Note, that this approach of solution selection will be used on all 5 processes

Table1

Success Criteria	Strike System	Indirect Mgmt.	Traditional Artefacts
Direct PM influence of project execution enabled?	2	0	2
PM influence of project execution measurable?	2	0	2
Usable for all project scales?	2	1 (only large scale)	2
Extensive communication required?	2	1	1
SUM	**8**	**1**	**7**

Conclusion:

After comparison of three potential solutions enabling IT project managers in agile developed projects to manage project execution without disturbing SCRUM processes or culture, it shows that the Strike system is potentially the best candidate to be integrated in this particular PMBOK process. It acts without disturbing SCRUM development at all in most of the time. Only when high involvement of a project manager is needed in projects, it is used to solve issues that the self-managing development team was not able to solve on their own. This management by exception approach combines traditional project management methods and agile frameworks in the least conflicting way.

Solution proposal for PMBOK process "Develop Project Structure Plan" and "Project Scheduling"

Note: Due to the strong relation between PMBOK Processes Structure Plan Development and Project Scheduling", these two processes are analysed together

Traditional project management structures and schedules the whole project in the initial planning phase. This regards all work packages. Even work packages that are still far away in the future and very uncertain. There is no difference in the level of planning between certain and uncertain work packages accepting that uncertain packages may change in the future causing the project schedule to be adapted. SCRUM totally avoids this restructuring and re-planning by just focusing on the next sprint. This gap in the two approaches can result in major conflicts between agile developments and traditional project managers. Three different solution approaches are now proposed and will later be evaluated using suitable KPIs:

Hybrid Macro and Micro Planning of Project Schedule and Structure

A hybrid approach could differentiate between a macro and micro structuring level - also separating the two cultures. The project manager keeps the overall scope and focus by structuring the whole project like usually with a project structure plan, but only on a macro level. Accepting, not knowing definite responsibilities and durations. But for example only T-Shirt size estimations on an epic instead of a user story level.

But during actual development, in development sprints, micro planning in form of planning poker story point estimations can be used in sprint planning meetings to get into details.

After several sprints, a factor between actual effort and rough T-Shirt size can be postulated. So with experience in project delivery, a project manager could even get quite

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detailed effort and structural estimations enabling him to even develop an understanding about longer term planning (Wendt R.., 2016).

1) Project Phase Specific Backlogs

This approach does not change the structural planning in the initial project phases at all. A project manager, will create a work breakdown structure and will define project phases and major milestones based on a basic specification in a traditional way. All these major project phases are then seen as "mini-agile-projects" within a traditional project. Each phase has its own specific backlog, SCRUM team and goal. With such an approach, the two cultures can easily coexist. On a big level, managed by a project manager in a traditional way, on the small level in a purely agile SCRUM based approach with minimal project management interference. (The Project Group, *TPG Phase Method, 2019).*

2) Extrapolation and continuous adjustment

When an agile development framework like SCRUM should not be changed, adapted or disturbed at all, a project manager could accept not planning and structuring before the start at all. Just starting the development, when the first user stories are ready for development in the product backlog. Based on a comparison of story points associated before the sprints to user stories and the actual needed time and cost consumption extrapolation about the open efforts and timelines with the currently existing product backlog can be made, fulfilling the PMBOK need to plan, structure and schedule. These extrapolations will get more and more accurate and refined, when more and more sprints have been finalised and learnings from these sprints are available for adjustment of extrapolation. Due to a product backlog that is typically constantly changing in agile projects, the planning and work breakdown structures will also be affected by these changes and the project manager has to constantly keep them up to date. In such a role, the project manager is essentially just "documenting change" and not really managing change, to apply to PMBOK process requirements.

Table2

Success Criteria	Macro/ Micro	Phase specific backlogs	Extrapolation
Effort of planning and work breakdown structure creation and maintenance	2	2	0
Accuracy of planning	1	2	1
Agility and flexibility of planning and structure	2	1	2
SUM	**5**	**5**	**3**

Conclusion:

Planning project work structures and based on those, planning the timing of projects is challenging in agile developed projects, because planning is based on fixed assumptions and agility is based on flexibility. However, the analysis of potential solutions and their applicability shows, that two approaches are especially usable to close this gap between traditional project management and agile development. Phase specific backlogs divide large projects into phases enabling maximal flexibility within the phases themselves. In these phases accepting only macro level planning in the beginning and micro level planning only on sprint level can help traditional project managers to fulfil PMBOK requirements.

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Solution proposal for PMBOK process "Estimate and define costs based on requirements"

Cost estimation in traditional projects normally consists about manpower related costs and material related costs. IT projects, basically sharing these concepts with all other projects, often develop most of their costs manpower related. Often the actual time and effort invested by people is much more significant then investments in hardware or other material. Based on this understanding, the cost estimation can also be split in two parts:

- Material related costs:
This part of costs are untouched by agile development frameworks

- People related costs:
These costs are difficult to estimate and define, because complete and traditional requirements are missing in SCRUM developed IT projects, due to constant backlog changes.

So focussing on people related costs, the following two approaches could be used be integrated into PMBOK processes:

1) *Cost estimation based on Development Velocity*

Velocity is a key performance indicator of agile development teams, describing the amount of Story Points being developed in each sprint in average. It's the speed, the SCRUM teams are developing with. Often this measurement is also used in portfolio management of agile developed project portfolios (Rouse, M., 2013). Knowing and tracking the velocity of development teams can enable an agile project manager to estimate project costs. Knowing the developers involved and their internal and external hourly rates, the project manager can summarize the cost of one story point, or one average user story based on the amount of user stories developed by the team in one sprint. So relying on the planning of work breakdown structure and project scheduling and knowing the development teams and their costs and velocity the project manager can simply multiply planned development effort with velocity related cost factors and therefor develop a cost planning in the same way as a scheduling. It is important to mention, that the velocity can change and therefor the basis of the cost factor can change. The project manager needs to keep constant track of this factor.

2) *Fixed Minimal Viable Product and unplanned ongoing feature development costs*

A minimal viable product (MVP) is often used as basic concept of so called "hybrid" IT projects. This MVP is the smallest, fastest and most simple set of features providing desired functionality, without taking care of usability, design, safety, reliability and all other necessary factors of a quality system. In hybrid IT projects the development of such MVPs is planned and executed in a classical waterfall approach, which is easily manageable with PMBOK processes due to the high level of planning activities and rigid structure. After finalization of the MVP increment, features and "quality" is added to the system in a strictly agile way. This hybrid approach of splitting MVPs and agile feature integration can also be used to solve cost estimation gaps in agile projects. Classical cost estimations are used to define MVP costs, and no cost estimation is used at all for agile feature integration later on. This allows strict separation of agile and classical frameworks, avoiding problems (Sharma, S, 2017).

Success Criteria	Velocity based	MVP based
Applicability for different project	2	1

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categories and sizes		
Accuracy of cost estimation	1	2
Effort of cost estimation	2	1
SUM	**5**	**4**

Conclusion:

Velocity based cost estimation present itself as a usable solution for agile developed projects by building up on planning regarding schedule and project structure and just applying people-related costs. In addition to this solution classical cost estimation methods can be used, when the definition of a Minimal Viable Product makes sense or is defined in a hybrid project management environment. In this case, only the agile part of the hybrid project should use velocity based cost estimations. It is important to mention, that MVPs minimize the agile culture and advantages to a great extent, and the decision to use them should be taken carefully and with intensive communication effort to all project stakeholders.

Solution proposal for PMBOK process "Develop and Manage Team"

According PMBOK(*PMBOK-Guide) – Sixth version*, 2017, Project Management Institute, Pennsylvania, USA), the project manager is responsible for organizing and managing resources, including human resources, for the project. The organizational part is not as critical. A project manager can and will set up a project team and including development teams in the initial project phase. As soon as the development team is set up, it demands self-management. Meaning, that there should not be active management and controlling from outside. This characteristic is a very strong one in SCRUM. The teams share work and task internally and are even "protected by a SCRUM master from outside disturbances. So as soon as a development team is set-up by a project manager the management tasks are taken away from the project manager and are transferred to the team itself. This shift in responsibility can cause trouble in a project and challenge a traditional PMI project manager who needs to take all-over project responsibility.

Two solutions approaches have been identified to close this gap:

1) *Adaptation of Strike System for team management*

As described in the first process, Lewthwaite (Lewthwaite, J., 2006) mentions a strike system as a potential compromise to share responsibility between self-managing SCRUM teams and outside project managers. This approach can not only be used in project execution, but also in processes of team-management. Potential trigger of Strike-Situations, in which the project manager will pause self-management of the team and take over, could be retrospective meetings, in which problems within the development team are discussed. It is important to define clear situations within that retrospective to start a strike-action. Otherwise, development teams will always hesitate to solve problems within the retrospective meeting in fear of a potential loss of self-management.

2) *Project Manager takes role as SCRUM Master*

If a project manager is comfortable in only being "inside" of a self-managing development team but accepting their demands of self-organization, he or she could take the roll as SCRUM master. Within this role the project manager can actively trigger team-problem-solving in retrospective events or even on a daily-stand-up basis. This realization of critical situation and the start of a problem solving process is often more than enough to keep projects

and team structures productive, even without acting as authority and directly manage and decide changes.

Success Criteria	Strike System	PM as SCRUM Master
Applicability for different project categories and sizes	2	2
Interference with agile culture and methods	1	2
Amount of influence by PM if necessary	2	1
SUM	**5**	**5**

Conclusion:

Comparing both solution proposes with each other and assessing their applicability with SCRUM methods as well as their ability to be integrated into PMBPOK processes, the KPIs show no favourite solution. So a potential approach combines both solutions. A project manager acting as SCRUM Master in non-critical project phases, triggering team communication and problem solving when necessary, but at the same time, being able to take corrective measures, using authority by applying the strike system.

PMBOK Integration of Proposed Solutions

This article searches for solutions regarding PMBOK processes not suitable for SCRUM developed IT projects. In the article "Suitability of PMBOK 6th edition for agile-developed IT Projects" (Rosenberger P. & Tick J ,2018) critical PMBOK processes have been identified. Based on literature research and a KPI based evaluation of possible solutions, the following methods can be used for PMBOK integration:

- Manage project execution
  Strike Systematic enables the project manager to take full responsibility, via management by exception only when necessary, so the agile culture of self-management and personal responsibility is not disturbed at all as long as not necessary.
- Develop project structure plan and Develop project schedule
  Phase specific backlogs divide large projects into phases which can be easily planned by an experienced project manager. Within these phases, only macro level planning at the phase beginning and micro level planning and structuring on a sprint level is necessary.
- Estimate and define costs based on requirements
  Cost estimation based on agile structure planning and scheduling using velocity estimations of development teams and their manpower related costs can be used by project managers to handle work-related costs. No changes are necessary in estimating and defining material related costs.
- Develop and manage team
  Project Manager acts as SCRUM Master passively influencing team related problem solving and using temporary Strike System to stop classical SCRUM rolls and approaches and using management authority to manage projects as long as necessary.

Please note that these results are only based on detailed literature research and KPI assessments, but not proven to be effective in agile environment. In a next step of research, the effectiveness

of these solutions will be measured by optimizing the PMBOK processes including the new solutions.

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PROJECT SUCCESS IN IT: AN ATTEMPT TO DEFINE AN AMBIGUOUS CONCEPT IN AN INCREASINGLY AGILE, CUSTOMER-CENTERED WORLD

Gründler Rebecca
Butterfield Reginald A.
University of Applied Sciences Burgenland, Eisenstadt, Austria

Abstract

As projects have advanced to value drivers in the IT Services industry, their success is increasingly crucial to organisations. Success is a complex concept. This paper draws on new empirical evidence as to what constitutes success in IT-services projects. Traditional project management frameworks define project success using easily measurable indicators such as budgetary control. This approach neglects the complexity of the subject matter. Newer approaches in the IT industry projects now emphasize qualitative success indicators such as customer satisfaction. An on-line questionnaire was used to examine the extent to which the success factors defined and used by current project management frameworks have kept up with the industry changes. The study identified that it is necessary to have an appropriate mix of both qualitative and quantitative measures in order to check the degree of success of such projects. This indicates that project success in IT is a multidimensional concept. It also shows that the more quantitative approach established within project management frameworks promulgated throughout the industry is insufficient for the holistic nature of what success means to the different actors. This study is important as it can serve as a catalyst for the development of an improved framework for practitioners to use to measure success in a way that meets the changing landscape of actors' expectations towards what success means and lead to more informed decision-making.

Keywords: project success, agile, project management, performance measurement, KPIs
JEL Code: M15

Introduction

It is the long-established consensus that in order to assess success, it must be clearly defined and measured in meaningful ways that fit the definition of success in the field in which it is applied. There is extensive research on success and performance especially in the areas of organisational and occupational psychology (Gleich, 2001, p. 34; Thorpe, 2008, p. 58), but a unified approach towards the topic on an operational and project level has yet to be defined. Standardising performance measurement has proven fruitful in industries such as financial services, production and construction (Atkinson, 1999, p. 338) as these industries share a characteristic: their organisational success historically depends on easily quantifiable performance measures of resource efficiency and productivity (Mamaghani, et al., 2011, p. 12). Measuring these success indicators is rather straight forward as the data are easily quantifiable, but the approach is piecemeal (Sureshchandar & Leisten, 2005, p. 12). These early systems reflected an organization's output criteria and neglected the effort needed to achieve them (Barrett, 2004, p. 12). As subjective judgment lies at the heart of business management (Hoffmann, 1999, p. 25), it almost seems like a natural development that – in order to avoid this

bias – systems to achieve quantifiable evaluation of performance were put in place. While established traditional and integrated concepts such as the Balanced Score Card (Sureshchandar & Leisten, 2005, p. 12) have been adapted for the IT Services industry (Van Grembergen, et al., 2004, p. 131), these efforts only address the issue on a governance level (Van Grembergen, et al., 2004, p. n.a.), not on an operational level and again set a focus on quantitative measures such as financial efficiency. While quantitative performance indicators are highly relevant from an overall organizational viewpoint, this paper hypothesises that this approach does not sufficiently address all aspects of performance and success relevant to value drivers such as projects. Given the changing focus and importance of IT-related projects, to what extent are traditional performance related measures an effective measure of success? How do organisations define project success today? This paper sets out a case for change.

The IT Services industry and project success

The IT Services industry is diverse and complex. IT projects have evolved to become the industry's core value driver and a strategic asset (Judgev & Müller, 2005, p. 20). Projects are now the main unit of operation (Xia & Lee, 2004, p. 10) and key to organisational advancement (Shenhar, et al., 2001, p. 701). As value drivers directly contribute to organisational success, delivering successful projects is key. Project management frameworks such as the Project Management Body of Knowledge or the Agile Manifesto have attempted to create a definition and measurement approach for success on the project level and broaden the definition of success by also considering qualitative factors. This is in line with the research community's view that success is, in fact, multidimensional (Aguinis, 2009, p. 78) even though historically the focus was on easily quantifiable indicators.

Defining "Project Success"

In order to *assess* success, organisations must determine what *constitutes* success, so they can employ suitable measures. In other words: success is assessed by measures of both quantitative and qualitative nature, depending on its definition (Tadeu de Oliveira Lacerda, et al., 2009, pp. 133-135).

These two aspects of performance and success are also reflected in the delivery models established for projects in the IT Services industry, which approach the concept of "success" from opposing directions. The Guide to Project Management Body of Knowledge (2013) represents a general and classic view on the subject that neglects qualitative aspects of project management itself and how they may relate to project success (Tadeu de Oliveira Lacerda, et al., 2011, p. 133). Agile delivery models address this shortcoming by placing high value on qualitative indicators and yet place lower value on budgetary and time-related concerns.

As success depends on its context, any attempt of gaining an understanding of what constitutes "project success" will be fruitless if it is unclear what success indicators are important to organisations. This paper provides an understanding of what constitutes success in IT Services today and to what extent the traditional view on success and its measurement prevails.

This was achieved by addressing the following assumptions:

1.   Performance is multidimensional. Quantitative and qualitative aspects of performance are considered important and contribute to an organisation's understanding of project success.

2.   While the research community has become more aware of qualitative success indicators, it is still a fact that quantitative performance measures are more easily assessed than qualitative ones; measurement strategies reflect this.

3.   Attempts to standardise performance and success assessment in a universally applicable framework for projects in the IT industry have not yet been of any avail. The available delivery frameworks emphasise opposing aspects of performance and success and provide guidance for their assessment. These frameworks, however, are one-sided, and their values oppose each other.

4.   Projects are the value drivers of the IT Services industry. Project success determines organisational success. Meaningful assessment of the same is key, but complex.

Research approach and methodology

This study was based on identifying the current methods used by IT professionals to measure success in IT-service projects and comparing these with existing study results identified in the literature review and the methods promulgated through industry-wide frameworks. A set of hypotheses were formulated to establish a view on the definition of project success in IT services industry and on how this definition shapes the current approach towards measurement. These tests were steered towards exploring to what extent traditional, quantifiable project assessment frameworks still carry weight in the industry, since newer delivery frameworks such as SCRUM also direct their focus towards customer satisfaction and work quality, thus substantiating the consensus in research that performance is in fact multidimensional, no matter what its area of application is. The definition and measurement of project success should reflect varied organizational settings to be effective and provide strategic benefit.
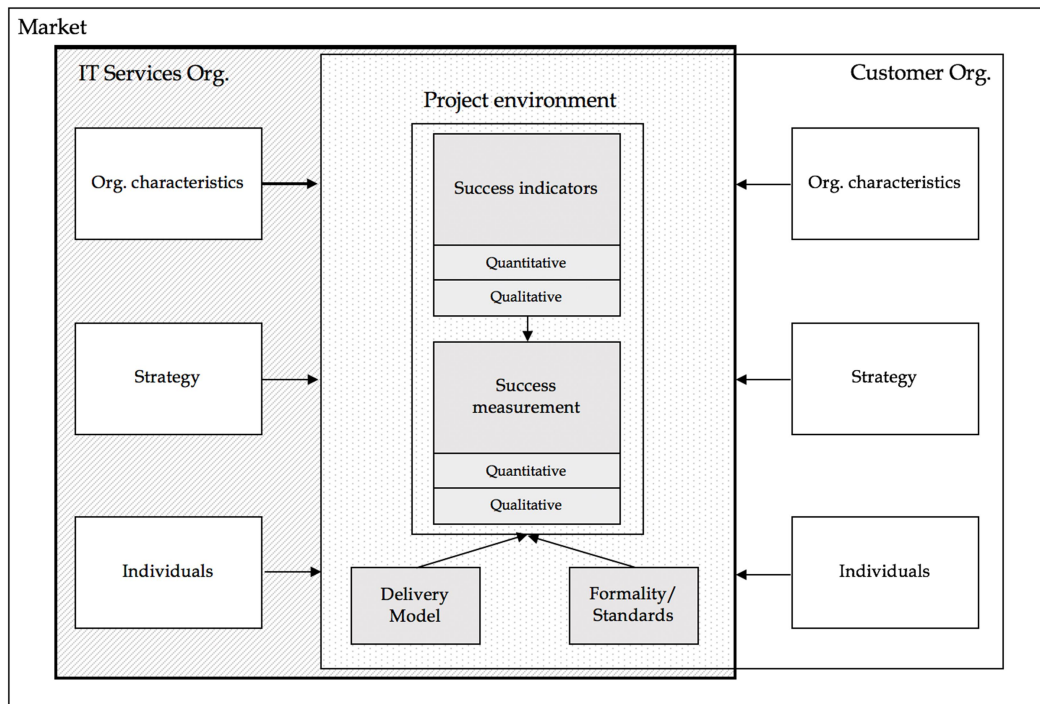
Fig. 4 **Theoretical Model. Aspects relevant to thesis shown by grey highlights.**
Figure designed by authors.

Figure 1 shows the complexity of the subject matter and how they relate to the components addressed in this paper (highlighted in grey). This paper describes the components that lie at the heart of this model, the project environment. The learnings from this study serve as basis in understanding the added complexity and possible variability of the subject matter when considering the involved organizations and cultures in further research

Data collection

The research aimed at accomplishing two goals: 1) identifying the dominant project success indicators in the industry and 2) looking into possible correlation between success assessment practices and the importance of project success indicators. The data was collected by means of an online questionnaire. A representative sample of the population of professionals working on projects in the IT-Services industry was obtained through non-probability, purposive, and expert sampling. The sample frame was set by explicitly reaching out to communities of professionals working in IT Services organisations via professional network sites online. As the representative sample of individuals is otherwise hard to address, randomization was not possible; snowball sampling was also employed to obtain a representative sample; the risk of sampling error was mitigated by clearly stating the target group and by approving suggestions made before the survey was forwarded to other individuals by a participant. 55 completed surveys were submitted by professionals working for organisations located in Central Europe and one in South Africa; ranging in size from <100 to

>10.000 employees. All participants were working as a project manager or in a similar role at the time at which this survey was conducted. The data were prepared following the CRIPS-DM standards and checked to match standards of completeness, accuracy and validity.

Measures

To accomplish the goals described above, the questionnaire addressed these topics from the perspective of the participant, from the view point of her respective organisation and was designed to investigate possible correlations between variables. The variables were organised along three dimensions: success indicators, assessment and organisational factors. While only some variables were used to perform the statistical tests necessary to test the hypotheses, several supporting variables were addressed in the questionnaire. These were applied to analyse differences and trends in support of the general research topic and serve as input for further research. The statistical analysis, however, was conducted irrespective of these additional variables and focused on those pertaining to the three dimensions described above.

Project success

As this paper builds on the theories stating that there are two sides to project success – indicated by quantitative indicators on the one side and qualitative indicators on the other – these were applied to cluster the individual success indicators into two classes:

Quantitative Success indicators	*Qualitative Success indicators*
Budgetary control	Customer satisfaction
Adherence to timeframe	User satisfaction
Delivering the defined scope	Building intellectual capital through learning and teamwork
Quality of end product	Uncovering potential for innovation

Fig 5 *Table representing the two categories of success indicators applied in this research.*

Table by author. Success indicators based on indicators from the PMBOK (2013) and agile methodologies (Scrum Alliance, 2014).

These variables were partly derived from theory and partly based on the research of Shenhar et al. (2001, pp. 707-709), who suggested to clustering project performance and success indicators in this manner. This list, however, is by no means exhaustive but merely representative. The questionnaire employed these variables in the context of actual and perceived importance, as well as in relation to completeness of success measurement. Perceived importance of success indicators was measured along a scale of 1-6 (where 1 is "not important" and 6 is "very important").

Assessment

As discussed in the introduction of this paper, qualitative success indicators are likely to be difficult to measure. Therefore, *completeness* and *type of assessment* were addressed in the questionnaire by employing the success indicators or classes stated above. *Formality of*

assessment was also assessed along an ordinal scale from 1-6, where 1 is "not formal" and 6 is "very formal".

Organisational indicators

This class included two variables: the applied delivery model (waterfall or agile) and the delivery phases during which assessment is conducted. The latter was assigned to this class as the lifecycle phases correspond to the chosen delivery model.

Analysis

Three statistical methods were applied to analyse the data to gain an understanding of project success in the IT industry today: t-tests to identify the dominant success indicator class, single and multiple linear regression to identify a correlation between assessment variables and the success indicators, and moderation analysis to investigate any influence of organizational variables on assessment practices.

While sample size (N=55) is sufficient to apply these statistical tests, p-values for statistical significance must meet the $p \leq 0.05$ decision rule (Uriel, 2013) for all performed tests. The only exception being the multiple linear regression model, which was accepted even when one predictor variable does not meet $p \leq 0.05$, but $p \leq 0.06$ (as suggested by Boston University (2013)), and all other predictor variables meet the required significance level of $p \leq 0.05$.

Results and discussion

Defining Project Success

The results of the data analysis show that quantitative performance and success indicators are still considered more important than their qualitative counterparts. This assessment consequently shapes the definition of project success. However, when asked to rank the importance of quantitative and qualitative success indicators on a scale from 1 through 6, the mean result differs only by 0.37 units, as shown in the graphs below.
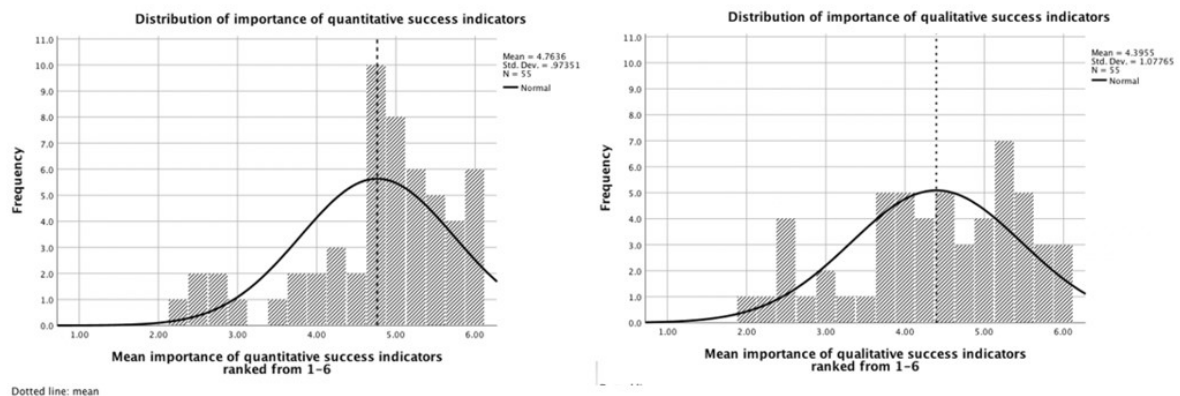
Figure 6 Distribution of mean rating of quantitative and qualitative success indicators. Representation of skewness. Figure by author.

This indicates that – while quantitative performance indicators are still dominant in their perceived importance – the importance of qualitative indicators has gained awareness and is now a defining aspect of project success. This result is also in accordance with the assumption

that – even though there may be a dominant indicator – the concept of performance and success is in fact multidimensional, also in the IT Services industry.

While neither the results of the hypothesis tests nor the available data indicate as to why quantitative indicators are still prevalent in today's definition of project success this may add to the issue discussed at the beginning of this paper: quantitative factors are easy to measure. In addition, the industry environment requires tight control over resources and profit margins, thus making quantitative indicators highly relevant to project success.

Another cornerstone in exploring the definition of project success in the IT Services industry is the possible difference in perceived importance of qualitative indicators depending on which delivery model is applied. Now, as qualitative success indicators seem to have gained an importance overall, it might be suggested that they are also rather significant in the IT Services industry when waterfall models are applied: the research has shown that agile delivery models place significantly higher importance on qualitative indicators, but the rated level of importance still positively deviates from the mean when the waterfall model is applied. Overall, qualitative success indicators also seem to carry weight in organisations in which delivery models with traditionally quantitative focus are applied, and vice versa: Qualitative indicators play a role in organisations that apply a model traditionally focusing on quantitative indicators. While the gap between the mean rating of quantitative vs. qualitative indicators is larger for waterfall than it is for agile, the mean importance is still above average when rated on a scale from 1-6.

The importance of qualitative success indicators is ranked only marginally lower than their quantitative counterparts. This suggests that there is an ongoing shift in awareness, placing higher emphasis on quality and customer involvement. It is interesting to note that, even though the two frameworks that are the subject of this paper have a clear emphasis on their success indicators, the opposing criteria were ranked almost equally regarding their importance. The theory alone would suggest that, for example, in the case of waterfall projects, customer involvement should be ranked extremely low, as the clear emphasis of both the definition of project success and also its measurement lies on budgetary concerns, timeframe and scope (Atkinson, 1999, p. 338), all of which are quantitative indicators. However, all participants ranked both dimensions almost equally.

While organisations may not place exact equal weight on all the measures (Sureshchandar & Leisten, 2005, p. 24), the results show that the concept of multidimensionality of success has reached the industry, regardless of which of the opposing frameworks or respective "ruleset" is applied. Based on these results, the first part of the research question can be answered: Quantitative success indicators still play a large role in IT Services organisations. They seem to carry significant weight in the definition of project success, regardless of whether a traditional delivery model, i.e., waterfall, is applied or not. Therefore, it can be concluded that what is referred to as "traditional definition" of project success is still valid, although challenged by the increasing importance of qualitative success indicators.

Measuring project success

The two opposing delivery models both follow a standardised framework, have a set of values and certain success criteria, and therefore imply specific measurement approaches. This means that some degree of standardisation of success assessment is an inherent part of these models. Waterfall models traditionally emphasise the quantitative definition of success, which influences the assessment approach, since the data are easily obtainable, measures applied are

rather straight forward, and thus also easily standardised (Judgev & Müller, 2005, pp. 19-20). Agile methods on the other hand value quality, which is influenced by many factors (e.g., the project goal and the customer) and are thus much more complex to define and measure.

Research suggests that traditional assessment approaches of project success are very formal: The Project Management Body of Knowledge, codifying the waterfall approach, focuses on Phase Gate Reviews and other formal aspects of review (Project Management Institute, 2013); agile delivery methods assess project success almost constantly by promoting rigid success assessments during every cycle (Abrahamsson, et al., 2002, p. 30). Therefore, the underlying assumption is that when following traditional approaches such as waterfall – since they also focus on easily measurable aspects of success – the assessment process must be formal. However, the results show that this is not the case: The degree of formality of the assessment and review processes is not directly related to the delivery model applied. A reason for this may be that formality suggests that "all bases have been covered", that formality goes hand in hand with the frequency and completeness of measurement.

The analysis showed that the more formal the review process is, the more likely it is that many aspects of performance are measured: This includes quantitative and qualitative aspects, as the participants were asked to select them from a list including both types of indicators. This relationship is even stronger when success is assessed throughout the project lifecycle. This is in line with the consensus discussed in research on organizational performance: Holistic measurement models increase the complexity of assessment (Frigo, 1999, as cited in Currle, 2002, pp. 15-16).

So, does this relationship prove that both quantitative and qualitative performance indicators are being measured, and a shift towards a holistic performance measurement approach has occurred? Unfortunately, this is not the case. The relationship explored above merely indicates a trend, which states that when more data is assessed, assessment processes tend to increase in formality. When the mean completeness of measurement across both indicator types is analysed in relation to formality, the data show that the more that is measured, the more formal the assessment process is. The authors can merely hypothesise that this is caused by organisation's need to understand, learn and adjust to sustain competitive advantage for which proper documentation is a must. When it comes to the question of what is *actually* measured, the data show that more often than not, qualitative indicators – while they are considered important – are *not* measured!

Success indicator: Budgetary Control

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	measured	39	70.9	95.1	95.1
	not measured	2	3.6	*4.9*	100.0
	Total	41	74.5	100.0	
Missing	System	14	25.5		
Total		55	100.0		

Success indicator: Customer satisfaction

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	measured	16	29.1	39.0	39.0
	not measured	25	45.5	*61.0*	100.0
	Total	41	74.5	100.0	
Missing	System	14	25.5		
Total		55	100.0		

Fig. 7 **Degree to which quantitative/qualitative success indicators are assessed, expressed in % of participants who indicated that their organizations' assessment is incomplete.**

Figure by authors.

The graph above shows that 41 out of 55 participants indicated that not all success parameters were measured, and 61% responded that their organisations do not assess customer satisfaction, as opposed to budgetary control, which is not measured by only 4.9% of respondents. Given these results, it becomes apparent that the shift towards a multidimensional definition of project success is still more conceptual than actual.

Conclusion

Neither the definition of success nor its measurement is dogmatically defined by a framework, be it waterfall or agile. Even though these and other traditional frameworks have a strong foothold in the industry and seem to influence the definition of success as well as the assessment process, other contributing factors are likely to be shaping these concepts as well. The shift towards including qualitative success indicators in the definition and measurement of project success is noticeable and is applied irrespective of the boundaries set by project management frameworks. Traditional concepts are still valid today but share an almost level playing field with their counterparts emphasising quality. Data regarding measurement reinforce

the prevalent opinion that quantitative success indicators are likely easier to measure. Still, organisations seem to be striving to find ways to include qualitative success indicators in their assessment process

Given the complexity of the industry and the broader project environment, aspects such as size of the organisation, the customer environment, as well as the individual people involved shape the assessment process. It seems to be a question of organisational culture. However, this is merely one conclusion drawn based on the literature review and the results at hand.

Limitations and further research

This study explored the definition of project success and revealed the relevance of traditional measurement approaches by assuming a closed system, where only the view of professionals regarding their respective organisations was considered. However, project environments are more complex. The impact that customer organisations have on the definition of project success as well as the assumption that "success" is a context-specific concept can only be tested by broadening the scope of research. This research does also not consider the causality of the established relationships i.e. *why* a change in the predictor variable *causes* a change in the dependent variable. This, too, may be subject to further research.

This paper is merely the first stepping stone towards a much broader area of research, with aspects ranging from organizational psychology to business administration. To take this research one step further, the authors suggest an exploratory case study involving customer organisations as well as delivery organisations with project setups of varying complexity and homogeneity. Such an approach could be useful in discovering not only how flexible the definition of project success really is, but how the concept morphs, for example, when opposing or two similar cultures come up against each other. Since the data has shown a shift towards multidimensionality in assessing project success, developing a standardized, modular scorecard that can be shaped to the individual differences of project environments and considers varying organizational needs poses an interesting challenge for the future.

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PROJECT MANAGERS OF DIFFERENT GENERATIONS: HOW TO DEAL WITH EMOTIONAL INTELLIGENCE ISSUES

Rūta Čiutienė, Evelina Meiliene, Asta Daunoriene, Indre Surgelyte
Kaunas University of Technology, School of Economics and Business

Abstract

The importance of projects is extremely increasing. There is number of literature addressing the relationship between project manager's competence and project success. Leadership is a crucial part of managing complex projects, affecting directly on successful project outcomes. Social competences become more and more crucial for project managers. Caruso and Salovey (2004) discussed that there is a potential relationship between emotional intelligence (EI) and the performance of organisation members (Caruso and Salovey, 2004). Zhang et all (2013) pointed out that the emotional competences influence the PMs' level of effectiveness. Research shows that leadership success can be predicted based on emotional intelligence (EI) competences, as well as the proven influence of EI on leadership. EI competence enhances the relationship between leader and followers, leading to higher organizational performance (Ramanauskas, 2014). Thus we can say that project managers' emotional intelligence and the role of emotional intelligence in project management over the past decade have become a very relevant and widely discussed topic.

Emotional intelligence consists of different persons' abilities and qualities, so the generation to which the project manager belongs influences the expression of his emotional intelligence. It is important to understand this expression both for the project managers themselves and for the organizations they work for, as it reveals the project manager's strengths and areas for improvement. Currently we can meet employees representing four or five different generations in the workplace. Organizations that implement projects deal with different generations projects managers having different emotional intelligence.

The paper aims to analyse the expression of emotional intelligence by the project managers of different generations and to find emotional intelligence development strategies.

Based on the theoretical analysis of different generations and the concept of emotional intelligence, the model of emotional intelligence of project managers of different generations and its development strategies was developed.

Methods. Quantitative and qualitative research methods were employed. Research population was covered by project managers and project management experts of Lithuanian companies and organizations.

Keywords: *project manager, competence, emotional intelligence*
JEL code M10. M5, M540.

Introduction

Today, many organizations facing with practices where the organization's employees represent very different generations (Moss, 2017). Project management is no exception. Organizations' implementing more than one project faces a situation where the implementation of the projects is led by representatives of different generations. The representatives of each generation have a unique set of personal qualities, determined by their birth time, social environment and significant life events.

It is widely acknowledged, that emotional intelligence is a key that can help to collaborate different generations under one project. Researchers explore and confirm the importance of emotional intelligence for the project team collaboration, trust and satisfaction, conflicts management, project manager leadership style, as well as project results and success. Different

researchers' emotional intelligence present as a key and even mandatory competence for the project managers (Tran, 2015).

According to the scientists, emotional intelligence consists of different person's abilities and qualities, so the generation which project manager belongs to influences the expression of his emotional intelligence. It is important to understand emotional intelligence expression for the project managers and for the organizations where they work. The scientific literature is full of information about different generations and emotional intelligence, but the research that focuses on the expression of project leaders from different generations emotional intelligence is missed. To highlight this gap, the article aims to answer the question: how does emotional intelligence of different generation's project managers occurs and what are the strategies for its improvement?

Literature review
The importance of project managers'emotional intelligence

Increasingly both practitioners and the research community address the issue of importance of emotional intelligence for project managers. Goleman (2018) states that project managers spend a large part of their working time communicating with people, as that often occupies 60-80 per cent of their working time. Jakupov et all (2013) states that professional success of the person is related to knowledge, skills, erudition and thinking ability in general. Emotional intelligence (EI) broadly understood as person abilities to communicate effectively due to the ability to understand people emotions and ability to react to their emotional condition (Derevyanko, 2007). The high level of of emotional intelligence development allows to achieve professional and vital success as a whole (Meshcheryak, 2010). An attitude which is a part of emotional intelligence is extremely important for project management as well.

The importance of the emotional intelligence is directly related to the success of the project (Rezvani et al., 2016). Hobbs and Smyth (2012) highlighted that the empathy, transparent behaviour, self-confidence, leadership and ability to act significantly contribute to the project success. Lindebaum and Jordan (2012) discovered that emotional intelligence positively affects the ability of the project manager to organise and coordinate project activities, motivate the team and manage conflicts. Obradovič et all (2013) confirmed that project managers with the higher education diploma are emotionally more intelligent. Mazur et all (2013) identified a direct link between the emotional intelligence of project managers and a successful management of different stakeholders. Vierimaa (2013) research findings showed that project manager emotional intelligence is one of the most important skill for team management and collaboration.

Obradovic et all (2013) states, that project manager ability to control emotions show their maturity. Therefore, for the project manager is extremely important to understand themselves, i.e. it's strengths and weaknesses; to be able to recognise the emotions of other people, understand their needs and manage interpersonal relations. Those skills enable project managers to inspire the team and lead it towards a common goal.

Research authors have been discussing whether emotional intelligence directly depends upon age, i.e. depends to different generations. Fariselli et all (2008), Mayer et all (2004), Bar-On (2006), Sengupta and Jha (2014) have agreed that the manifestation of emotional intelligence of representatives of different generations is different. However, there is a lack of scientific discussions how emotional intelligence of project managers of different generation occurs.

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Emotional intelligence models

A number of different models can be found in research articles that also presents different components of emotional intellect. Some models are based on abilities, and some other models are more based on abilities and personal qualities. The models proposed by Mayer et all (2004) is based on abilities, and otherwise referred to as a four-branch model. The model offered by Mayer et all (2004) analyses four dimensions of emotional intelligence:

- Emotional perception and expression are related to non-verbal language and describes a person's ability to assess the facial expressions of other persons, also the voice, posture by recognising certain emotions.
- Emotions are used when a person creates a base of experiences and their relations to emotions, which allows determining how a person should behave in specific situations.
- Understanding of emotions and application of knowledge show an ability to analyse emotions, predict their development trends and potential consequences.
- Management of emotions is understood as an ability to regulate emotions for the purpose of pursuing personal objectives, social awareness and knowledge (Mayer et al., 2004). Positive emotions support creativity a negative emotions lead to appearance of mistakes (Lindebaum & Jordan, 2012).

The Goleman model presents the following dimensions of abilities and personal qualities:

- Self-perception is assigned to personal competences and includes recognition of own emotions and their impact, clear assessment of personal strengths and weaknesses, self-confidence.
- Self-governance is another personal competence that includes emotional self-control, an integrity of values, emotions and actions, an ability to react and behave flexibly in an ever changing environment, efforts to further improve and seek objectives, as well as initiative.
- The motivation dimension includes enthusiasm, inspiration and emotions encouraging seeking higher targets. In this respect an important role is played by values.
- Social perception is understood as a social competence including abilities to understand the emotional condition of other persons, understand, recognise and realise the needs of customers.
- Relationship management is another social competence including an ability to inspire and manage people, and persuade them, promote and support, and develop abilities of other people, initiate changes and manage them, resolve conflicts, promote cooperation in pursuit of a common goal, promote cooperation and work in teams.

Bar-On (2006) model reflects holistic approach. The model distinguishes five components of emotional intelligence:

- Personal abilities are considered to include five factors: self-regard, emotional self-awareness, assertiveness, independence and self-actualisation. According to the author emotional self-awareness is an ability to look into oneself, accurately understand, and accept oneself. Assertiveness, sometimes also referred to as polite perseverance is an ability to express one's feelings efficiently and constructively.

Bar-On referred to independence as people's ability to be independent emotionally from other people, and self-actualisation means an ability to define personal goals and seek to attain such goals by disclosing one's potential.

- Interpersonal communication includes empathy – a person's ability to understand and realise how others feel, and social responsibility as our ability to adapt to different social groups and the community by cooperating and contributing to common goals. Interpersonal relationship is establishing and maintaining mutually pleasant relationships.
- The adaptability component includes reality testing, i.e. our ability to objectively assess one's feelings and think realistically, flexibility is an ability to regulate one's feelings, thinking and behaviour and adapt to new situations and conditions; problem solving as our ability to resolve personal problems and those related to interpersonal relations.
- Stress management includes stress tolerance and impulse control. The first ability is associated with efficiently and constructively managed emotions, and the second one is related to an ability to resist instant temptations.
- A general mood component is treated as a trigger of emotionally intellectual behaviour and including optimism (an ability to maintain hope and a positive attitude toward life even in view of bad luck) and happiness (ability to be satisfied with oneself, others and life).

According to Goleman (2008) emotional intelligence competences are not programmed in human brains, but they can be acquired and improved by to the growth of experience or exercising.

Emotional intelligence development strategies

Emotional intelligence development research focuses on the role of emotions mostly in psychological research area and pays a key role in expressing human success (Van Rooy & Viswesvaran, 2007). In connection with psychological dimensions, emotional intelligence has been analysed in various environments such as academic, business, health, performance. Therefore, emotional intelligence analysis under different environments has emphasized different aspects of the emotional intelligence dimensions and its development possibilities. Dolev & Leshem (2017) conducted research on understanding possible mechanisms for promoting high-quality emotional intelligence professional development. Research results showed that emotional intelligence development is an essential determinant to the professional development which can be trained through individual coaching sessions and group workshop. Taking into account individual and group levels, emotional intelligence development could be implemented by adjusting three types of decision-making interactions (Bell et al., 1988). The first level is a descriptive level which aims to analyse meaningful information for the emotional intelligence development. It can be described by the analysis of *past effects and contradictions* ← taking into account today "*I with my*" features, conditions and environment → and looking forward for *Future development* possibilities. Predictive level is taking a look what has been already learned under the descriptive level. It can be used to dive deeper to the further emotional intelligence development steps and conditions. Prescriptive level helps to identify the best emotional intelligence alternatives and practices in *My* relations → with a group or team.

At the descriptive level, emotional intelligence could be presented as analysis of emotional knowledge (Salovey et al., 2003), and how to cope in different situations through non-cognitive skills (Bar-On et al., 2003). Based on the basic knowledge, Salovey et all (2003) presents two layers for emotional intelligence development: understanding emotions and managing emotions. In order to understand emotions, the author suggest to decompose emotions into different combinations of different emotions. For the emotion management skills development Caruso et all (2002) suggest to acknowledge self-management and social management skills. Moreover, Jung et all (2016) states that emotional intelligence should be trained in common with a humans' body. For this purpose, emotional intelligence development incorporates physical exercises as a body movement, relaxation, breathing and meditation. Following this direction, basic emotional intelligence development encompasses the ability to understand emotions and to manage it mentally and physically in appropriate way. Ramanauskas (2014:80) suggest a construct of trainings which provides knowledge and skills adequately and effectively address not only the challenges of life but also to act accordingly in everyday situations; technology trainings which helps to train your psychical and emotional activity; and trainings for development of self-regulating and emotional activity differentiation skills.

In predictive level, researches state that an emotional intelligence can be trained through the use of feelings to facilitate thought. Here, emotional intelligence could be trained through coaching sessions (Ramanauskas, 2014:80). Tschannen-Moran and Carter (2016) states that during coaching sessions, emotional intelligence could be trained through interpersonal and interpersonal composites in self-awareness, self-regulation, motivation, empathy, and social skills subscales. The idea of coaching for emotional intelligence is to choose main purpose for the conversation and move forward along with different questions by focusing on the desired results. Those sessions could help to increase awareness, enhance empathy (Tschannen-Moran & Carter, 2016) and improve mind flow or listening skills.

In prescriptive level, emotional intelligence development takes care about creativity, effective and positive thinking (Ramanauskas, 2014). Creativity analyses the emotions that influence productivity. Effective thinking guides how to manage complexity by increasing efficiency of thinking. Positive thinking helps to develop good attitude algorithms working with a team or group of people.

As emotional intelligence development strategies become apparent, the emotional intelligence development strategies cover multidimensional characteristics and possibilities for development. Trying to find explanatory nature different generations projects managers emotional intelligence development, paper integrates key concepts of emotional intelligence and three types of emotional intelligence development strategies.

Research methodology
Sample and data collection
Since the aim of the research was to identify how emotional intelligence of different generation's project managers occurs and what are the strategies for its improvement, the exploratory empirical study was used. Therefore, there was developed different project managers' generations emotional intelligence model based on Goleman (2008) and Bar-On (2006) emotional intelligence models. The emotional intelligence model is made up of the following dimensions:

- Personal qualities and abilities: emotional self-awareness, assertiveness, emotional independence, self-actualisation, accurate self-assessment, self-confidence and initiative.
- Adaptability: understanding of real situation, problem solving, flexibility, service-orientation;
- Stress management: stress resistance, impulse control;
- Mood: happiness/wellness, optimism;
- Interpersonal communication abilities: empathy, interpersonal relations, social responsibility, political judgement, reliability;
- Relationship management: leadership, education of others, change initiation and management, influence, conflict management.

The category of the generations of project managers was defined on the basis of the generation periods proposed by Howe & Strauss (1991). The Baby Boom Generation refers to those born in 1943 - 1960, the Generation X born in 1961-1981, the Y Generation born in 1982-2004.

The complex survey was carried out for seven months. The survey was carried out in 2018. The first and the second part of the survey were carried out in January-May, and the third part of the survey was carried out in October.

With a view to assessing the significance of emotional intelligence model dimensions for the model of emotional intelligence of project managers of different generations, an expert survey was carried as part of this research exercise. The experts were selected having considered their project management or expert work expertise (completed and ongoing projects), positions held and their willingness to participate in the survey. The model was assessed by nine experts. For the purpose of determining the compatibility of expert opinions, the authors calculated the Kendall rank correlation coefficient, whose value set ranks from 0 to 1. The average emotional intelligence rank was computed on the basis of expert evaluations (*see Table 1*).

Table 1

Expert assessment of dimensions of emotional intelligence

Dimensions of emotional intelligence	Average rank
Personal qualities and abilities	
Emotional self-awareness (identification of own emotions and their impact)	9.56.
Assertiveness (polite perseverance)	12.72.
Emotional independence (ability to be independent and be emotionally free from others)	14.06
Self-actualization (ability to identify personal objectives and seek to attain such objectives by disclosing own potential)	13.67
Accurate own assessment (knowledge of own strengths and shortcomings)	11.72
Self-confidence (strong own value and ability feeling)	11.33
Initiative (ability to take advantage of circumstances conducive for activities)	14.94
Adaptation	
Perception of an actual situation (ability to objectively assess the feelings and think realistically)	12.78
Problem solving (ability to efficiently cope with personal problems and those related to interpersonal relations).	16.33
Flexibility (ability to manage own feelings, thinking and behaviour and adapt to new situations and conditions)	18.61

Dimensions of emotional intelligence	Average rank
Service-orientation (ability to identify, recognize and satisfy the needs of another person).	7.17
Stress management	
Stress resistance (ability to efficiently and constructively manage emotions in stress situations)	16.83
Impulse control (an ability to resist a temptation to act)	5.06
Mood	
Happiness/wellness (ability to be satisfied by oneself, others and life)	8.22
Optimism (determination in pursuing an objective irrespective of obstacles and failures)	16.33
Interpersonal communication abilities	
Empathy (compassion for feelings, needs and concerns of others)	14.28
Interpersonal relations (ability to establish and maintain mutually pleasant relations with others)	16.56
Social responsibility (ability to communicate without concern for personal benefit)	9.72
Political judgement (perception of emotional flows and power relations in the group)	10.5
Reliability (compliance with morality and honor principles)	10.28
Relations management	
Leadership (inspiration of people and their groups, leading such groups)	18.67
Education of others (understanding of development needs of other persons and promotion of their abilities)	13.06
Initiation and management of changes	15.44
Influence (use of effective persuasion methods)	11.94
Conflict management (negotiations regarding conflicts and their resolution)	15.22

Source: Authors' construction

For the purpose of studying the key qualities and abilities of emotional intelligence 13 project managers were selected on the basis of the highest rank results. The qualities studied included emotional independence, self-expression, initiative, problem solving, flexibility, stress resistance, optimism, empathy, interpersonal relations, leadership, education of others, initiation and management of change, conflict management), the manifestation of which in relation to project managers of different generations was studied in a later stage of the survey.

The next step in the study sought to assess the expression of dimensions of emotional intelligence of project managers of different generations. Three statements were assigned for each quality and ability of the updated model; the statements were rated at a six-point Likert scale. This stage of the study was dedicated to a quality survey realised using an electronic survey tool. The questionnaire was circulated to targeted project managers of entities and organisations. The sample being studied was based on the "snowball principle". That means that for the purpose of the study the initial sample was composed of 15 different age project managers working in entities and organisations. The sampled persons were contacted by e-mail and the social network LinkedIn, and were called to fill in the questionnaire, and share it with other project managers. Total 51 questionnaires were filled in and submitted. It is important to note that a sample selected following "a snowball" principle is considered not completely reliable and the survey results may not be extrapolated to the entire populations, i.e. transformed beyond the group being surveyed (Kardelis, 2016), therefore the survey completed is considered a pilot survey. The collected data was processed using the SPSS Statistics programme.

Reliability of the questionnaire was calculated using the Chronbah's α coefficient. The Cronbach alfa of the questionnaire was equal to 0.836. As DeVellis (2003) claims that if Chronbah's α coefficient exceeds 0.6 value the questionnaire is acceptable.

During the third stage of the survey based on the model of expression of the emotional intelligence of project managers of different generations, a survey of a focus group was carried out with a view to selecting the development strategies of emotional intelligence of the project managers belonging to different generations. A group of 10 different project managers was set up and the respondents were asked to answer the questions asked to them.

Research results

As a result of interviewing of project managers of different generations the survey produced a model generalising the emotional intelligence expression of the project managers. The model was constructed by computing the percentage values of the answers supporting the expression of emotional intelligence qualities and abilities.
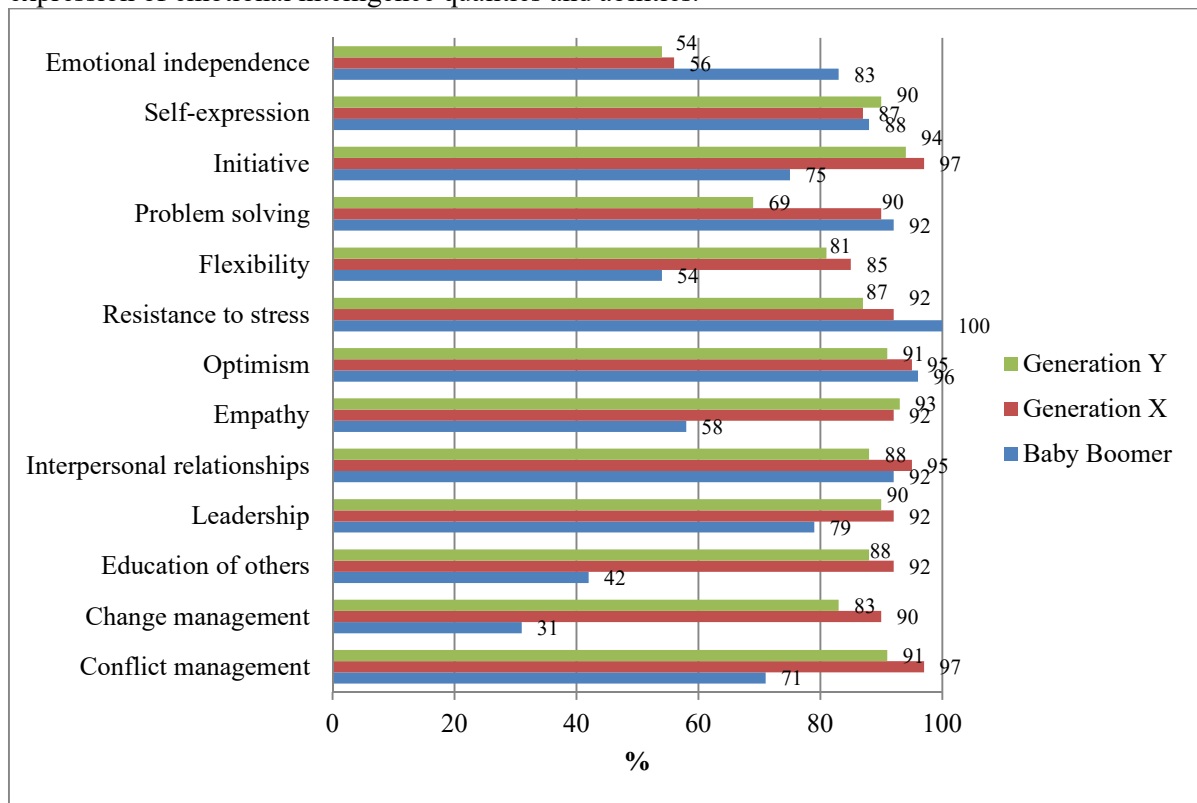
Fig. 1 **Expression of emotional intelligence of project managers of different generations**
Source: Authors' construction

The results of the survey led to a conclusion that there is no significant difference in the optimism, self-expression and the ability to manage interpersonal relations of project managers of different generations (Fig.1). The project managers of generation Baby boomers' that participated in the survey demonstrated strongly expressed (more than 90 per cent) optimism, stress resistance and ability to deal with problems. The emotional independence and stress

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resistance of the project managers belonging to generation Baby boomers' are more prominently manifested than those of the project managers of generations Y and X. Leadership and initiative qualities are less prominent in the project managers of generation baby boomers' than of the other generations. Conflict management, change initiation and management, education of others, empathy and flexibility are less prominently expressed than by the respondents of other generations.

The project managers of generation X that participated in the survey displayed a strongly expressed (more than 90 per cent) abilities such as conflict management, interpersonal relations and education of others, also leadership and conflict management. The emotional independence of generation Y project managers is less prominent than of the project managers representing the baby boom generation.

The project managers of generation Y that participated in the survey displayed a strongly expressed (more than 90 per cent) ability such as conflict management, empathy, optimism and initiative. The project managers of that generations displayed more prominent empathy and self-expression than the project managers of other generations. The emotional independence of generation Y project managers is less prominent than of the project managers representing the baby boom generation.

The survey was launched by asking question: "Do you think that project managers of different generations have differently developed emotional intelligence?" Most of the respondents answered the question positively. Members of the focus group replied that "*representatives of different generations have different educational background; therefore, their emotional intelligence development should be based on different strategies*". The replies can be interpreted as confirmation that project managers of different generations have differently develop emotional intelligence, because on the basis of a generalised model of expression of emotional intelligence of project managers of different generations display different emotional intelligence dimensions.

Further the survey included asking questions on the basis of the dimensions (conflict management, change initiation and management, education of others, leadership, interpersonal relations, empathy, optimism, stress resistance, flexibility, problem solving, initiative, self-expression, or emotional independence) of the generalised model of expression of emotional intelligence of project managers of different generations. An example of other questions was "*can the conflict management abilities be developed on an individual descriptive or predictive levels?*". Further questions were designed to clarify "*whether the conflict management abilities can be developed within the group at the prescriptive level?*"

During the organised discussions the focus group members agreed that change initiation and management and problem-solving abilities could be developed individually on the descriptive level. Such dimensions of project managers of different generations as leadership, interpersonal relations, empathy, optimism, stress resistance, flexibility, initiative, self-expression and emotional independence could be developed on the predictive level. Conflict management and education of other abilities could be developed on the prescriptive level. The focus group members were asked "*are emotional intelligence development strategies different depending on the generations of the project managers*". The received answers permitted a further and more detailed analysis of the emotional intelligence development strategies of project managers *of different generations*.

The members of the focus group agreed that "representatives of different generation can efficiently develop the emotional intelligence competences in entirely different methods". A

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summary of the answers of the focus group allowed a conclusion that a selection of the emotional intelligence development strategies need to take into account the following:

- The Baby boomer generation is able to efficiently use information technologies, however, it to a smaller extent than other generations use social networks, therefore their learning strategies should be based on face-to-face and are classroom learning for soft skills. Baby boomers my efficiently combine a number of innovative learning methods with the conventional methods, such as classroom learning to develop such competences as conflict management, change management, education of others and leadership. In addition to classroom learning descriptive level methods can be used to develop empathy, flexibility and initiative.

- Generation X is distinguished for high computer literacy, its representatives are knowledge susceptible and most often select on-the-job learning. Prescriptive level may be an effective learning access for generation X project managers. On-the-job training efficiently integrates a perspective of group and team group training. Emotional independence is the weakest expressed emotional intelligence competence, and should be developed by applying integrated team training methods.

- Generation Y is in all cases prepared for learning and improving, able to efficiently operate technologies and seeks regular feedback. They favour learning whilst doing with regular coaching and feedback. Predictive level excellently realises learning based on coaching. Such strategies may be applied for developing problem solving, emotional independence and flexibility abilities.

Conclusions

An analysis of the research papers in the area produced additional confirmation that emotional intelligence plays extremely important role in managing projects. Best project management results are achieved when the project manager is at the same time also the leader and demonstrate the same well developed emotional intelligence competences. A daily work of the project manager is related to people, and team management, leading the team towards the objective. The success of project managers in managing their teams depends on their ability to resolve conflicts (Kerzner, 2017). Successful conflict management helps to hold positive work relationships, while collusions of different opinions enables the team to pass more creative decisions and increases productivity. Changes and problem solutions are possible at all and any project living cycle stages and the easiest way to tackle such issues is to anticipate them in advance. Project managers should not be afraid to talk about changes and be able to explain their team members their roles with respect to the changes. Emotional independence is also very important for project managers. A self-confident and emotionally independent manager is confident in performing his/her duties, is more at ease when taking the required decisions (especially when such decisions are unpopular with others) and is efficient in dealing with conflicts. According to Goleman (2008) education of others is related to the perception of the needs of other people, and the promotion of their abilities. Learning teams normally achieve better results. All managers must be leaders and be distinguished for ability to initiate and self-actualisation, and without such qualities it is not possible to form a team consistently seeking a common objective (Morgan, 2015). The interpersonal relations dimension is associated with sensitivity, and the ability to feel positively and comfortable when communicating with other

people (Bar-On, 2013). Empathy helps leaders to efficiently communicate, reduces the gap between the different team members, brings about motivation and helps all in their efforts to look for useful solutions (Bar-On, 2013). The optimism dimension is associated with the project manager's ability to communicate, address problems and ensure productivity, while stress resistance helps efficient and constructive governance (Bar-On, 2013). Flexibility is an important quality of a project manager, because each project is unique: even if project objectives completely coincide, their implementing circumstances are different (Andersen and Collins, 2015). Flexible project managers never think that an envisaged plan is final until it is not fully implemented.

The survey of the expression of emotional intelligence of project managers showed that empathy, flexibility, education of others, initiative and stress management are the least prominent competences of project managers of baby boomer generation; while problem solving abilities and stress management are least developed among generation Y project managers. A comparison of emotional intelligence of project managers of three generations showed that not a single competence was expressed less prominently than of the two other generations. Irrespective, project managers of all generations can further strengthen their emotional intelligence competences. With a view to ensuring the quality and efficiency of learning results, it is specifically important to select most suitable competence development strategy. When selecting emotional intelligence development strategies, the important factors to consider are the generation that the project manager belongs to and the competence intended to be developed.

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THE PRINCIPLE OF COMPETITIVENESS IN EUROPEAN PROJECTS - THE CASE STUDY

Sebastian Kania, Bożena Błaszczyk
VERUM Advisory & Management, Katowice, Poland,
University of Economics in Katowice, Faculty of Informatics and Communication,
Katowice, Poland

Abstract

One of the basic conditions for the granting of EU funds for co-financing of the project is the application of the principles of equal treatment of contractors, fair competition and transparency of procedures in their spending. The public procurement under the project takes place in accordance with the relevant legal provisions. Beneficiary being a public entity obliged to apply the Public Procurement Law. In other cases, including in the case of private companies, disbursement of funds should take place in accordance with the principle of competitiveness.

Competitiveness is recognized as a natural phenomenon in economic life and a source of wealth creation (Czerniachowicz, 2012). In order to be successful, every company is forced to effectively use its material, financial resources and employee potential, and to analyze the environment in which it operates. All this makes companies in the process of development undergo constant evolution, adapt functions, goals and tasks, or organizational and management methods to the changing conditions of economic activity (Grzebyk, 2009).

The article presents a case study: the problem of applying competition rules in the event of the need to purchase meat raw materials for the project entitled "Development of a comprehensive technology for premium products from ostrich meat produced in Poland" carried out by Strusia Kraina & MOBAX Sp. J., co-financed from EU funds by the National Center for Research and Development in Poland. A methodology for the settlement of meat raw material costs, developed for the needs of this project, has been proposed.

The study was based on an analysis of literature, legal provisions and experience of the project manager presented as a case study.

Key words: *project management, international project, innovative project, competitiveness, public orders.*
JEL code: L21, L23, M11, H43

Introduction

In the Universal Declaration of Human Rights, adopted by the UN General Assembly resolution 217 / III A on December 10, 1948 in Paris, it was assumed that everyone has the right to life, liberty and security of person. The right to life requires satisfying basic physiological needs, among which nutrition can be distinguished. The Special Rapporteur on the Right to Food as an independent expert appointed by the Human Rights Council, explained that the right to food is the right to regular, permanent and unlimited access, directly or through financial purchases, to the quantity and quality of adequate and sufficient food corresponding to traditions the cultural people that the consumer belongs to and provides for physical and mental, individual and collective, full of life and a decent life free from fear..

In recent years, the market for health-promoting products has been growing strongly in Europe. There is a large increase in consumer awareness of the nutritional value of food and the

impact of a well-balanced diet on health. Consumers check the composition of food products and increasingly consciously choose those that are as least processed, natural and providing high quality nutrients.

Among the pro-health products, you can distinguish ostrich meat products, which are among the best quality meats, they are especially valued for their taste and health values. The largest producer of stusa meat in Europe is a company from the SME sector. Strusia Kraina & Mobax Dudka Motz Sp. J., which offers premium customers in Europe in the form of fresh culinary meat from ostriches. The company has obtained co-financing from European funds for the implementation of a research and development project entitled: "Development of a comprehensive technology for premium products from ostrich meat produced in Poland", co-financed by the National Center for Research and Development in Poland from the European Regional Development Fund under the Smart Growth Operational Programme 2014-2020.

The case study presented in the article concerns the problem of applying competition rules in the event of the need to purchase meat raw materials. A methodology for the settlement of meat raw material costs, developed for the needs of this project, has been proposed.

Information about the project

The subject of the project entitled "Development of a comprehensive technology for premium products from ostrich meat produced in Poland" is to carry out comprehensive industrial research as well as development and pre-implementation activities on the development of high quality innovative products from ostrich meat originating in Poland.

The subject of research at all stages of the project implementation are meat raw materials from ostrich meat originating from Poland.

The results of the project will be product innovations in the form of:

- in the area of culinary ostrich meat, a significant improvement of the products offered so far,
- in the area of ostrich meat products - launching new ostrich meat products that have not been available so far.

Technologies developed within the project will be implemented in production plants directly after securing intellectual property through European and Polish patent applications.

The main goal of the project is to increase the company's competitiveness on the European market by implementing the developed solutions on the market.

Costs in European projects

In accordance with Article 174. (ex Article 158. TEC) of the Treaty (Official Journal of the EU 2016 C 202), in order to promote the harmonious development of the whole Union, it develops and conducts activities to strengthen its economic, social and territorial cohesion..

Cohesion policy for 2014-2020 is a leading EU investment policy for economic development, employment and implementation of EU projects. Cohesion policy aims to support activities leading to equalization of economic and social conditions in regions of the European Union, and in the years 2014-2020 they are territorially targeted investments, among others in:

- research and innovation activities;

- support for small and medium-sized enterprises (SMEs).

The instruments for the implementation of cohesion policy are operational programs.

Regulation of the European Parliament and of the Council (EU) No. 1303/2013 of December 17, 2013 specifies the common rules applicable in the European Union countries applicable, among others to the European Regional Development Fund (ERDF).

Under EU rules, subsidies and repayable assistance in ERDF projects can take specific forms, as illustrated in Fig. 1.
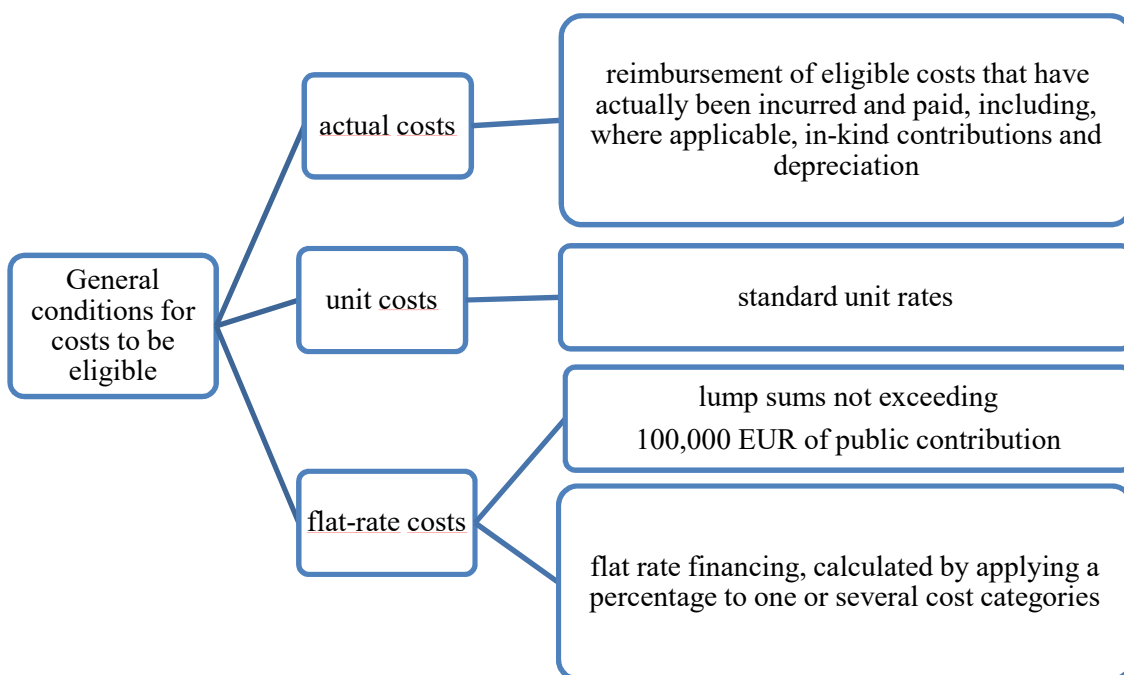
Source: Authors' own work

Fig. 1. **Forms of subsidies and non-returnable aid in European Regional Development Fund projects - European Union**

The legal provisions concerning the European Regional Development Fund, applicable in Poland, are in particular:

- Act of 11 July 2014 on the rules for the implementation of programs in the field of cohesion policy financed in the 2014-2020 financial perspective (i.e. Journal of Laws of 2018, item 1431, as amended);;

- Guidelines for the eligibility of expenditure under the European Regional Development Fund, the European Social Fund and the Cohesion Fund for 2014-2020;

- Cost Eligibility Guide under the Intelligent Development Operational Program;

- Contracts awarded as part of projects. Handbook of the applicant and beneficiary of the cohesion policy programs for 2014-2020.

According to Polish regulations, subsidies and repayable assistance in ERDF projects may take specific forms, as shown in Fig. 2.

Source: Authors' own work

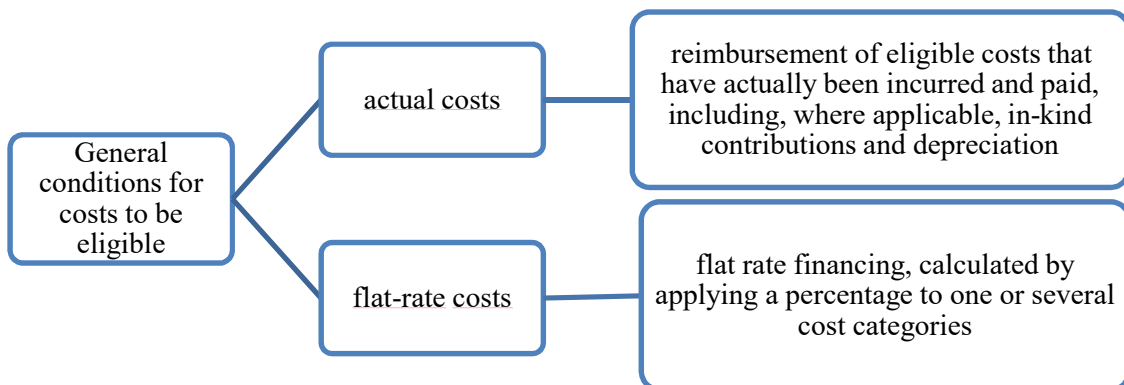Fig. 1. **Forms of subsidies and non-returnable aid in European Regional Development Fund projects - Poland**

The general conditions of eligibility of costs laid down in the Regulation of the European Parliament and of the Council (EU) No. 1303/2013 of 17 December 2013, allow the settlement of subsidies with standard unit rates, whereas this form of settlement has not been accepted in Polish legislation..

Procedures for awarding public contracts in European projects

In Poland, in the programming period 2014-2020, Guidelines on the eligibility of expenditure under the European Regional Development Fund, the European Social Fund and the Cohesion Fund for 2014-2020, hereinafter referred to as "Guidelines", which specify harmonized conditions and procedures for eligibility of expenditure .in. for structural funds and the Cohesion Fund.

n the 2014-2020 programming period, eligible expenditure is one that has been made in a transparent, rational and effective manner, respecting the principles of obtaining the best results from the given inputs.

In addition, Chapter 7 of the Regulation of the European Parliament and of the Council (EU, EURATOM) No. 966/2012 of 25 October 2012 defines the fundamental principle of sound financial management, requiring the use of resources in an economical, efficient and effective manner:

- in accordance with the principle of savings, the resources used by the institution to carry out its activities should be made available in due time, in the right quantity and quality and at the best price.
- the principle of efficiency is associated with the most advantageous relationship between the resources used and the results achieved.
- the principle of effectiveness is associated with achieving specific objectives and intended outcomes.

Granting funds for project co-financing depends on the application of the principles of equal treatment, fair competition and transparency (Lech, 2016).

A statement of the beneficiary's violation of public procurement, community procurement procedures and / or the provisions of the Public Procurement Law Act is related to the establishment and imposition of the so-called financial correction. The selection of the public procurement procedure in European projects implemented in Poland is primarily dependent on the type of Beneficiary / Applicant, as set out in Figure 3.
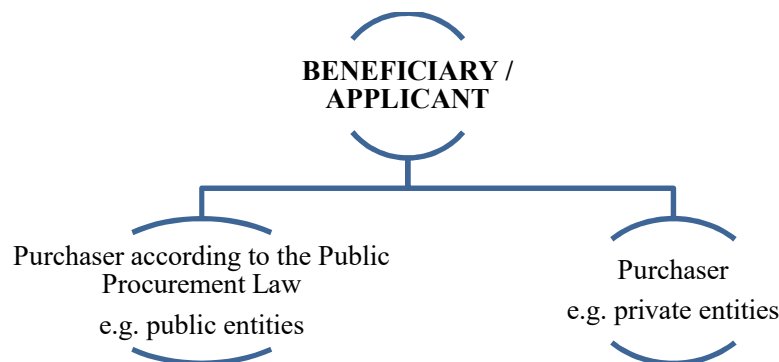
Source: Authors' own work

Fig. 3. **Types of Beneficiaries / Applicants**

If the project is carried out before a public entity governed by the provisions of the Public Procurement Law, then the purchase should be carried out in the first place in accordance with the provisions of the Public Procurement Law. However, if the purchase can be made without applying the Public Procurement Act, the procedures set out in the guidelines will apply, depending on the estimated value of the contract. Fig. 4
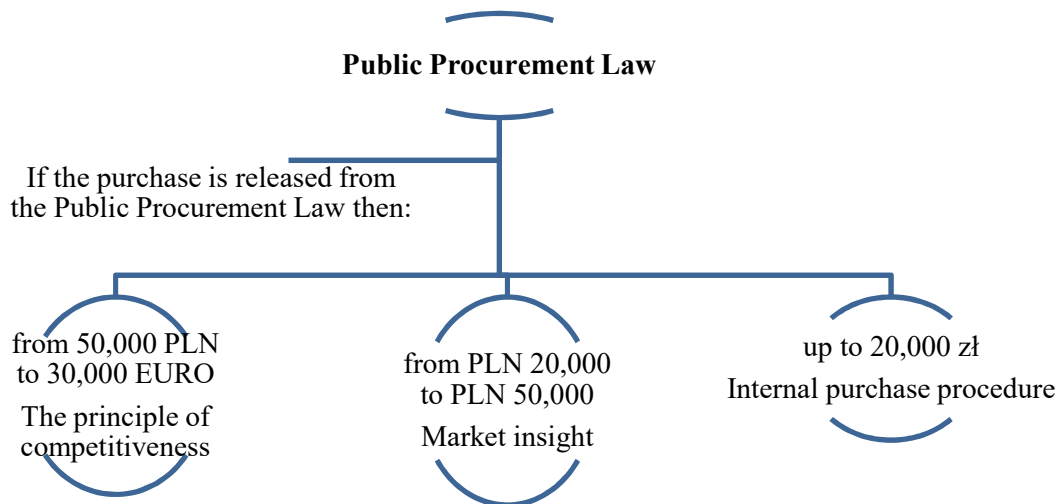
Source: Authors' own work

Fig. 4. **Procurement procedures applicable in public entities**

If the project is implemented before a private entity, then the procedures set out in the Guidelines will apply, depending on the estimated value of the contract, and in specific cases indicated in the Public Procurement Law, the provisions of the Public Procurement Law should apply. Fig.5.
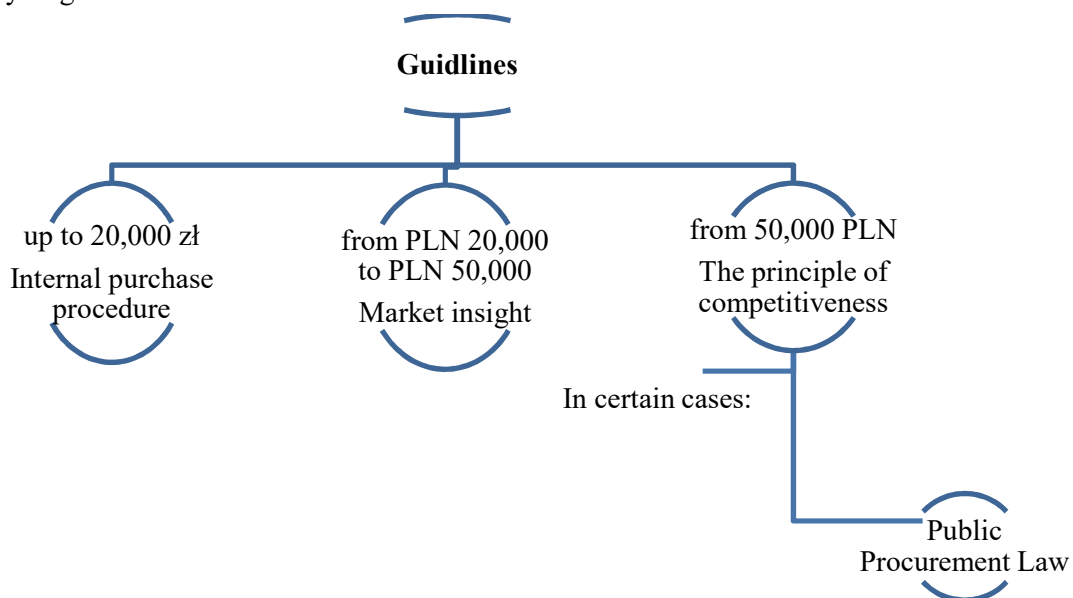
Source: Authors' own work

Fig. 5. **Procurement procedures applicable in private entities**

Case study

In this article as a case study, the process of purchase of meat raw material is presented, which is the subject of research within the project. Because the Beneficiary is a private company, the purchase procedure was carried out in accordance with the Guidelines. The next steps of the completed procedures are shown in Fig. 6.

Step 1

• **ESTIMATING THE VALUE OF THE ORDER**
• Object of the contract: "Successive delivery of vacuum-packed ostrich meat from Poland"
• Estimated value of the order: over 50,000 zł
• Purchase mode: Competitiveness rules

Step 2

• **PROCEDURE ACCORDING TO THE PRINCIPLE OF COMPETITIVENESS**
• The offer inquiry was made public: "The successive delivery of vacuum-packed ostrich meat from Poland" https://bazakonkurencyjnosci.funduszeeuropejskie.gov.pl/
• The deadline for submitting bids has been set at least 30 days
• **NO OFFERS**

Step 3

• **PROCEDURE FOR PURCHASE WITH OMISSION PRINCIPLE OF COMPETITIVENESS**
• Searching for ostrich meat suppliers according to the subject of the order
• **NO OFFERS**

Step 4

• **APPLICATION FOR THE PROJECT OF OWN MEAT RAW MATERIALS**
• No possibility to settle the cost of meat raw materials from own resources according to the unit cost calculation, without the margin
• Reconciliation with the National Center for Research and Development, the method of solving the problem of the purchase of meat raw materials - change of the type of costs: instead of meat raw materials, the costs of producing meat raw materials should be introduced, without changing the total value of project costs

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Step 5

• **CHANGE OF THE PROJECT BUDGET**
• Costs were removed: meat raw materials
• Cost items have been introduced:
  • Meat ingredients - ostrich livestock
  • Cutting and confectioning staff
• Conclusion of an annex to the contract for co-financing and changes to the Project budget

Step 6

• **ESTIMATING THE VALUE OF THE ORDER**
• Object of the contract: "Successive supply of livestock from African ostrichs"
• Estimated value of the order: over 50,000 zł
• Purchase mode: Competitiveness rules

Step 7

• **PROCEDURE ACCORDING TO THE PRINCIPLE OF COMPETITIVENESS**
• The offer inquiry was made public: "Successive supply of livestock from African ostrichs"
  https://bazakonkurencyjnosci.funduszeeuropejskie.gov.pl/
• The deadline for submitting bids has been set at least 30 days
• **NO OFFERS**

Step 8

• **PROCEDURE FOR PURCHASE WITH OMISSION PRINCIPLE OF COMPETITIVENESS**
• Search for livestock suppliers from African ostriches according to the subject of the order
• Awarding orders to African ostrich farmers contracted in production plans
• **Development of a methodology for converting ostrich livestock costs into meat raw materials**

Source: Authors' own work

Fig. 6. **Stages of the procurement procedure for the case study**

Repeated purchase procedures and introduction of necessary changes to the Project budget caused the necessity of shifts in the project implementation schedule.

Methodology of settling costs of meat raw material - ostrich livestock

For the purposes of settling the cost of raw meat in the draft, based on the purchase costs of ostrich livestock, a methodology for calculating the indicator was developed.

For the calculation, historical data was adopted for the period from 01 / 2018-09 / 2018:

- Number of live ostriches purchased: a [pcs.]
- Total weight of purchased live ostriches: b [kg]
- Total weight of produced meat raw materials that will be covered by research in the project::
  - Fan Filet: c_1 [kg]
  - Filet mix: c_2 [kg]
  - Steak: c_3 [kg]
  - Class II: c_4 [kg]
  - Class IIIA: c_5 [kg]
  - Class IIIC: c_6 [kg]

  c_1 [kg] $+ c_2$ [kg] $+ c_3$ [kg] $+ c_4$ [kg] $+ c_5$ [kg] $+ c_6$ [kg] $=$ c [kg]

Calculation of the percentage share of ostrich meat covered by research in the art of live ostrich:
Efficiency = (c [kg] / b [kg]) x 100 % = X %

Calculation of the ratio of 1 kg of ostrich meat in the weight of ostrich live::
Indicator = 1 [kg] of ostrich meat / X % = Y [kg] of ostrich livestock

Interpretation:

To produce 1 kg of ostrich meat necessary for testing, it is necessary to buy and process Y [kg] of ostrich livestock.

The Y-ratio [kg] of ostrich livestock applies to all types of meat used in the project in one height

Based on the above the indicator has been calculated the amount of livestock necessary to conduct research and have been proposed changes to the Project Budget

Conclusions

The company's success in the area of purchases is dependent on proper management. Its aim is to get to know, satisfy and constantly control methods and procedures leading to the proper course of the purchase process and decisions connected with it (Gąsiorowska, 2007, p. 117).

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Recognized in the literature dependence between phases of purchase and its type is presented in tab. 1.

Table 1.

Purchase model in the institutional market of F.E. Webster and Y. Wind

Purchase phases	New purchase	Purchased modified	Routine purchase
Recognizing the need to buy	Yes	sometimes	no
A general description of the need	Yes	sometimes	no
Determination of the characteristic features of the product	Yes	Yes	Yes
Searching for potential suppliers	Yes	sometimes	no
Collection and analysis of offers	Yes	sometimes	no
Selection of the supplier	Yes	sometimes	no
Specification of the order	Yes	sometimes	no
Control and evaluation of purchase	Yes	Yes	Yes

Source: abased on (Gąsiorowska, 2007, p. 127).

The purchase model on the institutional market of FE Webster and Y. Wind Phase presents in how the purchase phases are related to the types of purchases: new purchase, modified purchase or routine purchase. Similar models can be seen shopping in the normal practice of private companies, where the shopping is characterized by routine and minimumformalities that, as opposed to purchasing new. The type of purchase and business relationship depends on the procedure necessary to carry out the procedure.

If the company is carrying out the European project, purchases are made according to procedures s public procurement Phase result from the purchase necessary to apply the procurement procedures in European projects, which depend on the type of Beneficiary / Applicant and the estimated, current value of the order (so-called quota thresholds). This is an approach that can cause problems for companies implementing European projects , in particular for SMEs.

Based on the case study presented, the following conclusions can be made:

1) Polish law in projects co-financed from the European Regional Development Fund do not allow the possibility of settling expenses on the basis of unit costs.

   The general conditions of eligibility of costs set out in Regulation (EU) No 1303/2013 of the European Parliament and of the Council of 17 December 2013 allow the settlement of subsidies using standard unit rates.

   Unit rates in normal practice most often occur in manufacturing companies, where carrying out the required purchase procedures would be significantly difficult or economically unjustified, and sometimes even impossible.

2) The procedure of buying meat raw material carried out in accordance with the Competitiveness Rules was unsuccessful - no offers. The contracting authority, as a

producer of ostrich meat, supplies ostrich meat products to the market. It is not possible to settle the cost of meat raw materials from own resources in the project.

3) The procedure for purchasing ostrich livestock carried out in accordance with the Competition Rules was unsuccessful - no offers. Purchase of ostrich livestock takes place at market prices and is conducted on the basis of long-term contracts between producers and breeders.

4) After two procedures of purchase in accordance with the Principles of Competitiveness, notification of changes to the Project budget and development of the "Methodology for settling costs of meat raw material - ostriches from livestock", the meat products produced by the Beneficiary are accepted for the project implementation. The costs of meat raw materials are settled on the basis of actual expenses incurred for the purchase of ostrich livestock from breeders. Depending on the amount [kg] of the used raw material, the corresponding amount [kg] of the ostrich live with the indicator is converted.

5) Purchase procedures required by Polish law have been unsuccessful, but as a result, the Beneficiary purchases at market prices from breeders from whom they make routine purchases in connection with normal business operations.

The presented case study concerns the problems of settlement of raw material costs in a project implemented by a Polish ostrich meat producer. Similar problems may occur in the case of manufacturing companies from other industries..

The purpose of the article was to signal a problem and a possible way to solve it. It seems rationally justified that in the next programming period, the legislator would allow the settlement of subsidy costs according to standard unit rates - which may occur in the case of manufacturing companies. It seems also legitimate to see that companies in their normal activities make routine purchases from regular contractors, pursuing a specific pricing policy when building long-term business relationships. In such cases, also the requirement to use specific procedures as for new purchases seems unreasonable..

The case study shows that in some cases the conduct of purchase proceedings does not result, but only affects delays in the substantive implementation of the Project and is associated with the necessity to incur additional costs by the Beneficiary. Such problems could be avoided by allowing some simplifications..

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SCRUM4CONSULTING - AGILE PROJECT MANAGEMENT FOR CONSULTING PROJECTS

Sylvia Kerscher
LIV-T GmbH, Munich, Germany
Holger Günzel
Munich University of Applied Sciences, Munich, Germany

Abstract

The megatrend of digitalization is not only having an impact on IT in companies, more than ever it focuses on the development of new business models and the adaptation of business processes (Berman, 2012). In this context, client requirements for the project management approach in management consulting projects are also changing significantly (McKinsey, 2017)(Sywottek, 2018). It is no longer the autonomous development of a concept by the consulting firm, but cooperative and transparent processing, the discussion of early and tested partial results and increased short-term change requests during implementation that make it necessary to adapt the project management approach. Classic project management approaches with a waterfall like approach such as PMI (Project Management Institute, 2017) or Prince 2 (Axelos, 2017) are only suitable to a limited extent; often they are also too costly for a small project team. Management approaches such as Lean Startup (Ries, 2017) or Design Thinking (Lewrick & Link, 2018) show the current trend towards iterative and flexible methods (Denning, 2018).

The goal of the research is the adaptation of Scrum (Sutherland, 2015) for management consulting projects in process, innovation or strategy consulting. In addition to the process model and the roles, the areas of requirements definition and test are primarily to be adapted. After a literature analysis and expert interviews, the procedure in industrial consulting projects was evaluated at the Munich University of Applied Sciences.

With the present conception of an agile project management model for management consultancies, consulting projects outside of IT projects can be carried out agile. The cooperation between client and consultants is in the foreground, the consideration of changes is possible and positively affects the client orientation. Furthermore, projects with subsequent IT implementation are simplified. Still the requirement definition by means of user stories is unusual and the client must accept and support an increased project speed as well as the mindset of the agile proceeding.

Key words: Digitalization, consulting, agile project management, flexibility
JEL code: O31

Introduction

The digital transformation has to be understood as an answer of enterprises, in order to fulfil the ever-larger expectations of the clients in addition, the project complexity increases (Techconsult, 2017). The associated demand for faster responsiveness is therefore cross-industry (Lindner, 2017).

External experts are called in for support more than ever before: 63%, of those involved in a study by Techconsult in 2017, stated that they increasingly expect support from management consultants in such projects (Techconsult, 2017).

Client expectations and market-driven requirements also demand a more flexible and adaptable project management approach from management consultants. Agile process models are thus

becoming more and more important for management consultancies (Risch, 2018); to date, there is no scientifically validated, agile project management approach specifically for consultancies. The present report addresses the aforementioned problem in the research questions.

- What are the project management requirements for consulting projects from the client's point of view?
- To what extent do existing project management models cover these requirements from a literature side?
- How can the client's requirements be taken into account in agile project management?

The paper on hand focuses on a flexible project management approach explicitly for consulting projects. In advance, the requirements (chapter 2) for project management from the client's point of view have to be ascertained. Based on this, existing project management models have to be analysed for the fulfilment of the required requirements (chapter 3) in order to develop a suitable project management procedure (chapter 4). Chapter 5 deals with the research method and critical reflection.

Client requirements for projects

The demands of clients regarding management consultancies have changed significantly due to the digital transformation. Not only more innovative results, but also an intensification of the cooperation with the customer, interactive processes and flexibilization of the advisory assignment are expected and wanted.

1) **More innovative and goal-oriented results (1)**
- Ability to innovate: In order to remain successful in a volatile market, clients increasingly demand innovative solutions. According to 74% of respondents (Techconsult, 2017), project dynamics are increasing, whereby this depends on the type of project (Komus & Kuberg, 2017); Wautelet et al., 2017).
- More precise goal definition of the project result: The higher the agreement between actual project outcome and outcome required by the client or the traceability for deviations, the higher are clients' satisfaction and the chances of re-contracting.
- Ongoing work on results: For almost one third of all projects, implementation difficulties are recognised too late, as often too few or only at large intervals results are completed and presented. Early interim results give clients assurance that the project is moving in the right direction (Techconsult, 2017).

2) **Interactive processes (2) in the implementation**
- Planning reliability: The client demands planning reliability with regard to time and budget in the implementation (Komus & Kuberg, 2017). Nevertheless, after a few weeks 42% of generated project plans are already considered obsolete (Techconsult, 2017). 90% of surveyed companies say there are delays or increased costs through implementation of the projects.
- Relevance and accuracy of progress documentation: The consulting team is requested by the client to provide continuous, qualified information on the content and status of the project.
- Reduction of risks: A suitable handling of potential risks is a basic requirement for projects (Komus & Kuberg, 2017).
- Time flexibility: In many companies, employees are not only deployed for a single project, but - especially in large corporations - are often only scheduled for a certain percentage of their working time for a project. A recent study shows that 65% of

companies will continue to divide their employees between parallel projects in the future (Techconsult, 2017).

- Spatial flexibility: In the context of Working Environment 4.0, the client's employee is often accustomed to spatial flexibility - such as "new work" or home office - which he would also like to retain in a consulting project (Keese, 2014).

   3) **Intensification of cooperation (3)**

- Increased communication: Regular communication regarding the process and product provides the client with an opportunity to actively influence the project, help shape the outcome of the project and reduce the risk that the product is not marketable.
- Information flow towards management: Management support is an essential success factor in projects (Standish Group, 2015).
- Employee integration: The involvement of employees in the project is only partially desired by the client, as the lack of resources often conflicts with an organizational culture that has not been designed for this purpose.
- Solution-oriented conflict management: The increasing complexity of projects has resulted in more frequent use of experts from different consulting firms (Techconsult, 2017). Nevertheless, the client expects all consultants to work together across companies, conflict-free, cooperatively and solution-oriented.
- Transparent processes between client and consulting firm: 34% of the projects report problems during implementation, which are often due to a lack of transparency in the process and progress or a communication deficit (Techconsult, 2017).

   4) **Flexibilization (4) of the consulting assignment**

- Consideration of change requests: 51% of the projects are subject to frequent change requests, which entail adjustments to the project plans (Techconsult, 2017). The client's satisfaction increases if his change requests are taken into account quickly and flexibly (Ewenstein et al., 2015).
- Flexible combination of procedures: Flexibility in the method of proceeding and an equally flexible combinability with other methods is required in order to select the most suitable solution for each situation (Techconsult, 2017).

Related work

The three project management orientations "classic", "lean" and "agile" are evaluated with the requirements for consulting projects. The selection of the classic methods is based on Prince2 (Axelos, 2017), PMI-PMBOK (Project Management Institute, 2017) and ICB (Rauer 2015). Kanban (Epping, 2011), Lean Six Sigma (Devane, 2003) and the Toyota Production System (Ohno, 1988) are chosen as representative approaches for Lean. The agile approaches are represented by Extreme Programming (Baumeister et al., 2017), Scrum (Sutherland, 2015) and Agile in the waterfall world (Lindner, 2017).

No model lives up to clients' expectations in all areas. In the area of results (1), agile methods have an advantage due to the continuous partial outputs. Secondly, traditional methods can be used in the field of processes (2) to suitably implement the required flexibility in terms of time and location and planning security. Clear strengths with regard to cooperation (3) are lean and agile procedures. Flexibilization (4) with regard to requirements is easiest to implement with agile methods.

Table 1.
Requirements / Methods Evaluation

++	+	o	-	- -
The method meets the requirement completely	The method meets the requirement to a satisfactory extent	The method is neutral to this requirement.	The method cannot partially meet this requirement.	The method does not meet the requirement

Type of requirements	Requirements	Type of project management		
		Classic	Lean	Agile
(1) Results		-	o	++
	Ability to innovate	-	-/ o	+/ ++
	Accuracy of the desired project result	o	+	+
	Sequential, continuous results	--	-/ o	++
(2) Processes		+	o	o
	Planning reliability	+	++	o
	Relevance and accuracy of progress documentation	o	o	+
	Risk reduction	o	+	+
	Time flexibility	+	o	-/ --
	Spatial flexibility	++	--/ -	--
(3) Cooperation		-	+	+/ ++
	Possibility for feedback communication	-	+/ ++	+/ ++
	Information to management	-	o	+/ ++
	Integration of employees	-	o	+/ ++
	Transparent processes	+	+/ ++	+/ ++
	Solution-oriented conflict management	o	-/ o	o
(4) Flexibility		o	+/ o	++
	Consideration of change requests	--	o	++
	Flexible combinability with process models	++	+	+

Source: Authors' construction

Scrum4Consulting Concept

The adaptation of agile project management towards requested requirements of consultancies must take place in the areas mind-set, roles and processes.

1) Agile Values and Principles

Through the agile values (Agile Manifesto, 2001) and the focus on interactions, working products, cooperation with the client, acceptance of change, commitment, focus, courage, respect and openness become essential components of the approach. These are required from both, the consultant and the client. The second must actively engage in the cooperation,

otherwise the project cannot be carried out successfully. Therefore, the principles (derived from the agile manifesto) such as continuous delivery of increments, positive response to change, a self-organized team, daily cooperation, personal dialogue, professional as well as technical excellence and reduction to the essentials are essential fundamentals of the new concept.

2) Roles

The roles for Scrum4Consulting are based on the roles of traditional Scrum. However, these roles are extended by some necessary ones and tasks are adapted in order to reflect the temporary cooperation between companies and consultancies.

Table 2.

The roles for Scrum4Consulting

Roles	Tasks
Scrum Master	The ScrumMaster (SM) is responsible for ensuring that the Scrum4Consulting (S4C) process is followed. For this he protects his team and eliminates disturbances and obstacles. This position is often covered by an employee of the consulting firm. Particular attention is paid to the work on the agile mindset of the participants, since his focus is on increasing the productivity of the team.
Product Owner	The Product Owner (PO) is responsible for the value of the project and prioritizes user as well as client stories by value. The PO delivers the requirements that the consulting team needs for the project. He is either a trained employee of the client, who can also be supported by consultants, or an employee of the consulting company.
Scrum 4 Consulting Team	The Scrum4Consulting Team consists of external consultants and client's employees. Together they are responsible for a constant and qualitative delivery of results (self-organized). Together with the product owner, the strategic added value and the direction towards product development are permanently worked on.
Client	The client has requested the consulting service and is number one contact person for contractual and organizational matters. He mainly works together with the PO. He receives and accepts the product increments in each review meeting and coordinates them continuously with the PO.
Management	The management is defined in this concept as the manager one level above of the client in the advised company. He is responsible to ensuring that all essential elements for product development are available to the team. In cooperation with the SM he revises structures and conditions in the client's company.
User	The user is the customer of the product or service. The user is always actively asked for feedback and can be invited to review meetings. Depending on the type of project, the user can be an external customer or an internal employee.

Source: Authors' construction

3) Phases and Procedure

The Scrum4Consulting process is divided into an initiation phase, an implementation phase and a final phase (figure 1), with adjustments being made in the first two phases. In comparison to a consulting procedure model with a conventional project management approach, client's requirements are fixed in the beginning and completely worked towards the entire project, the initiation phase is also used to understand the project scope and client's requirements, but not to analyze and document them comprehensively. The focus is on breaking

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down the requirements into redundancy-free "stories" for the iterative implementation phase, which, in addition to fast partial results, provides intensive cooperation and optimisation of the process.

4) Initiation Phase

The initiation phase (according to Gloger (2016) also called strategic phase) is used in Scrum4Consulting to carry out the elements to be planned, such as the detailing of the idea, generation of a common vision, creation of a backlog with user and client stories, its prioritization and initial estimation of the Scrum4Consulting Team. This phase is characterised by the fact that work is not done directly for the result, but the requirements of the client are fixed (Gloger, 2016) (Heikkilä et al., 2015).
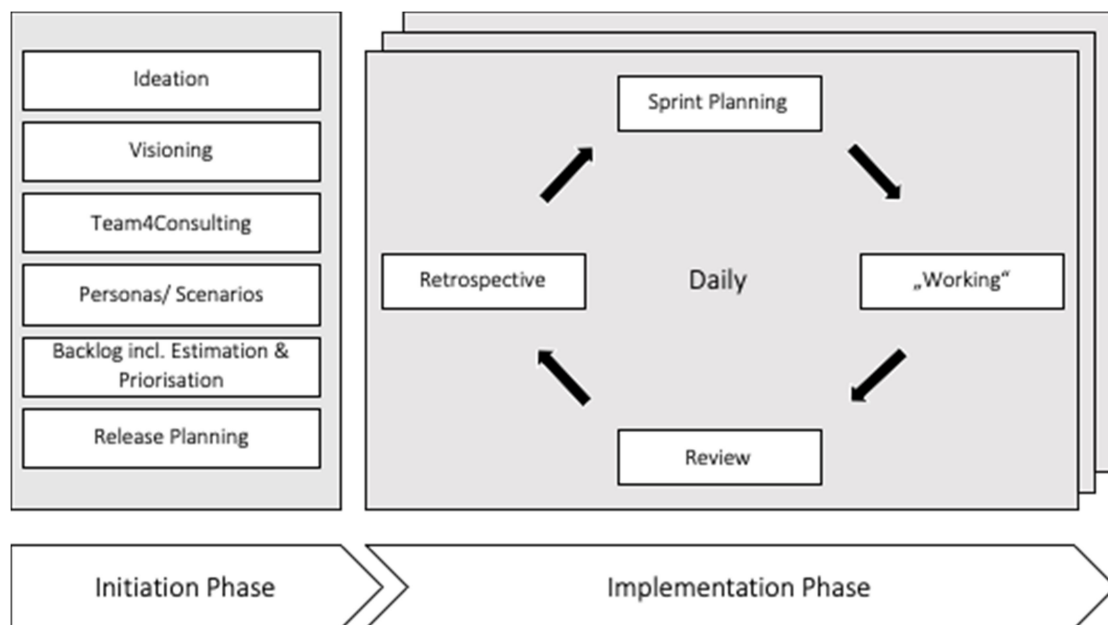

Fig. 1: **Phases and Work Products**

Depending on the type of project, a new consulting project is triggered either by a client's idea or need or their management. For example, business process optimization serves to improve quality or process execution speed. The vision creates a motivating target picture for the consulting team. The challenge in creating a vision is to create a strong product vision that simultaneously triggers emotions (Gloger, 2016); (Gottesdiener & Gorman, 2011). The creation of this vision often already takes place within the assignment. It is the responsibility of the Product Owner to create the vision. In "Team4Consulting", in addition to the selection of the client's employees for the consulting team and team building, work is done with the consulting company on the activation of the agile mindset - which is currently not available in all companies. The mindset is an essential success factor or, in a negative case, a show stopper for agile projects (Gloger, 2016). Furthermore, the common "rules of the game" in the team such as working hours, exchange of work results, sprint length, definition of done, etc. are defined. The consulting team is supported during the whole project by the Scrum Master. Personas serve as a

description of a potential target group that uses the result. In addition to the description of the person, goals of the person, life circumstances and context of the product use are recorded. The scenarios show the use and influence of the product on the target group. The consulting backlog consists of the scrum backlog with the user stories as functional requirements for the result and additional requirements (also called side products) of the client. The consulting situation makes it necessary to introduce client stories.

- User Stories: User stories can be used analogue in consulting (Wirdemann & Mainusch, 2017). The user stories are based on the personas/ scenarios (Gloger, 2016; Kandil et al., 2017) (Wautelet et al., 2017). User stories serve as a basis for the creation, improvement or use of a process/product, as they take needs of users into account and meet them. All user stories are predominantly prioritized according to business value by the product owner in the consulting backlog (Heikkilä u.a., 2015)(Kandil et al., 2017). An example should illustrate this: A service provider in the healthcare sector commissions a consulting firm to remain competitive in the course of the digital transformation. Among other things, the onboarding experience is to be revised for this purpose. One user story from the customer's perspective is "As a customer, I want a personalized onboarding experience in order to be perceived as a person". Since this user story is too big to be implemented in an iteration, the user story is divided and detailed, e.g. in "As a private customer, I would like a personalized onboard experience in order to receive more personalized advice from the beginning".

- Client Stories: Client stories arise from the client's requirements for side products such as a market analysis, a business case, SWOT analysis or management presentation. The structure of user stories is supplemented by a time component: "Who needs what, what for and until when" in order to obtain a further prioritisation criterion. "Who" is the specific client or manager who has requested the respective side product. The "what" represents the requirement (e.g. management presentation); "why" also reflects here the justification basis (e.g. decision basis). The product owner is responsible for prioritizing the client stories according to dependencies, business risk and cost of delay.

The consulting team initially estimates the stories according to the scope of features in the Estimation Meeting. In contrast to prioritization, the estimation is carried out by the team, supported by the functional explanation of the product owner under the direction of the Scrum Master. The release plan is the control element of the project, which is managed by the product owner. From the release plan it can be determined which prioritized stories will be completed at which time. This information enables the client together with the Product Owner to move the stories between the different sprints (Wirdemann & Mainusch, 2017).

5) Implementation

In the Scrum4Consulting concept, the implementation phase describes all activities to be performed by the implementation team. These activities are carried out in time-limited ("timeboxed") iterations. The sprint length for consulting projects is set to a short period of time such as one week. The consulting approach (e.g. an as-is state analysis, creation of the target concept and implementation, rollout) is run through during the sprint for the individual story (figure 2). The final rollout only takes place when the solution has proven to be suitable through the test of the implementation phase.
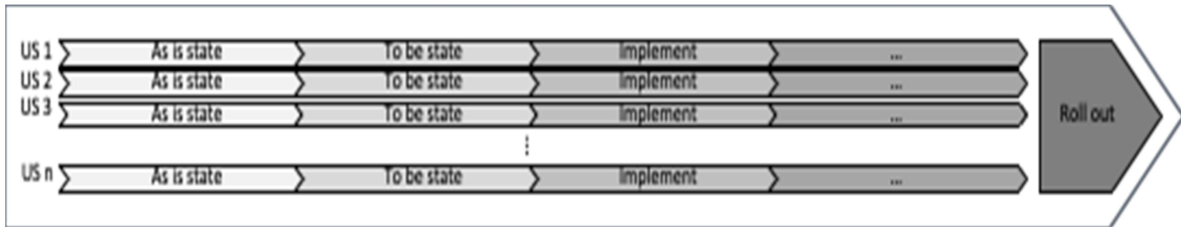
Fig. 2: **Implementation method**

The implementation phase includes the sprint planning meeting, the review meeting, the retrospective and the daily (Wirdemann & Mainusch, 2017).

Analogue to Scrum, sprint planning is separated into two different meetings in order to carry out planning (sprint planning 2) only after understanding and creating a team commitment in sprint planning 1 (Gloger, 2016) (Maximini, 2018). For each selected backlog item, the requirements must be clarified, acceptance criteria (behaviour) and constraints (framework conditions) fixed and a test generated (Gloger, 2016) (Maximini, 2018).
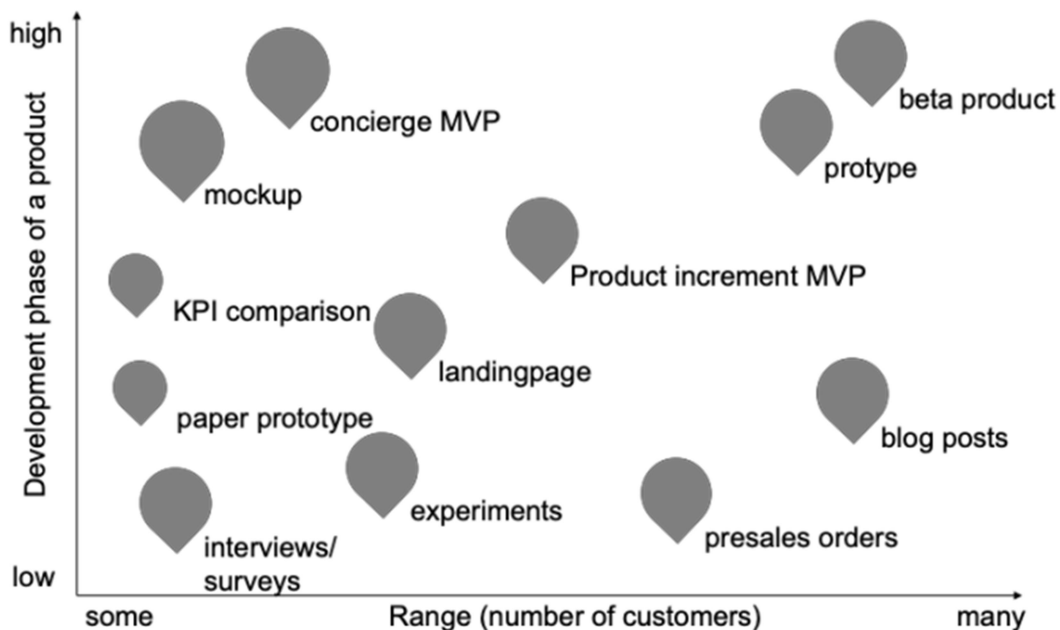
Fig. 3: **Types of Test** (Source: similar to Chuang (2016))

A special feature of consulting is the testing of consulting results that differs significantly from software. Scrum4Consulting follows the principle of Behaviour-Driven-Development (BDD), whereby a certain reaction has to be generated during the test. As a first step, the team considers which type of test can be used to test a client/user story accordingly. A certain reaction by the user should occur when using the product. By working out the test and

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the expected reaction, the later identification of the requirements and acceptance criteria for the consulting team is facilitated. Different types of tests (figure 3) are specified, which can be classified according to the state of development of the product and its range (van Geldrop, 2016). It is based on the test types of the Lean Startup procedure (Ries, 2017). The size of the icons is proportional to the effort involved (Chuang, 2016). As a new type of testing, "10 minutes feedback", derived from classic interviews, is introduced. Each user of the consulting team should evaluate the change every day in a ten-minute feedback discussion.

Tasks in Sprint Planning 2 are initially derived directly from the consulting process models, which are then further detailed. All potential consulting work products such as requirements, weak point analysis or process models in the consulting phases (as-is state analysis, target concept, etc.) lead to tasks that are extended by acceptance criteria, constraints and tests.

Daily Scrum meeting as a regular exchange date (transparency) (Shaughnessy, 2018), Taskboard (Gloger, 2016) (Wirdemann & Mainusch, 2017) or the Burndown Chart (Gloger, 2016) as a visualization of progress, or the Impediment Backlog for collecting obstacles are used.

On the last day of the sprint, the Sprint Review Meeting takes place, in which the created sub-products are presented and reviewed (McKinsey, 2017) (Gloger, 2016).

The retrospective is carried out at the end of each sprint, which results in specific suggestions for improvement. The entire Scrum4Consulting Team and the ScrumMaster take part in it. It is facilitated by the ScrumMaster and therefore plays a leading role (Gloger, 2016) (Maximini, 2013).

Research Method and critical discussion

The described approach was scientifically evaluated through interviews and a practical implementation.

1) Research Method

The paper is founded on qualitative research based on a comprehensive literature research on the topics of agile project management (model), project management in consulting and project management for business process optimization. Five guided expert interviews deepen, expand and validate the requirements concept (Berger-Grabner, 2016). Scrum4Consulting is based on a multiple-case study (Yin, 2012). It took place in the "Co-Innovation Lab" of the Munich University of Applied Sciences (Günzel & Brehm, 2018), which was continuously improved during project implementation through surveys of participants (Döring & Bortz, 2016) (Berger-Grabner, 2016). In the "Co-Innovation Lab" companies work together with students in project-oriented courses on future innovations. This lab serves as a common development environment for innovation projects. Students change from discussing case studies to interact with business reality through projects and experience as well as develop new approaches to solving complex business problems. Subsequently, the concept was validated with the help of five experts in qualitative interviews.

2) Evaluation and limitation of the concept

As a central aspect of the interviews it emerged that there is a great urgency for management consultancies to proceed agile in the future. At the current state of research, there

is no general cross-company model for this. Therefore, the relevance of this iteratively designed model is rated as high.

The previously established requirements can largely be fulfilled by the developed model. The spatial and temporal flexibility, which is shifted to the team level for the solution, remains difficult.

It has also emerged that, in addition to functions and components of the main product, user stories also create requirements for other additional products, the side products, which are addressed by client stories. It is important to find the right granularity and description.

Because a finished partial product must be provided in a short period of time, the topic test becomes essential in the non-software field. It is not trivial to set up and carry out a suitable test.

The concept on hand requires working with an agile mindset (consultant and client), which is to be evaluated as an essential success factor. If this is not given or if the project is not applied holistically, there is an increased project risk. Especially the conversion to an agile mindset needs sufficient time.

Despite the positive evaluation of the relevance and the preceding research results, it should not be neglected that the concept was only tested in a student context. Aspects such as the conclusion of contracts or international teams were not taken into account. However, in the expert interviews it was deliberately placed in the focus of the survey and validated in the course of this.

Conclusions

The aim of this paper was to create a first scientific approach that would verify the compatibility of the consulting industry, outside of software development, with an agile project management approach. This goal was based on the assessment of project management needs from the client's point of view. In order to check the extent to which existing models cover these specific requirements, a gap analysis is generated on the basis of a literature search. From this, it was possible to identify the approach that best fulfils the desired aspects. The aim was to further develop this approach in such a way that it takes into account the special features of the consulting industry. The concept Scrum4Consulting, which is developed on the basis of a literature analysis, validated by five expert interviews and repeatedly tested and further developed with project partners from industry in the Co-Innovation Lab of the Munich University of Applied Sciences, forms the nucleus of this work.

Based on the research results obtained, further research topics will emerge. Since the consulting industry is heterogeneous and extensive, it makes sense to extend the study to other project types. It is also recommended to investigate the scaling of Scrum4Consulting. If necessary, the interaction of different consultancies can also be tested. Furthermore, specifics like contract types like the "agile fixed price" and organizational aspects like the four-day week can be taken up.

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CRITICAL SUCCESS FACTORS IN PROJECT MANAGEMENT: A COMPREHENSIVE REVIEW

Viktoriya Abylova, **Leila N. Salykova**
Satbayev Kazakh National Research Technical University, Kazakhstan

Abstract

There is an increasing interest in project management studies since more companies become project-oriented and apply project management principles in building their strategic business models. Project management is a broad subject with different knowledge areas that embrace variety of issues a project manager, a team, organizations and experts have to deal with to succeed in project implementation. When we talk about concept of project success, primarily there are two project success concepts: project success and project management success. Many researchers and professionals try to define the correct meaning of project success and project management success, yet it is challenging to make a strong difference between them due to their mutual nature. It is quite interesting to observe how the concept of project success have been developed through history, what kind of models were emerged and what methods researchers used to find the factors that lead to a project success. This research aims to provide a comprehensive literature review related to the concept of project success factors by studying different views, models, theories and approaches to gain better understanding on this issue, what methodologies are used in previous studies and what are further considerations in project success factors theories. This article provides a survey on ideas, knowledge, and principles to explain the project success by means of analyzing various techniques and to insert findings as a part of research design of PhD dissertation. It helps to get more precise and clear idea on the chosen topic and serves as a tool to proceed the work in progress at data collection stage. Apart from personal application, this review facilitates project managers to use obtained knowledge in practice in order to understand the relationship between project success and project efficiency.

Key words: project management, project success, factors, efficiency.
JEL code: O22

Introduction

Probably every project manager wishes of successful implementation of projects. Usually literature differentiates between project success and project management success. Since these two concepts have mutual nature, there is still some similarities as well as differences.

In general, project success delivers established goals or objectives of the project while project management success is evaluated based on the traditional approach of project triangle namely cost, time and budget.

Over the years of studying success concept and project performance several extensions were brought to the traditional understanding. Success criteria evolved and developed according to project's perception and perspective of key stakeholders. Previous works on project success or project management success were not limited only by traditional approach but examined different aspects of success as human factors, knowledge transfer, stakeholders and perception concept, communication and advanced considerations.

This articles aims to contribute to knowledge and practices of project success concept and provide a broad overview on this topic by analyzing different views, theories, opinions, investigations. The paper consists of several parts: first part deals with traditional approach of project success and project management success, then few upgrades to the traditional concepts

are given followed by detailed overview on numerous aspects of success. Later detailed literature review on critical success factors is provided and conclusions on these topics are made.

This work serves as a tool to build theoretical framework for future PhD research and facilitates to form a research design according to existing trends and knowledge in project management practice.

Project success and project management success

Usually when project managers evaluate project realization, they generalize project outcome by the word "success". However, literature usually distinguishes between two concepts: project success and project management success. De Wit (1988) was the first one who suggested this distinction. Undoubtedly, successful project management makes successful projects (Sebestyen Z.). Although poor project management still can make project successful. Munns and Bjeirmi (1996) shared similar ideas and noted that "a project can be a success despite a poor project management performance".

Typically project success relates to the achievement of project or company's goals and objectives, while project management success commonly refers to the traditional measurement factors of project triangle – cost, time and quality (Radujkovic M.). Sometimes in relevant literature it is called triple restriction. Cooke-Davies (2002) distinguish between project management success that leads to the desired objectives within stated time and cost, and project success where project delivers the business objectives. Generally, there are various models and views on project success and project management success and it is quite difficult to find a right definition between these two fundamental concepts because of their similar nature. Cooke-Davis integrated in their research elements that lead to consistent, sustainable success (Sebestyen Z.). Despite of the attempts to find the right definition of what are the elements of project success, many researchers agree that project manager's good combination of actions contribute to project success (Radujkovic M.). In their work Williams at al. (2016) evaluated project success in two fields: customer satisfaction and client relationship quality in project management (P. Williams). Project management creates tangible and intangible benefits of organization that is why it is hard to find exact project management evaluation. The importance of perception also takes place while assessing project's success.

Traditional PM triangle was the first model of project management success. It appears in every definition of project. However, many researchers find it not sufficient to assess project success. These factors were observed later only as a part of project success (Radujkovic M.). One of the most important ideas is that project triangle should include factors that create and transmit value. Reich, Gemino and Sauer (2010) mentioned in their work that a final goal of project manager is to create a business value (Exploring the impact of knowledge management on business value on IT projects, B.H. Reich). There are many other approaches of project management success like integration, scope, human resources, communication, risk and procurement management. Morris and Hough (1986) mentioned four success factors, apart from time, cost and quality they introduced safety. Stakeholder's satisfaction, benefits to project's owner-organization and long-term impacts on project environment (Radujkovic M.) can be considered as part of success as well. Stakeholders have different understanding and perception of success. Interestingly that at the end of 20th century the idea to consider stakeholders to evaluate success appeared in literature. (Sebestyen Z.). In their research Collins and Baccarini (2004) stated that the satisfaction of owner's needs is the most important factor in project's success (Project Success – A Survey, A. Collins). Bryde and Robinson (2005) proved the same statement and mentioned that for contractors cost and time play most important role. With the increasing interest to the point of project management success through stakeholders' fulfillment, few fundamental papers were published on this topic. Initially customer as a single stakeholder

appeared in the work, then later some authors investigated communication with the customer (A retrospective look at our evolving understanding of project success, K. Jugdev, R. Műller) as critical success factor. Hyvräri (2006) defined communication as the main factor contributed to project implementation.

Due to further considerations of project success, more complex system of factors was developed. Researches felt the need to introduce another factors or elements to the traditional perception of project success. Thus to extend the basic evaluation criteria several groups of critical success factors are presented according to existing relevant works (Fig. 1).
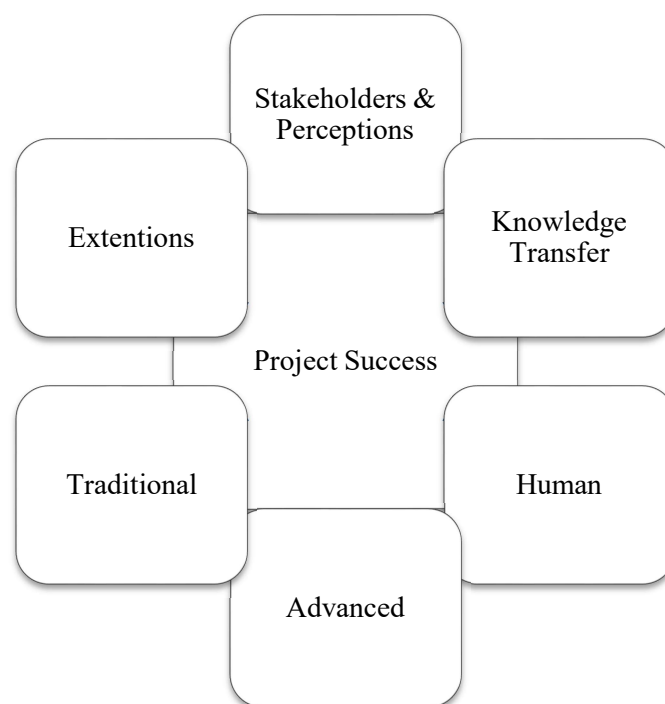
Source: author's construction derived from the literature

Fig. 1. **Aspects of success**

Stakeholders

Stakeholders have different understanding and perception of success. Interestingly that at the end of 20th century the idea to consider stakeholders to evaluate success appeared in literature. (Further Considerations in Project Success, Zoltan Sebestyen). Turner and Zolin (2012) mentioned that project success is best judged by the stakeholders, especially the primary sponsor.

In their research Collins and Baccarini (2004) stated that the satisfaction of owner's needs is the most important factor in project's success (Project Success – A Survey, A. Collins). Bryde and Robinson (2005) proved the same statement and mentioned that for contractors cost and

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time play most important role. With the increasing interest to the point of project management success through stakeholders' fulfillment, few fundamental papers were published on this topic. Initially customer as a single stakeholder appeared in the works, then later some authors investigated communication with the customer (A retrospective look at our evolving understanding of project success, K. Jugdev, R. Műller) as critical success factor. Hyvräri (2006) defined communication as the main factor contributed to project implementation. Munns and Bjeirmi (1996) stated that most of the projects ends when they reach their customers (The Relationship between Project Success and Project Effiency, Pedro Serrador, J Rodney Turner).

Communication

It was indicated earlier in the work that many researchers define communication as one of the critical factors in assessing the project success. Pinto and Slevin (1988) defined several factors that contribute to successful implementation of several projects namely project schedules/plans, client acceptance, monitoring and feedback, communication, trouble-shooting, and characteristics of the project team leader. To support this point of view Hyvräri (2006) indicated communication as the most relevant factor in project implementation. In addition to this, communication in large companies considered as the most important critical success factor, while small companies evaluate it as the most critical one. Andersen et al., (2006) in their research derived nine critical success factors: communication, planning approval by stakeholders, formal and well-structured approach, commitment to the project, influence of stakeholders, understanding and accepting the proposal, restrictions, flexibility in the execution, and influence over the project processes. In this case, communication was perceived as a great contribution to trustful relationship between project participants, also as a crucial aspect of providing long-term benefits to stakeholders and of procedures and processes that support the activities.

Apart from traditional specifications of success, Verma (1995) pointed that success is a function of communication, teamwork and leadership (V.K, Verma, Organzing Projects for Success). He also developed the idea of perception of project performance in his works. Since project success depends on the perception of stakeholders, there is mostly "perceived success" rather than "absolute or ultimate success" (Improving project success: A case study using benefits and project management, Jorge Gomes, Mario Romão).

Knowledge transfer

There is another approach that is less discussed among academics yet there is a growing popularity and need to include the concept of knowledge impact on project outcome. Knowledge can be transferred between individuals, teams and organizations. Authors define knowledge as "a process of learning from previous projects through an interactive exchange of experiences". Ayas noted that the ability to access experience guarantees continuing improving and create business value.

Knowledge is considered as "mind" of organization and the process of effective knowledge transfer becomes essential for successful outcome of the project (Effective knowledge transfer in successful partnering projects, Alessia Bellini, Wenche Aarseth, Ali Hosseini). Several authors dedicated their works of studying the factors that affect positively on knowledge transfer. Hajidimitriou et al. and Chen et al. noted trust as an important key element for effective knowledge transfer. According to Yew Wong trust between the project participants enables the creation of knowledge-transfer environment. Among other key elements team work, communication, meetings, supportive organizational culture and location of project participants support effective knowledge transfer. Despite the obvious importance of knowledge management in projects many researches recognize it as a challenge to companies (Anantatmula, 2010; Lindner & Wald, 2010; Boh, 2007; Bresnen et al., 2003; Schindler &

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Eppler, 2003; Disterer, 2002; Kasvi et al., 2002). According to T. Johansson et al. (2012) understanding of the roles within the knowledge transfer process is essential because business benefits of project management are only achieved when knowledge is transferred between employees.

Human

Many researchers realized the importance to include human assets in success criteria since there were limited studies on human resource in project management (Fabi and Pettersen, 1992). However measuring the impact of human factor is on project performance is not an easy task since it is difficult to quantify it. Authors started introducing in their works such concepts of human factors affecting success as flexibility, adaptability, enthusiasm, spontaneity, aggressiveness, confidence, initiative and leadership, ambition, verbal abilities.

The Standish Group 2000 study and other works stated that human factor is perceived as the most influential factor that causes failure or success (Johnson et al., 2001; Kor & Wijnen, 2001; Schein, 1995; Storm & Jansen, 2004; Turner, 1999). Except studies on business cases or organizations, several studies on education were conducted. Many authors in their works noted that process aspects are dependent on human factor, which is described as management competence. Several authors indicated that number of projects failed because of incompetent leadership or management, lack of support from senior management or other person in charge, lack of support from peers or organization.

Human assets as success criteria found their place in the works of many authors. Thus Liphadzi et al. (2015) reveled correlation between leadership styles and project success. Yang and his co-researchers examined the relationship between international character of the project and leadership style and success, apart from considered teamwork, project type, industry sector, team size and etc. The paper on "Critical success factors in project management: implication from Vietnam" states that the social–cultural, political and economic context of a project is critical in understanding what is successful, particularly in developed countries, but it is largely ignored (Cao Hao Thi and Fredric William Swierczek, 2010).

Human factors do not only affect project performance but they have impact on client satisfaction and project acceptance (Procaccino and Verner, 2006). There is a positive connection between project manager, team competences and project performance. All these studies developed more interest of success criteria and led to new approaches towards investigation of project success.

Advanced aspects

Since topic on project success turns to be more complex and uncertain there are still many areas covered partially by investigators compared to others. As it was stated earlier in the paper Cooke-Davies pointed factors that lead to the sustainable success. Mishra, Dangayach and Mittal (2011) evaluated ethical standards as critical factors towards sustainable project success. Yang, O'Connor and Wang (2006) studies the technology-intensive level of project.

According to M. Radujkovic (2017) there are several areas for future project management studies including project management competences and effective way to use them, since project manager and project team are the most responsible people of project success: relationship between project and parent organization because the accessibility to project-oriented environment create greater chances to succeed; developing, adapting and adopting project management tools, methods and techniques in order to optimize planning, monitoring and

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control processes. Joslin and Műller (2015) identified that applied project management methodology has an impact on success.

One more aspect that will find future application is the analysis of links between partnering and knowledge transfer. Several authors recognized that partnering success factors, like collaboration, mutual trust, and open communication, are directly related to effective knowledge transfer. It shows that knowledge transfer and partnering have mutual effect on each other.

Defining Critical Success Factors

Authors mention in their works that project managers contribute in case they have good knowledge of project success factors and their controls (Andersen, 2006). Studies show that in each management process, practices related to factors that influence project success vary from company to company (Nogeste, 2004; Nogeste e Walker, 2008). Despite the numerous studies on project success factors there are still very limited empirical facts related to the identification of the project success factors to the successful project management (Success Factors in Project Management, Élen Nara Carpim Besteiro, Jefferson de Souza Pinto and Olívio Novaski, 2015). Fortune et al. (2013) in their research stated that success factors are part of strategic perspective and several influencers are derived from the expectations of the stakeholders. Élen Nara Carpim Besteiro et all in their research indicated that the factors under the direct control or influence of the company facilitate the success of project management. Control is the one in accessibility of a project manager. Therefore, the benefits are in understanding the factors that need be monitored (Élen Nara Carpim Besteiro, Jefferson de Souza Pinto and Olívio Novaski, 2015).

The other literature says that the criteria for success evolve constantly, creating an ongoing challenge for industry professionals. In such a situation, the development of a strategic framework that tactically deals with project success and the identification of critical success factors (CSFs) is an important starting point. As a result, the objectives of this study were to (1) identify key critical factors that determine project success overall and (2) define and identify key CSFs on construction projects from the perspectives of different project participants with varying objectives (Bon-Gang Hwang, A.M.ASCE; and E-Sin Janicia Lim, 2013).

Dvir et al. (1998) argued that success factors should not be universal to all projects. To define success factors, a different approach is necessary to develop an improved framework that can include these widely diverging views. Lim and Mohamed's framework (1996) suggested two levels of critical success factors. First level (micro level) included time, cost, performance and safery as Morris and Hough previously mentioned. Second level (macro level) consisted of total project time, satisfaction during the use and operation of the final product.

According to Pinto and Covin (1989) at early project stages there are internal factors like budget, schedules and technical performance, while in later stages of a project external factors as customer needs and satisfaction are considered to be more important.

Many authors agree that evaluation of project success differentiate according to the evaluator and it should use multi-dimensional, multi-criteria approach (Cooper and Kleinschmidt, 1987, Pinto and Mantel, 1990, Freeman and Beale, 1992). The following Table 1 presents several approaches on identifying critical success factors according to project's objectives and perception.

Table 1.

Critical Success Factors

Author	Year of Publication	Success Factors
Pinto and Mantel	1990	Implementation process, perceived value of the

		project, client satisfaction with the final product
Paolini and Glaser, Pinto and Slevin	1977 1988	Customer welfare
Freeman and Beale	1992	Technical performance, efficiency of execution, customer satisfaction, personal growth, organizational ability, business performance
Kerzner	1998	Cost, time, technical performance, customer acceptance
Belassi and Tukel	1996	External environment, project manager and team members, organization, project
Schultz et al.	1987	Strategic: project mission, top management support, project scheduling; Tactical: client consultation, personnel selection and training.
Cooke-Davies	2002	Project team and management competencies

Source: author's construction based on the literature review

Based on the literature review success factors are usually expressed as general factors including "iron triangle" or very specific factors relevant only to a particular project or organization (Baker, Murphy and Fischer, 1983; Cleland and King, 1983; Finch, 2003; Pinto and Slevin, 1987). Due to project's nature, objectives and perception critical success factors change accordingly. Pinto and Prescot (1988) investigated critical success factors over the project life cycle. They concluded that relative importance of several critical factors change significantly based on the life-cycle stages (I. Hyväri, 2006).

There is an evidence that shows the need to understand priorities of different success factors according to project phases, project's objectives, influence of managers, communication, control and learning.

Conclusions

Project management practice is a broad field that includes numerous topics for debates. This paper provided a general overview on the success concept with particular emphasis on the development of traditional approach and understanding of project management critical success factors existed in the literature today.

We can conclude that the perception of the term success changed significantly over years. It is obvious that since there is an increasing number of project types and penetration of project management to different spheres and industries there is a need of studying and introducing more critical factors.

Due to more complex, uncertain and demanding nature of projects nowadays, yet research is seeking for the right indicators of success. This summary focuses on small section of success concept and there are many other uncovered areas like project knowledge management, human resources in project management and application of certain tools and methodologies in project management expertise.

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