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GROUP COMPOSITION OF RISK ASSESSMENTS AND SUSTAINABILITY OF RISK MANAGEMENT SUPPORTED DECISION MAKING

DOCTORAL THESIS

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ANNOTATION

This dissertation demonstrates that working company-wide risk management systems are never the responsibility of a single risk manager. In fact, the implementation of effective risk management processes always involves numerous individual responsibilities and employees, all of whom must make their own contribution within the organization. The respective organizational structures play a key role in supporting the risk management processes. Group dynamics also play a role here that should not be underestimated. Socio-psychological aspects must also be taken into account during the evaluation and assessment of risk portfolios.

To measure the aspects described above, a research design on the empirical study on group composition of risk assessments and sustainability of risk management supported decision making was established. The research design is based on the comparison of expert and daily practitioner opinions. Ten well-known experts completed the survey "Expert Interviews with Structured Survey on the Latent Exogenous Variables" and 131 professionals completed "Experimental Field and Case Study with Structured Survey on the Effect of the Endogenous Variables". The results of these two surveys were analyzed. Based on these studies and as one result of this dissertation, a new theoretical model for specific improvement of enterprise risk management has emerged. Furthermore, a new method mix has been developed which makes it possible to compare differing populations (size, specialist education, mode of expression). A significant element of the development of this new methodology is the scientific and statistical validation of the model. The newly developed five-method mix applied here has proved to be scientifically meaningful and valid for producing results for the proposed model that can be dealt with methodically. This dissertation demonstrates that the group composition in risk assessments has a substantial influence on the sustainability of risk management supported decision making. Incorrect group compositions can lead to business-critical errors of judgment. In a very large number of cases, composition is left to chance. The results of the dissertation indicate that it is very important to take account of personality types in the group composition for risk assessments, in terms of the sustainability of risk management supported decision making. Future research could look more closely at a possible positive impact on the sustainability of risk management supported decision making through the use of differing type weightings in the group composition in risk assessments.

Keywords: risk management, risk assessment, management theory, decision making, organizational theory, group processing

JEL code: C01, D81, O33

CONTENT

LIST OF ABBREVIATIONS

DM	Decision Making
ERM	Enterprise Risk Management
MBTI	Myers-Briggs Type Indicator
MRA	mixed risk aversion
IRM	Information Risk Management
RM	Risk Management
R&D	Research & Development
SPSS	Statistical Package for the Social Sciences

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INTRODUCTION

Actuality of topic

The implementation of effective risk management processes always involves numerous individual responsibilities and employees. All of them must make their own contribution within the organization. The respective organizational structures play a key role in supporting the risk management processes. Individual and group-based decision-making processes are accorded just as much attention for the decision making as the influences from the social roles of the members of the process. In particular, handling quality-based risk measurements or stochastic models and simulations will not work (e.g. fat tails) as effective risk assessment has to be done by human judgment.

Although the above findings show that different kinds of risk assessments by individual groups take place cyclically to be able to provide their risk estimations, research in the field of risk management has not yet considered the detailed group composition and the impacts thereof on the results.

Previous research has dealt extensively with group compositions in decision-making processes, but there are no approaches related to decision-making processes in the particular field of risk management. Research relating to the risk management has dealt with the delimitation of stochastic risk assessments from group-based risk assessments, but not with the group composition itself. This dissertation closes this research gap.

In this dissertation the current situation in enterprise risk management concerning group composition in the risk assessment was first analyzed in order to then infer the relations between group composition of risk assessments and the sustainability of risk management supported decision making as reflected in the causal model. The associated variables and the metrics thereof are determined in the process.

Appropriate research hypotheses have been derived taking account of the theoretical bases from the literature.

Beginning with the evaluations of the structured expert interview and the determination of the empirical norm, continuing with the experimental field study and associated specific statistical evaluations, and finishing by testing the results against the hypotheses, all the data collected has been considered, assessed and analyzed in terms of the research question. It has been shown that owing to the research question selected and the specific context of enterprise risk management, the chosen research methods intermesh to produce value.

By means of the overall scientific approach and the newly developed five-method mix used in the process, with literature review, observation, structured expert interviews, experimental field and case studies and results review, the intention is to show, for the first time, the extent of the influence of different group compositions on risk assessments, so as to provide business professionals with concrete proposals on how to act. This should make it possible to avoid dangerous errors of judgment and consequent poor group compositions for risk assessments in the future.

Purpose

The empirical results of the research make it possible to give clear suggestions concerning the group composition for risk assessments. Standard processes in enterprise risk management can be substantially adapted as a result, to ensure that even less experienced business managers have tools and processes at their disposal to help avoid errors of judgment in group compositions for risk assessments. Current software systems for risk management can thus take account of the results of the dissertation in the master data and workflows so as to improve the quality of the risk assessments.

Aim of the Dissertation

The aim of the research is to develop a methodology to enable the analysis of the effects of group composition, the assessment of the risk potential of business decisions and their impact on the sustainability of decision making based on these risk assessments.

Tasks

For this research, the author needs to introduce a new method mix to empirically examine the group composition of risk assessments and the sustainability of risk management supported decision making. Therefore, the following tasks need to be carried out:

1. Based on a comprehensive literature review and in-depth theoretical analysis, the author has to develop a theoretical framework to demonstrate the specific cause-effect relationships, which comprises the group composition of risk assessments as an independent variable and the sustainability of risk management supported decision making as a dependent variable.

2. The results of this literature review have to be used to develop the hypotheses as to the influence of group compositions on risk management processes and their value.
3. Expert interviews must be conducted, and the result of the interviews must be used to confirm the literature review and observation. In addition, an empirical norm must be determined from the results and the causality reduced by statistic evaluation.
4. The hypotheses must form the basis for building the causal analytical model that shows the cause-effect relationship between the independent variables of group composition and the dependent variables of sustainability of decision making.
5. Carrying out an experimental field and case study with the target group of business professionals forms the basis of the empirical data, which have to be evaluated (parametrically and nonparametrically) in the differential analysis against the data from the expert interviews, additionally making use of the determined empirical norm.
6. Findings from the correlation analyses and mean values must be used to falsify or tentatively substantiate the hypotheses and to draw conclusions from the results.

Research object

Risk Management for Business Organizations

Research subject

Group based risk assessments behavior and its impact on the sustainability of business decisions

Hypotheses

The basic hypothesis is formulated as:

H_0: The group composition of risk assessments has an impact on the sustainability of risk management supported decision making

Statements for defense as results of the research outcomes

1. Group composition in risk assessments has a substantial influence on the sustainability of risk management supported decision making. Incorrect group compositions can lead to business-critical errors of judgment.
2. In the field of risk management, a simple correlation analysis would be the incorrect methodology for comparing the statements of experts directly with those of business professionals. The research question can only be analyzed by using a multi-stage method mix.
3. The estimation of the business professionals deviates from those of the experts in significant areas. This can lead to a dangerous error of judgment and thus inevitably to poor group compositions for risk assessments.
4. The estimation of the business professionals differs fundamentally from that of the experts particularly when it comes to the degree of influence of "Personality type" and "Age". The influence of "Personality type" is greatly underestimated by the business professionals, while that of "Age" is widely overestimated, which can lead to business-critical errors of judgment.

Methodologies

The basis of this research was the development of a new five-method mix from sequential scientific methods. This made it possible to guarantee valid, reproducible, intersubjective, reliable and precise results.

In general, the academic aim of the literature review method is to gain an overview of the current state of research. It is moreover possible to identify appropriate gaps and new academic questions. Taking an in-depth look at a field of academic research not only expands one's general understanding in relation to the research question, it also serves to reopen issues that were previously considered to be settled.

If we now consider the first step of the five-method mix selected, it is first of all necessary to work through the relevant basic theories and associated publications. These are now the basis for the second step, the observation method. The background to the method consists in objectivizing the material selected subjectively in the literature review, i.e. the basis for an initial approach to a hypothesis. Observation of the industrial environment in which the research

question plays out is also a key starting point. Industrial standards, current developments, and also existing behaviors bear a relation to academic publications. All these outcomes can now be incorporated into the theoretical model and the formulation of the hypotheses.
The hypotheses arising from the first two scientific methods applied are reinforced by the methodology for the expert interview. In this environment, based on the research topic, a structured quantitative method having preformulated questions is recommended in order to get results that can more easily be evaluated.
In the method mix underpinning the research question, this section is designed to confirm or reduce the latent exogenous variables (independent variables that affect the model without being affected by it) in the model. The preselected variables, the mapping thereof in the model and the resulting hypotheses are a fundamental component of the questionnaires in the expert interview. In the process, the experts helped reinforce or discard the hypotheses.

The experimental field and case study were selected for the next method as other approaches were ruled out by the research question. The relatively new field of risk management in the context of decision making, into which very little research has yet been done, makes it impossible to do a simple correlation analysis between two groups (in our case, between the group of experts and the group of business professionals). The experts reflect the current state of scientific knowledge and use specialist terms in their communication, while the business professionals administer the business necessities of risk management and use more work-related expressions in their communication. This in itself already leads to a difference in terminology and depth of application. Any correlation analysis to be applied would need to compare two completely different groups, which would lead to erroneous interpretations. To resolve this, the experimental field study was chosen for the group of business professionals.
The survey results provided a basis for further statistical tests. The latent endogenous variables (dependent variables generated within the model and, therefore, a variable whose value is changed (determined) by one of the functional relationships in the model) has been analyzed along with the corresponding sub-variables.

Based on the research question and the resulting causal model, it is first of all necessary to verify the statistical analysis methods. There are fundamentally two groups: the group of nonparametric tests and the group of parametric tests. By comparing the characteristics of the two groups, it is possible to establish that the parametric tests have a greater significance than

the nonparametric tests. On the other hand, with parametric testing it is necessary to make more assumptions about the quality of the data.

This results in the following research design:

Table 1. Steps of the five-method mix

Method	Topics	Output
Step 1		
Literature review for exogenous variables	Evaluation the state of science in the specific fields of: - Decision making theory - Organization theory and group processes - Theory of personality types - Theory of decision strategies - Risk management terminology and theory	Research for possible independent variables for the causal model
Literature review for endogenous variables	Evaluation the state of science in the specific fields of: - Fundamentals of decision making in risk management - Influences of group compositions in risk management - New technology influence on risk Management communication workflows - Uniform ratings at different decision makers or decision making teams - Procedural, behavior and temporal decision making analysis	Research for possible dependent variables for the causal model

Method	Topics	Output
	- Budget and strategic responsibility impacts on decision making	
Step 2		
Observation	Observation of the industrial environment in which the research question plays out	Reduction in the indicators for finding a model and improved abstraction
Determination of Variables and Causal Model Postulation	Determine the latent exogenous variables	Independent variables of the causal model
	Removing insignificant latent exogenous variables	Focusing on the process-relevant variables
	Determination of latent endogenous variables	Dependent variables of the causal model
Construction of hypothesis	Main hypothesis and sub hypothesis	Construction of one main hypothesis and five sub hypotheses
Step 3		
Structured expert interviews	Structured quantitative method with preformulated questions on the research topic	Confirmation of the literature review and observation. Reduction of the model by statistic evaluation and determination of an empirical norm
Step 4		
Experimental field and case study	The experimental field and case study based on examples such as the Pipers case study was selected as method as other approaches were ruled out by the research question	Survey results provided the basis for statistical tests with parametric and nonparametric test procedures.

Method	Topics	Output
Step 5		
Result view on aggregated variables	Aggregation of the results of the parametric and nonparametric tests and their effects on the research question	Test results with significance comparison as output of the measured values with respect to the exogenous variables
Testing causal model and summarizing examined results	Determine an overall result derived from the intermediate and partial results.	Documentation of the results based on the aim of the promotional work, the investigation of the group composition impact, assessing the risk potential of business decisions and its impact on the sustainability of executed decisions based those risk assessments.

Source: Author's compilation

Owing to this novel juxtaposition of different scientific methods, it is possible to determine to what extent the estimation of the business professionals differs from that of the experts in key areas.

Novelty

The scientific novelties are as follows:

1. A new methodology based on a mix of five scientific methods has been developed which makes it possible to compare differing populations (size, specialist education, mode of expression).

2. A new model, making use of the five-method mix, has been developed to improve the sustainability of risk management supported decision making processes in organizations in the field of risk management.
3. For the first time, with the help of scientific methods, the developed model can be used to determine the deviations of assessments of a surveyed group of people from the empirical norm at the level of the exogenous variables present in the model.

The practical novelties are as follows:

4. The assessments carried out in accordance with this new five-method mix developed, in particular the parametric and nonparametric empirical test results, provide for the first time the opportunity to analyze significant differences in perception between business professionals and risk management experts to avoid previous risks of misallocation in group compositions for risk assessments.
5. The author specifies methodology with which even less experienced managers can improve the risk assessments to be carried out by means of defined group compositions. As a result, new structures for more sustainable risk management can be easily created in daily corporate risk management.
6. A detailed demonstration in which exogenous variables in the group composition are underestimated or overestimated by the business professionals regarding the empirical norm in order to improve the risk assessments.

Approbation of research results

Several steps during the development of the dissertation were presented and discussed within the following international publications:

Publications

1. Mayr, R., & Sierpinski, Ch. (2010). Risikomanagement vs. Sicherheitsmanagement. Sicherheit in der Industrie, *S&I Kompendium, Publish-Industry Verlag GmbH, München, Germany.* ISBN 3-934698-67-0
2. Mayr, R. (2013). Returning lost elements in sales processes. *Conference Proceedings: ERP-Future Research University of Innsbruck, Springer Lecture Notes, Austria*. ISBN 978-3-319-07054-4
3. Mayr, R. (2016). Analyses of the influences of organizational hierarchy and group processes in risk management related to meaningfulness of risk assessments. *New Challenges of Economic and Business Development Conference Proceedings - 2016, p 70, Riga, Latvia*. ISBN 978-9934-18-140-5 https://www.bvef.lu.lv/fileadmin/user_upload/lu_portal/projekti/evf/konferences/konference_2016/Proceedings.pdf, pp 459-471
4. Schwerd, St., & Mayr, R. (2017). Introducing a Theoretical Model and an Empiric Norm for Information Risk Management in Decision Making. *Problems of Management in 21st Century, Vol.12(1), pp 39-53, Scientia Socialis, Ltd. & SMC "Scientia Educologica", Siauliai, Lithuania*. ISSN2029-6932 http://www.jbse.webinfo.lt/centras.htm
5. Mayr, R., & Schwerd, St. (2017). Introducing a Five-Method-Mix – To Measure the Different Perception of Experienced Managers and Information Risk Management Professionals. *Conference Proceedings: ERP-Future Research University of Innsbruck, Springer Lecture Notes, Austria*

Several steps during the development of the dissertation were presented and discussed within the following international conferences:

Conferences

1. Mayr Richard, Analyses of the influences of organizational and group processes in risk management related to meaningfulness of risk assessments - Part 1, International Business & Economics Conference, University of Applied Science Kufstein, August 03-05, 2012, Kufstein, Austria
2. Mayr Richard, Innovation and Future of Enterprise Information Systems, ERP Future 2012 Conference, University of Innsbruck, November 12, 2012, Salzburg, Austria
3. Mayr Richard, Analyses of the influences of organizational hierarchy and group processes in risk management related to the meaningfulness of risk assessments - Part 2, International Business & Economics Conference, University of Applied Science Kufstein, November 29-30, 2013, Kufstein, Austria
4. Mayr Richard, Returning Lost Elements in Sales Processes, ERP Future 2013 Conference, University of Innsbruck, November 11-12, 2013, Vienna, Austria
5. Mayr Richard, Schwerd Stefan, The Role of Information Risk Management - Evaluation of Decision Makers, RiskNET Summit, November 05-06, 2014, Ismaning, Germany
6. Mayr Richard, Prozessautomation mit Workflowsystemen, PQM-Dialog 2014 Conference, University of Applied Science Kufstein, November 14, 2014, Kufstein, Austria
7. Mayr Richard, Analyses of the influences of organizational hierarchy and group processes in risk management related to meaningfulness of risk assessments, New Challenges of Economic and Business Development Conference, University of Latvia, May 12-14, 2016, Riga, Latvia
8. Mayr Richard, Schwerd Stefan, Introducing a Five-Method-Mix – To Measure the Different Perception of Experienced Managers and Information Risk Management Professionals, ERP Future 2017 Conference, University of Innsbruck, November 18-19, 2017, Innsbruck, Austria

Content of dissertation

The first chapter is concerned with the literature review of the theoretical foundation of enterprise risk management, group composition and decision-making improvement factors. In the process, decision making theory and its characterizations of both the normative and descriptive models is analyzed alongside organization theory and group processes with the respective features of group size, group composition and group performance and detailed considerations in the fields "working in groups" and "organizational culture".

The focus here is on the analysis of individual and group-based decision-making processes and the influence of the social roles of the process members.

Following on from this, the theories of personality types and decision strategies have been considered. Although each individual is, of course, unique, personality type theory clearly demonstrates that classification or grouping by type is both possible and worthwhile. A further and complementary grouping results from an analysis of the theory of decision strategies, which, in the context of risk management, can also have a substantial impact on company performance or output.

To conclude the first chapter, there is a detailed look at risk management terminology and theory, ranging from a simple consideration of the definition of the term "risk", to risk aversion, enterprise risk management and the associated analytical models.

The second chapter, on modelling the relation of group composition of risk assessments and sustainability of risk management supported decision making, looks at the current situation in enterprise risk management in relation to group composition in the risk assessment. From this it is possible to infer the relations between group composition of risk assessments and the sustainability of risk management supported decision making as reflected in the causal model. The associated variables and the metrics thereof are determined in the process. Finally, this chapter is concerned with the corresponding derivation of research hypotheses taking account of the theoretical principles set out in the first chapter.

In the third chapter, on the scientific method-mix as the strategy of inquiry for testing the relationship between group composition of risk assessments and sustainability of risk management supported decision making, the causal model is checked using analytical methods (parametric and nonparametric) and the hypotheses are confirmed or proven false. The final part of the paper includes conclusions, suggestions and implications for future research.

Discussion of research results

Three main areas came to light in the literature review that could have an impact on the research question, although very little literature exists on the actual subject area. It is very probable that other influencing factors could also be identified from further literature reviews, even though the expert interviews have provided no indication of any such factors. A further risk arises from the direct comparison of statements by risk management experts with those of the business professionals. The group of business professionals exists in a different sphere which uses different terminology to that of the experts. A simple correlation analysis would give false results. This risk has been eliminated using a novel, multi-stage method mix.

This empirical study therefore initially concentrated on developing an empirical norm and proving the theoretical results derived from the literature review.

On the other hand, however, the current actual situation is also incorporated and compared against the newly created empirical norm so as to identify gaps and derive specific proposal for action. The methodically selected parametric test procedure must be based on a population of sufficient size having normal distribution. In order to rule out any weaknesses in the analytical methodology selected, the results have been compared with a nonparametric test procedure and the differences evaluated accordingly.

Main results

The outcome of the research can be summarized by the following general experimental findings:

By means of the overall scientific approach and the five-method mix used with literature review, observation, structured expert interviews, experimental field and case studies and results review, it is possible to confirm without exception that group compositions for risk assessments have a substantial impact on the sustainability of risk management supported decision making. Furthermore, it can be demonstrated unequivocally that the different exogenous variables have different levels of influence. This has been considered more closely in the sub-hypotheses. However, the fact remains that the main hypothesis H_0 must be comprehensively confirmed. The group composition of risk assessments has an impact on the sustainability of risk management supported decision making.

While it was possible to confirm the sub-hypotheses H_{01} to H_{04}, which essentially deal with the direct influence of the independent variables on the research question, there was a significant research finding from the consideration of sub-hypothesis H_{05}.

The estimation of the business professionals deviates from those of the experts and the empirical norm derived therefrom in significant areas. Even if the relevance of the influencing factors remaining in the model is equally accepted by the business professionals, the strength of the influence is differently, i.e. incorrectly, estimated in many areas. This can lead to a dangerous error of judgment and thus inevitably to poor group compositions for risk assessments. Based on these evaluations, which deviate fundamentally from the empirical norm of the experts particularly in regard to the exogenous variables "Personality type" and "Age", it must be noted that hypothesis H_{05} cannot, therefore, be confirmed.

Limitations of the study

The influences of culture and gender were not considered in the causal model. Although there are corresponding indications in the literature that these influencing factors in the field of risk management can be covered by others or should be marked as not significant, it would be interesting to carry out further consideration here.

Furthermore, the influence of different weightings of personality types within the risk assessment groups (e.g. grouped according to the Myers Briggs Type Indicator or the Big Five model) was not taken into account. Different personality types could have different risk aversion, which may have a positive effect on the sustainability of risk management supported decision making given appropriate weightings.

It also cannot be excluded that European legislation has an impact on the weighting of the influencing factors. The results are therefore applicable to the European legal area. Whether this also applies to other regions such as e.g. America and Asia would have to be analyzed in future research.

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1 THEORETICAL FOUNDATION OF ENTERPRISE RISK MANAGEMENT, GROUP COMPOSITION AND DECISION-MAKING IMPROVEMENT FACTORS

In order to implement and operate effective risk management processes, many dedicated responsibilities are assigned to the different employees. They all make an important contribution to the creation of risk assessments within the organization. The respective organizational structures play a key role in supporting the risk management processes. Individual and group-based decision-making processes are accorded just as much attention for the decision making as the influences from the social roles of the members of the process. In particular, by handling quality-based risk measurements or stochastic models and simulations will not work (e.g. fat tails) as effective risk assessment has to be done by human judgment.

1.1 Decision Making Theory

Decision theory is the part of probability theory that is concerned with calculating the consequences of uncertain decisions. This can be applied to state the objectivity of a choice and to optimize decisions. Below, the following aspects of decision theory has been discussed: risk appetite, risk attitude, expected value, expected utility, loss aversion and prospect theory.

To be an effective organization, it appears to be necessary to combine intuitive and analytical judgments (cf. Ju, B., Junwen, F., & Chenglin, M. 2007)(Kutschera, I., & Ryan, M.H. 2009)(Mintzberg, H., & Westley, F. 2001). Others take this a step further, asserting that intuitive judgment is an indispensable component of strategic aptitude and is thus of crucial importance to decision-makers (Hodgkinson, G. P., Sadler-Smith, E., Burke, L.A., Claxton, G., & Sparrow, P. R. 2009). For a long time, rationality was the dominant model, but this has been replaced for a number of reasons. For complex decisions, it is often difficult for the individual to get an overview of the complexity, conditions and predictability of the situation.

What's more, real life often differs significantly from "rational" decision-making processes, owing to a shortage of time and resources (Hodgkinson, G. P., Sadler-Smith, E., Burke, L.A., Claxton, G., & Sparrow, P. R. 2009). An intuitive approach is therefore often considered to be a good option for improving the quality of the decision-making process in complex situations (Shapiro, S., & Spence, M. T. 1997). Another option is to reduce the complexity of an existing problem at the start of a decision-making process. This is repeated until the complexity reaches

a manageable level. (Hauschildt, J., Gmünden, H. G., Grotz-Martin, S., & Haidle, U. 1983). In this case, decision making by business management can then be characterized by the following minimum criteria: (A) at least two alternatives, (B) at least one existing goal, which could be a resolution of the conflict or a problem, (C) change to previous behavior, (D) assessment of the alternatives while considering the resulting consequences, (E) evaluation of the outcomes (cf. Gzuk, R. 1975)(Hauschildt, J., Gmünden, H. G., Grotz-Martin, S., & Haidle, U. 1983).

Making a decision is not a one-off action; rather, it is a process that is carried out over a particular period. However, as well as achieving a particular purpose or improvement, the focus of the decision-making process is also on increasing the quality of decision making. Broadly speaking, the decision-making process can be considered to be a goal-oriented process which provides a basis for making a selection (Simon, H.A. 1997). However, before the ultimate outcome of the decision is reached in the form of the selection of one option from a range of alternatives, other cognitive sub processes come into play, such as the identification and evaluation of solutions. Administrative or business management decisions are primarily directed towards a specific goal and, indeed, can be identified as such by the selection of goals in the form of "value judgments" and their implementation in the form of "factual judgments". Decision making can be described as a process in which a series of alternatives are ruled out, one by one, until only one alternative remains (Simon, H.A. 1997). At the end of the day, all decisions are compromises.

The normative decision-making theory is mostly based on the rational choice theory. It aims to give advice on how ideal judgments or decisions should be made (cf. Gintis, H. 2005)(Koehler, D. J., & Harvey, N. 2004)(Laux, H., Gillenkirch, R. M., & Schenk-Mathes, H. Y. 2012).

To put it more generally, normative decision-making aims to support decision-makers by providing models for comparing possible outcomes of the various options available. A decision-making model is generally made up of decision-making rules and a decision-making field which includes alternatives, outcomes and the decision-making environment. It is only possible to make a rational decision if there are at least two alternatives to choose from. A decision-making model therefore always includes a minimum of two alternatives, which are evaluated considering their respective impacts. The consequences are generally incorporated into the model as goals. These goals express the consequences that the decision-maker must deal with if he or she selects a particular alternative. These goals are thus also an essential requirement

for making a rational decision (Laux, H., Gillenkirch, R. M., & Schenk-Mathes, H. Y. 2012). In essence there are three different attitudes towards risk: risk-seeking, risk-averse and risk-neutral.

In contrast to normative decision-making processes, which are designed to offer advice from a theoretical perspective, descriptive models of decision-making aim to describe the reality of how decisions are taken. These models consider how people really think and explain why an individual has reached a particular decision in a particular way. The objective of descriptive decision theory is to identify a workable hypothesis regarding individual or group behavior and to predict or control behavioral decisions in specific decision-making situations (cf. Camerer, C. F. 1997)(Koehler, D. J., & Harvey, N. 2004)(Laux, H., Gillenkirch, R. M., & Schenk-Mathes, H. Y. 2012). This distinguishes such models from rational or intuitive decision making and can, but does not necessarily, lead to the formation of a gulf as the phases of decision-making progress (Eisenführ, F., Langer, T., & Weber, M. 2010). This gulf between rational models and human behavior in decision making is the specific focus of "prospect theory" (Tversky, A., & Kahneman, D. 1992).

Table 1.1. Summary on literature results: Decision Making Theory

Main Authors	Findings
Ju, B., Junwen, F., Chenglin, M. (2007), Kutschera, I., Ryan, M.H. (2009), Mintzberg, H., Westley, F. (2001)	combining intuitive and analytical judgments is necessary to get an effective organization
Hodgkinson, G. P., Sadler-Smith, E., Burke, L.A., Claxton, G., Sparrow, P. R. (2009)	intuitive judgment is an indispensable component of strategic aptitude
Shapiro, S., Spence, M. T. (1997), Hodgkinson, G. P., Sadler-Smith, E., Burke, L.A., Claxton, G., Sparrow, P. R. (2009)	intuitive approach is a good option for improving the quality of the decision-making process in complex situations
Hauschildt, J., Gmünden, H. G., Grotz-Martin, S., Haidle, U. (1983), Simon, H.A. (1997)	reduce the complexity of an existing problem

Main Authors	Findings
Laux, H., Gillenkirch, R. M., Schenk-Mathes, H. Y. (2012)	normative decision making supports decision-makers by providing models for comparing possible outcomes of the various options available
Camerer, C. F. (1997), Koehler, D. J., Harvey, N. (2004), Laux, H., Gillenkirch, R. M., Schenk-Mathes, H. Y. (2012)	objective of descriptive decision theory is to identify a workable hypothesis and control behavioral decisions

Source: Author's compilation based on literature review

An essential element of enterprise risk management is the risk assessment, which can generally be divided into two main areas. On the one hand the quantitative risk assessment, often supported by stochastic procedures, and on the other hand the qualitative risk assessment, a procedure of human discretion. If the group composition of risk assessments and sustainability of risk management supported decision making is considered, it is essential to consider the decision making theory as well. The studies listed above show that there are proven approaches to improving quality, such as intuitive approach, reduce complexity, building models, which then has an impact on modelling the relation of group composition of risk assessments and the sustainability of risk management supported decision-making.

1.2 Organization Theory and Group Processes

An organization is "a structured social system consisting of groups of individuals working together to meet some agreed-on objectives" (Greenberg, J., & Baron, R.A. 2010).
Organizational theory is the study of organizations for the benefit of identifying common themes for the purpose of solving problems, maximizing productivity, and meeting he needs of stakeholders. Broadly organizational theory can be conceptualized as studying three major subtopics: individual processes, group processes and organizational processes.

In the following, the impact of group size on group processes is considered first. During recent decades, there has been a noticeable drive within research to investigate the impacts of group size on various aspects of group performance, attitudes of group members and interactions within the group. As early as the 1950s, research was being carried out into the effects of group size in terms of member engagement and leader emergence in groups with two to twelve

members. The findings showed that, in disproportionately large groups, the average engagement of the members falls. Groups having six members showed the best relationship between effective and efficient leadership (Bass, B.M., & Norton, F.T. 1951)(Gibb, J.R. 1951). If the group size is increased from 5 to 12 members, the consensus between members as to how to resolve the problem reduces. The drop in ability to reach an agreement is largely down to the growing number of individual opinions and ideas (Hare, A.P. 1952). The prevailing thought of the time, that larger groups would be of benefit to decision making, is borne out by studies showing that an increase in group size from two to six members improves the objectivity of a decision. As the group size approaches this figure (six members), the quality of the decisions becomes more consistent than for smaller groups. One possible explanation for this is that as the group size increases, so does the need for organization, especially where the decision to be made includes a large number of alternatives. Groups of three, four or five often fail to recognize the need for organization the task requires. In groups of six, the members are better organized in spite of the increased need for communication, meaning that they are better able to reach a decision more effectively (Ziller, R.C. 1957). Comparisons of group interactions within groups of two to six people demonstrated that, with 6 members, the solidarity and consensus is at its greatest, whereas groups with 4 members are most prone to conflict and dissent (Bales, R.F., & Borgatta E.F. 1955).

Since the end of the 1950s, a number of studies have focused on the impact of group size in connection with employee satisfaction. In this context, the optimum group size is 5 employees. Large groups have less effective leadership, are prone to conflict, and lack effective communication mechanisms. On the other hand, small groups are less inclined to be open about any dissatisfaction. However, behavioral studies have shown that these employees were more passive and stressed about restrictions to their interactions than members of larger groups with identical tasks (Slater, P.E. 1958). A current, similar study shows the advantages in terms of employee satisfaction of groups having four or five members. Groups smaller and larger than this both engender less employee satisfaction. The increase in satisfaction in these medium-sized groups can be attributed, firstly, to the increased presence of the members in smaller groups and the resulting increase in personal visibility of the individual members, and, secondly, to the fact that members of larger groups (e.g. groups having six or seven members) are often more dissatisfied owing to severe problems with communication and coordination in groups of this size (Hackman, R., & Vidmar. N. 1970). There is an increase in the quality of performance and productivity as the group size increases, but only where effective mechanisms

are in place for communication and coordination and there is the necessary freedom to make use of these. In this case, simple tasks were completed just as quickly in smaller groups as in larger groups (Thomas, E. J., & Fink C.F. 1963).

Now the influences of the group composition on decision-making processes are considered. Little is yet known about the influence of different personal characteristics within the team, and the relevant variables, such as personality, attitude and opinions, and decision-making functions within the group, are not easy to measure. Although teams have been investigated in terms of organizational form, strategies and practices, for example (cf. Finkelstein S., & Hambrick D.C. 1996), there are few studies considering the effects of changes to the variables listed above. The handful of studies that have been carried out in this field are concerned with the impact of demographic characteristics on changes within the decision-making processes (cf. Bantel, K., & Jackson, S. 1989).

What makes us do the things we do? Why would two individuals, in similar circumstances, choose two different options? The answer, in part, is motivation. Motivation drives behavior; it is the force behind an individual's decision to commit or not commit to certain acts or behaviors. The elements that make up what we call motivation are complex, unique for each individual, and generally dynamic through time. (Shuman, R. B. 2016). The roles we carry shape the way we see ourselves and help to define the behaviors we should exhibit, and those we should not. Roles also help us to clarify what is expected from others in terms of their roles and behaviors. Organization roles can help to clearly define boundaries between responsibilities of individuals and departments. (Barry, B., & Stewart, G. 1997). Personality is the unique and enduring traits, behaviors and emotional characteristics in an individual. Personality can either aid or hinder meeting work goals dependent on fit. (Boeree, G.C. 2008).

Finally, the area of group performance is considered part of the group decision. Research into group decision making has largely been concerned with the processes involved in converting lots of individual opinions or preferences into a group consensus. This was the basis for early work by theoreticians working in the field of social choice (cf. Arrow, K.J. 1963)(Black, D. 1958). Psychologists defined formal models for describing influential factors that lead to a consensus (Lorge, I., & Solomon, H. 1955)(Smoke, W., & Zajonc R.B. 1962). These topics furthermore gained attention at both the theoretical and empirical levels. Nevertheless, the

dominant paradigm behind the latest research into group decision making focused on information rather than on the fact that groups do not make the best use of this even when there is ample information available. Information is ignored and is not broadly disseminated within the group, leading to a new paradigm having multiple aspects of group decision making and its influence on society. The result was the formation of the "shared versus unshared information" paradigm, which has expanded in a host of interesting directions. A lot of current discussion focuses on the sharing of information within and by groups in order to achieve greater consensus in decision making. (Brauner, E., & Scholl, W. 2000)(Hinsz, V.B., Tindale, R.S., & Vollrath, D.A. 1997)(Kameda, T., Takezawa, M., Tindale, R.S., & Smith, C.M. 2002)(Larson, J.R., & Christensen, C. 1993).

In the traditional input-processing-output environments for teams and groups, the processes form the connection between input and output (Hackman, J.R. 1987). Current research has now accepted the more dynamic areas. It is concerned with the intrinsic way in which teams work and how the variables and output are structured (Ilgen, D.R., Hollenbeck, J.R., Johnson, M., & Jundt, D. 2005)(Marks, M.A., Mathieu, J.E., & Zaccaro, S.J. 2001). More recent studies are more likely to describe cognitive, motivational and affective states of teams, in contrast to studies about interactions between members within the teams. Group processes, on the other hand, describe the nature of interaction between team members (Marks, M.A., Mathieu, J.E., & Zaccaro, S.J. 2001). Communication remains a key process within a team. This is the means of passing on information and specifies how – and how effectively – teamwork can be carried out. Communication is also a crucial tool for management to coordinate other team members and thereby achieve collective goals. In particular, the correlations found between team communication and effective team performance are very telling (Hyatt, D.E., & Ruddy, T.M. 1997)(Campion, M.A., Papper, E.M., & Medsker, G.J. 1996). In this context, it is also important to consider team spirit. Team spirit is an affective, emotional state which reflects a common duty; it goes hand in hand with team pride, which arises from the experiences and interactions of team members.

Team spirit is a key indicator for the commitment of members to the team, and commitment in turn has a significant impact on team processes and their outcomes. New meta analyses provide overwhelming evidence of a clear positive correlation between team spirit and performance. (Beal, D.J., Cohen, R.R., Burke, M.J., & McLendon, C.L. 2003)(Gully, S.M., Incalcaterra, K.A., Joshi, A., & Beaubien, J.M. 2002).

Organizational culture is "a cognitive framework consisting of attitudes, values, behavioral norms, and expectations shared by the organization's members." (West, R., & Turner, L. 2004). Organizational cultures help to establish a sense of identity for employees within the organization and therefore can facilitate comfort and a greater likelihood of internalizing organization goals. Organizational culture also provides a status quo and maintains stability in processes, communication and role interaction.

Table 1.2. Summary on literature results: Organizational Theory and Group Processes

Main Authors	Findings	Group Size	Group Composition	Group Performance
Bass, B.M., Norton, F.T. (1951), Gibb, J.R. (1951)	relationship between effective and efficient leadership	X		
Hare, A.P. (1952)	consensus between members to reach agreements	X		
Ziller, R.C. (1957)	better communication	X		
Bales, R.F., Borgatta E.F. (1955)	group interactions	X		
Slater, P.E. (1958), Hackman, R., Vidmar. N. (1970)	employee satisfaction and conflict management	X		
Thomas, E. J., Fink C.F. (1963)	quality of performance and productivity	X		
Finkelstein S., Hambrick D.C. (1996)	attitude and opinions, and decision-making functions		X	
Bantel, K., Jackson, S. (1989)	demographic characteristics		X	
Shuman, R. B. (2016)	similar circumstances, different options		X	
Barry, B., Stewart, G. (1997), Boeree, G.C. (2008)	organization roles and personality		X	
Arrow, K.J. (1963), Black, D. (1958)	individual opinions or preferences into a group consensus			X
Lorge, I., Solomon, H. (1955), Smoke, W., Zajonc R.B. (1962)	factors that lead to a consensus			X
Brauner, E., Scholl, W. (2000), Hinsz, V.B.,	sharing of information within and by groups			X

Main Authors	Findings	Group Size	Group Composition	Group Performance
Tindale, R.S., Vollrath, D.A. (1997), Kameda, T., Takezawa, M., Tindale, R.S., Smith, C.M. (2002), Larson, J.R., Christensen, C. (1993)				
Hackman, J.R. (1987), Ilgen, D.R., Hollenbeck, J.R., Johnson, M., Jundt, D. (2005), Marks, M.A., Mathieu, J.E., Zaccaro, S.J. (2001)	processes and interactions between members			X
Hyatt, D.E., Ruddy, T.M. (1997), Campion, M.A., Papper, E.M., Medsker, G.J. (1996)	communication remains a key process within a team			
Beal, D.J., Cohen, R.R., Burke, M.J., McLendon, C.L. (2003), Gully, S.M., Incalcaterra, K.A., Joshi, A., Beaubien, J.M. (2002)	correlation between team spirit and performance			X
West, R., Turner, L. (2004)	organizational culture maintains stability in processes			X

Source: Author's compilation based on literature review

When analyzing the literature on organization theory with a focus on group processes, three main topics emerge based on the research questions of the dissertation: group size, group composition and group performance.

The literature review on organization theory and group processes shows that the group compositions have a significant influence on the decision-making processes. Personality, attitude, demographic characteristics and motivation are just a few aspects of this. These analyzes lead to a closer look at this area in the section's theory of personality types and theory of decision strategies.

Factors like interactions, performance, confiscation management and productiveness are decisively determined by the group size. It follows that the "group size" is a possible latent exogenous variable for a structured expert interview.

Looking at the subject area of the group performance, in particular the effects of communication, consensus skills, information flow and organizational culture are explored. For this there are again conclusions on the group compositions as well as possibly on latent exogenous variables of the causal model of this dissertation.

1.3 Theory of Personality Types

The definition of personality can be started with the following quotes:
"Personality is the dynamic organization within the individual of those psychophysical systems that determine his characteristics, behavior and thought" (Allport, G.W. 1937).
"The characteristics or blend of characteristics that make a person unique" (Weinberg, R. S., & Gould, D. 1999).
Both definitions emphasize the uniqueness of the individual and consequently adopt an idiographic view.
The idiographic view assumes that each person has a unique psychological structure and that some traits are possessed by only one person; and that there are times when it is impossible to compare one person with others. It tends to use case studies for information gathering.
The nomothetic view, on the other hand, emphasizes comparability among individuals. This viewpoint sees traits as having the same psychological meaning in everyone. This approach tends to use self-report personality questions, factor analysis etc. People differ in their positions along a continuum in the same set of traits.
We must also consider the influence and interaction of nature (biology, genetics etc.) and nurture (the environment, upbringing) with respect to personality development.
Trait theories of personality imply personality is biological based, whereas state theories such as Banduara's (1977) Social Learning Theory emphasize the role of nurture and environmental influence.

1.3.1 Trait Approach to Personality

This approach assumes behavior is determined by relatively stable traits which are fundamental units of one's personality. Traits predispose one to act in a certain way regardless of the situation. This means that traits should remain consistent across situations and over time, but may vary between individuals.

It is presumed that individuals differ in their traits due to generic differences.
These theories are sometimes referred to a psychometric theory, because of their emphasis on measuring personality by using psychometric tests.

Eysenck (1952, 1967, 1982) developed a very influential model of personality. Based on the results of factor analyses of responses on personality questionnaires he identified three dimensions of personality: extroversion, neuroticism and psychoticism.
During 1940s Eysenck was working at the Maudsley psychiatric hospital in London. His job was to make an initial assessment of each patient before their mental disorder was diagnosed by a psychiatrist. Through this position he compiled a battery of questions about behavior, which he latter applied to 700 soldiers who were being treated for neurotic disorders at the hospital (Eysenck, H.J. 1947).
He found that the soldier's answers seemed to link naturally with one another, suggesting that there were a number of different personality traits which were being revealed by the soldier's answers. He called these first order personality traits
He used a technique called factor analysis. This technique reduces behavior to a number of factors which can be grouped together under separate headings, called dimensions.
Eysenck (1947) found that their behavior could be represented by two dimensions: Introversion/Extroversion (E); Neuroticism/Stability (N). Eysenck called these second-order personality traits.

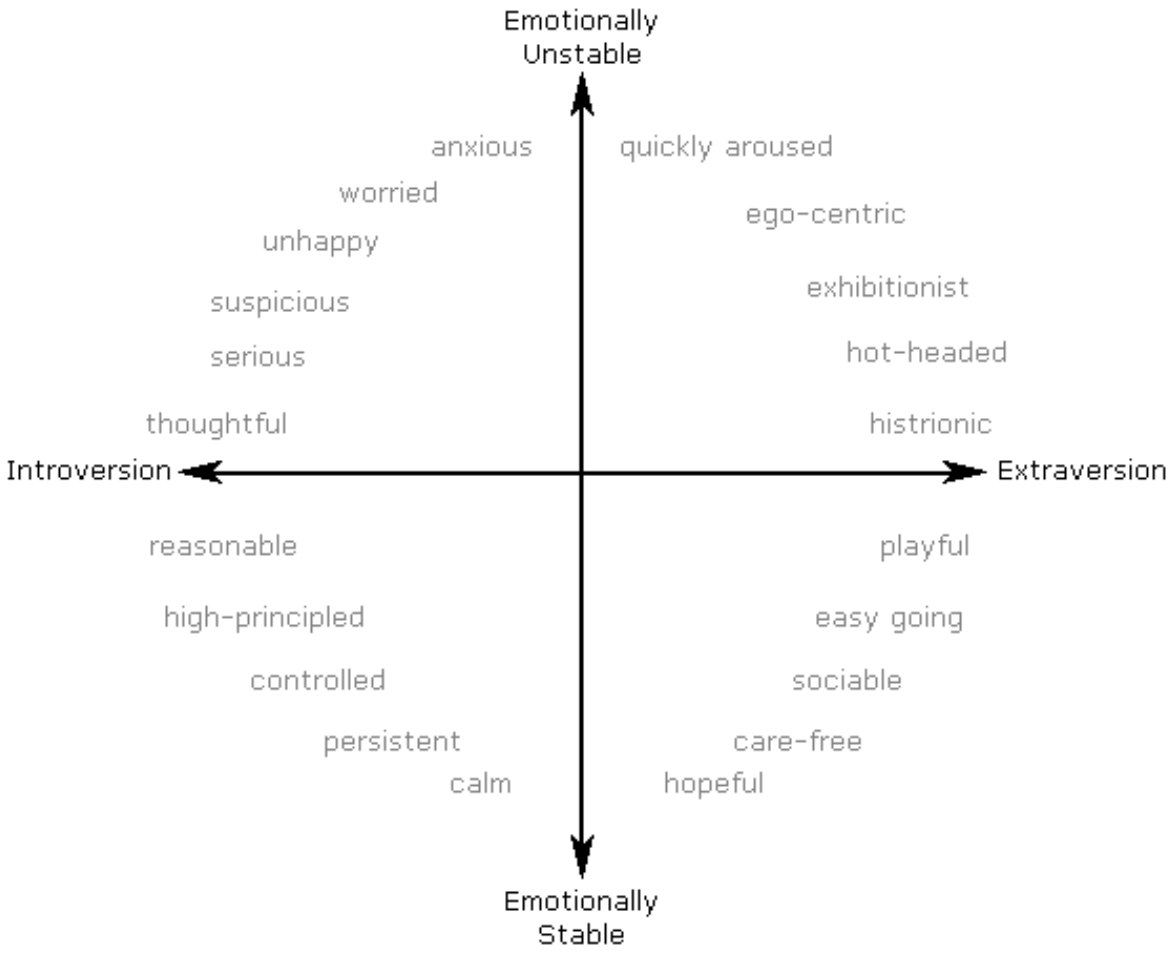


Figure 1.1. Eysenck traits theory of personality

Source: Eysenck, H.J., Eysenck, M.W. (1958). Personality and Individual Differences. *Plenum Publishing*

According to Eysenck, the two dimensions of neuroticism (stable vs. unstable) and introversion-extroversion combine to form a variety of personality characteristics.

- Extroverts are sociable and crave excitement and change, and thus can become bored easily. They tend to think less about the consequences of their actions, assuming a positive outcome.
- Introverts, by contrast, keep their inner feelings hidden and take time considering how to behave. They tend to be serious, reliable and pessimistic
- Neurotics tend to be anxious, worrying and moody. They are overly emotional and find it difficult to calm down once upset.
- Stables are emotionally calm, unreactive and unworried.

Eysenck (1966) later added a third trait / dimension - Psychoticism - e.g. lacking in empathy, cruel, a loner, aggressive and troublesome.

Eysenck related the personality of an individual to the functioning of the autonomic nervous system (ANS). Personality is dependent on the balance between excitation and inhibition process of the nervous system. Neurotic individuals have an ANS that responds quickly to stress.

1.3.2 Cattell's 16PF Trait Theory

Cattell (1965) disagreed with Eysenck's view that personality can be understood by looking at only two or three dimensions of behavior.

Instead, he argued that it is necessary to look at a much larger number of traits in order to get a complete picture of someone's personality.

Whereas Eysenck based his theory on the responses of hospitalized servicemen, Cattell collected data from a range of people through three different of sources of data.

- L-data - data from an individual's life record, such as educational qualifications, absence from work etc.
- Q-data - data from a questionnaire rating an individual's personality.
- T-data - data from objective tests designed to reveal the elements of a personality construct.

Cattell analyzed the T-data and Q-data using a mathematical technique called factor analysis to look at which types of behavior tended to be grouped together in the same people. He identified 16 personality traits / factors common to all people.

Cattell considered there to be a difference between what he called "source" and "surface" traits. Surface traits are very obvious and can be easily identified by other people, whereas source traits are less visible to other people and appear to underlie several different aspects of behavior. Cattell regarded source traits to be more important in describing personality than surface traits.

Table 1.3. Cattell's 16 personality traits

Descriptors of Low Range	Primary Factor	Descriptors of High Range
Impersonal, distant, cool, reserved, detached, formal, aloof	Warmth (A)	Warm, outgoing, attentive to others, kindly, easy-going, participating, likes people
Concrete thinking, lower general mental capacity, less intelligent, unable to handle abstract problems	Reasoning (B)	Abstract-thinking, more intelligent, bright, higher general mental capacity, fast learner
Reactive emotionally, changeable, affected by feelings, emotionally less stable, easily upset	Emotional Stability (C)	Emotionally stable, adaptive, mature, faces reality calmly
Deferential, cooperative, avoids conflict, submissive, humble, obedient, easily led, docile, accommodating	Dominance (E)	Dominant, forceful, assertive, aggressive, competitive, stubborn, bossy
Serious, restrained, prudent, taciturn, introspective, silent	Liveliness (F)	Lively, animated, spontaneous, enthusiastic, happy go lucky, cheerful, expressive, impulsive
Expedient, nonconforming, disregards rules, self-indulgent	Rule-Consciousness (G)	Rule-conscious, dutiful, conscientious, conforming, moralistic, staid, rule bound
Shy, threat-sensitive, timid, hesitant, intimidated	Social Boldness (H)	Socially bold, venturesome, thick skinned, uninhibited
Utilitarian, objective, unsentimental, tough minded, self-reliant, no-nonsense, rough	Sensitivity (I)	Sensitive, aesthetic, sentimental, tender minded, intuitive, refined
Trusting, unsuspecting, accepting, unconditional, easy	Vigilance (L)	Vigilant, suspicious, skeptical, distrustful, oppositional

Descriptors of Low Range	Primary Factor	Descriptors of High Range
Grounded, practical, prosaic, solution oriented, steady, conventional	Abstractedness (M)	Abstract, imaginative, absent minded, impractical, absorbed in ideas
Forthright, genuine, artless, open, guileless, naive, unpretentious, involved	Privateness (N)	Private, discreet, nondisclosing, shrewd, polished, worldly, astute, diplomatic
Self-Assured, unworried, complacent, secure, free of guilt, confident, self-satisfied	Apprehension (O)	Apprehensive, self doubting, worried, guilt prone, insecure, worrying, self blaming
Traditional, attached to familiar, conservative, respecting traditional ideas	Openness to Change (Q1)	Open to change, experimental, liberal, analytical, critical, free thinking, flexibility
Group-oriented, affiliative, a joiner and follower dependent	Self-Reliance (Q2)	Self-reliant, solitary, resourceful, individualistic, self-sufficient
Tolerates disorder, unexacting, flexible, undisciplined, lax, self-conflict, impulsive, careless of social rules, uncontrolled	Perfectionism (Q3)	Perfectionistic, organized, compulsive, self-disciplined, socially precise, exacting will power, control, self-sentimental
Relaxed, placid, tranquil, torpid, patient, composed low drive	Tension (Q4)	Tense, high energy, impatient, driven, frustrated, over wrought, time driven.

Source: Primary Factors and Descriptors in Cattell's 16 Personality Factor Model (adapted from Conn & Rieke, 1994)

Cattell produced a personality test similar to the EPI that measured each of the sixteen traits. The 16PF (16 Personality Factor Questionnaire, A-O original 12 factors and Q1-Q4 additional questionnaire factors), as it is known, has a total of 160 questions, with 10 questions relating to each personality factor.

1.3.3 Myers-Briggs Type Indicator

The MBTI, or Myers-Briggs Type Indicator, is a personality inventory designed to make C.G. Jung's theory of psychological types practical and useful in people's lives. It deals with what are considered natural personal preferences, not pathologies.
Isabel Briggs Myers and her mother, Katharine Cook Briggs, were the original developers of the MBTI commencing in 1942, and following almost two decades of study and observation. Since their deaths, others have carried on their work and the MBTI is being continually researched and developed.

The MBTI has been used effectively with individuals, groups and organizations throughout the world (there are a number of translations). There are a wide range of applications, including careers, communication, conflict resolution, counselling, management and leadership, relationships, teaching and learning, teamwork, personal and spiritual development etc.
There are various MBTI Forms. They all present a series of forced-choice questions, in phrase and word pair format. Each question, or item, relates to a preference of one of 4 sets of psychological opposites:

- Extroversion vs. Introversion
- Sensing vs. Intuition
- Thinking vs. Feeling
- Judgment vs. Perception

The 4 scales on the MBTI represent these opposites. They do not claim to say everything about these opposites.
The 4 dichotomies above give a total of 16 different combinations, or personality types, when all the various options are taken into account. Here, each personality type is represented by one of the two opposite qualities in each of the four pairings. Each personality type can be assigned a 4-letter acronym of corresponding combination of preferences:

Table 1.4. The 16 personality types

ESTJ Efficient Driver	ISTJ Responsible Executors	ENTJ Strategic Directors	INTJ Visionary Strategists
ESTP Dynamic Mavericks	ISTP Nimble Pragmatics	ENTP Innovative Explorers	INTP Expansive Analyzers
ESFJ Committed Builders	ISFJ Insightful Motivators	ENFJ Engaging Mobilizers	INFJ Insightful Motivators
ESFP Enthusiastic Improvisers	ISFP Practical Custodians	ENFP Impassioned Catalysts	INFP Inspired Crusaders

Source: Adapted from "Introduction to Type and Leadership" by Sharon Lebovitz Richmon

The first letter in the personality type acronym corresponds to the first letter of the preference of general attitude - "E" for extroversion and "I" for introversion.

The second letter in the acronym corresponds to the second dichotomy, with "S" standing for sensing and "N" for intuition.

The third letter in the personality type acronym corresponds to preference within the thinking-feeling pair: "T" stands for thinking and "F" stands for feeling.

The forth letter in the personality type acronym corresponds a person’s preference within the judging-perceiving pair: "J" for judging and "P" for perception.

The MBTI is a way of determining psychological preferences, rather than a measure of skills or abilities. Scores on the MBTI are like votes for one side or another, where each option is considered good, or valuable. People completing the MBTI can leave out questions where they like neither or all of the options presented. Isabel Myers did not want one to give false data about preferences.

Clarity of preference on a scale relates to a level of confidence that the result is correct for the person completing it. Scores are therefore not related to any notion of development, or lack of development. The MBTI is used effectively with individuals, groups and organizations throughout the world (there are a number of translations).

Not everyone can use the MBTI. Its publisher, CPP Inc, Sunnyvale, CA, has approved MBTI Qualifying Workshops to train eligible people to correctly understand and use it at a fundamental level.

1.3.4 The Big Five Personality Model

The Big Five model is a personality model which integrates the various personality traits and sets the foundation for a common taxonomy of personality dimensions. A personality dimension is a broad and stable factor of clustered characteristics which explains emotional, behavioral and cognitive patterns. In contrast to earlier typologies, people are characterized on a continuum from low to high values rather than as types (either or). Two of the five dimensions since incorporated into the Big Five model were originally described by Hans Jürgen Eysenck (1947) in his model of personality:

Extroversion (E): The concept of this as a factor was first considered by Jung (1921). Jung observed that people are either outward oriented (extroversion) or inwards oriented (introversion). Later, Eysenck (1947) used Extroversion as one of the major dimensions of his personality model. Extraverted people are characterized as talkative, assertive, active, energetic, and outgoing. The opposite is Introversion. Studies have shown that Extroversion is a prerequisite for successful managers. Extroversion correlates with leadership and general job performance (Lim, B., Ployhart, R.E. 2004). Often external persons are more satisfied with their job (Judge et al. 2002).

Neuroticism (N): The second factor of Neuroticism is independent of Extroversion and describes people as tense, anxious and nervous. The opposite of Neuroticism is Emotional Stability. Persons with high scores on the Neuroticism dimension are often less able to withstand stress and have a higher risk for psychological problems such as burn-out and depression.

These two main dimensions have been confirmed by numerous researchers and methodologies, e.g. by the lexical approach (Allport, G.W. 1937). The basic assumption of the lexical approach is that all important human qualities are reflected in the language. From the extensive analysis of adjectives and word lists, the two factors Extroversion and Neuroticism have been replicated and today they are included in the vast majority of all personality tests. In addition to these main dimensions, the lexical approach extracted three additional dimensions (Norman, W.T. 1963),

which also have been confirmed by other research. All five dimensions have been coined as the Big Five Factors by Goldberg (1981).

The additional three factors are:

Consciousness (C). People with high values in this dimension are described as organized, thorough, tactical and efficient. This factor turned out to be one of the most effective factors in predicting job performance. It is highly related to integrity (Hankes, J. 2011).

Openness (O): People with high values have wide interests, are imaginative, often intelligent and original. While Extroversion and Consciousness are important in a stable and predictable working environment, Openness plays an important role in transition phases such as reorganization and uncertainty.

Agreeableness (A): People with high values are described as sympathetic, kind, appreciative and warm. Agreeableness is often unrelated to job performance but positively correlated with team building and a productive working group climate. On an individual level, Agreeableness increases the chances of being selected for a job.

Various online tests (B5T) have been developed to measure the dimensions of the Big Five personality model. The online test consists of 50-Likert items and has been implemented on several German web pages using an open web service technology. It fulfills the need for easy to understand and short online tests in recruitment processes.

All scales have been proven to be reliable measures with an internal consistency between ,70 (Openness) and ,88 (Neuroticism).

A factor analysis confirmed the expected structure with five factors – one for each dimension of the Big Five personality model. The inter correlations where in line with the inter correlations of a meta-analysis reported by Van der Linden et al. (2010). Thus, the factorial structure as well as the inter correlation pattern provided strong evidence for the construct validity of the five scales.

In addition, analysis of variance revealed significant differences between job categories. Self-employed people achieved the highest values for Openness, and the lowest for Neuroticism. Clerks scored high on Consciousness and unemployed people showed the highest values for Neuroticism.

To clarify further the relationship between the Big Five scales of the B5T and job performance, the income for company employees has been analyzed. Differences in income were explained by gender, age and qualification. Beyond that, the Big Five scales, Neuroticism, Openness and Agreeableness were able to explain additional variance, whereas Extroversion and

Consciousness both failed to predict income in this equation. On the one hand, the results highlight the importance of the Big Five dimensions for job performance; one the other hand, it is unclear why Extroversion and Consciousness had no impact on income. One reason may be that income is mostly linked to collective labor agreements in Germany. Further analysis may show that Extroversion is a predictor of income in other job categories, e.g. for the self-employed.

In sum, this study shows that the B5T is already a reliable and valid measure of the Big Five personality model. Further enhancements of the B5T will improve the reliability of all scales to the COTAN level of at least ,80. In addition, scales are needed to deal with faking good tendencies. The current version is suitable for pre- selection / screening of candidates to reduce the risk for false negative decisions. Results should be validated by subsequent process steps such as interviews and assessment center.

Table 1.5. Summary on literature results: Theory of Personality Types

Main Authors	Findings
Eysenck, H.J. (1952, 1967, 1982)	individuals differ in their traits due to generic differences
Eysenck, H.J. (1947)	Extroverts tend to think less about the consequences of their actions, assuming a positive outcome
Eysenck, H.J. (1947)	Introverts tend to be serious, reliable and pessimistic
Eysenck, H.J. (1947), 166)	Neurotics are overly emotional and find it difficult to calm down once upset
Eysenck, H.J. (1966)	Stables are emotionally calm, unreactive and unworried
Cattell, R.B. (1965)	collected data from a range of people through different of sources of data means many different personality types
Allport, G.W. (1937), Shields, J. (1976), Loehlin, J.C., Willerman, L., Horn, J.M. (1988)	personality is biologically determined at birth, and shaped by a person's environmental experiences
Eysenck, H.J. (1947), Jung, C.G. (1921), Lim, B., Ployhart, R.E. (2004), Norman, W.T. (1963), Allport, G.W. (1937), Goldberg, L.R. (1981), Hankes, J. (2011), Van der Linden, D., Jan te Nijenhuis, J., Bakker, A.B. (2010)	Big Five Personality Model integrates the various different personality traits and sets the foundation for a common taxonomy of personality dimensions

Source: Author's compilation based on literature review

Based on the analysis of the literature review on organization theory in relation to group processes, it has become clear that due to the importance of group compositions, the field of "Theory of Personality Types" is one of the possible differentiation characteristics within groups is to be considered closer.

On the general view of personality differences such as extroverted, introverted, etc. spreads over a wide range of different personality types. The Myers-Briggs Type Indicator differentiates between a total of 16 different combinations, the Big Five model in 5 main groups. Assessments and interviews make a corresponding structured individual personality analysis possible.

The influence of the "personality types" on the groups compositions and thus on the decision-making processes shown in the literature and in the research results makes it clear that "personality type" is another possible latent exogenous variable for the structured expert interview.

1.4 Theory of Decision Strategies

Initial research into strategic corporate management was carried out in around 1960. A few pivotal works formed the starting point for this research. These studies introduced the concept of strategy into corporate management. Empirical studies of large US companies showed that the development of business structures was aligned with corporate strategy (Chandler, A.D. 1962). Another significant study was concerned with the analysis and development of strategy. This laid the foundation for the traditional understanding of strategy, whereby strategies are developed on the basis of an analysis of the corporate environment and of the company itself (Andrews, K.R. 1971). A model for strategic planning was also created (Ansoff, H.I. 1965). This was concerned with strategic orientation, as well as with competitive advantages and synergies.

Strategic corporate management began in practice with a conference at the University of Pittsburgh in 1977. This gave the necessary impulse for the dissemination of strategic thinking in practice. The stages of development of strategic corporate management can be subdivided into financial planning, long-term planning, strategic planning and strategic corporate management (cf. Knyphausen-Aufseß, D. 1995).

The theory of decision strategies has a decisive influence on corporate management and management research, and for this reason is also a core area in business theory and practice for

risk management evaluation. In the context of risk management, strategic decisions are decisions that have a fundamental impact on company performance or output.

The role of corporate management can be divided into the areas of normative, strategic and operational activity. The normative level is superior to strategic corporate management and gives the company its identity. This is also where corporate goals and missions are set. The strategic level is concerned with determining ways to achieve the goals. This involves the creation of new opportunities for success and the development of existing opportunities. The operative level is where these opportunities are maximized, and the success of the company is realized. The different levels of management are closely interlinked, forming an integrated system (Bamberger, I., & Wrona, T. 2004).

Reaching decisions is the most important criterion for being a Manager. There is a distinction between Routine decisions as recurring decisions which can be made in the same way each time and Management decisions.

Management decisions are required when a new combination of production factors opens up new opportunities to achieve goals. In this context, management decisions relate to innovation. Strategic decisions relate to the use of Strategy as a medium for Corporate policy. These are required wherever new Methods and combinations of ways to implement corporate goals are introduced (cf. Eisenhardt, K., & Zbaracki, M. 1992). Here, it is not only the combinations of ways mentioned above that play a key role; it is also the composition of the decision-making body, which has been looked at in more detail in the paragraphs which follow.

The first essential aspect is the consideration of the professional background of the group members. Very early on, research into strategic decision making was expanded to include the area of group composition and, as a subset thereof, to consider the professionalism or professional background of group members. When classifying the strategies in conjunction with the composition of the groups, particular attention was paid to "routine decision making" (Delbecq, A.L. 1967). The term "routine" essentially covers the two main aspects that can be considered to be influencing factors in relation to professional background: time and information. While the time aspect is easy to outline, the aspect of information requires further explanation. "Information is something that changes the state of its recipient or, more specifically, the knowledge state. A slight variation is to say that information is what determines a decision or allows a choice to be made. Making a decision represents a change of state (from undecided to decided) on the part of the decision-maker. A message understood by the recipient

and which changes that person's knowledge base" (Choo, C.W. 2002). The strategic role of information in decision making is clearly associated with the fact that the level of knowledge and, very probably, the decision made by the relevant parties is altered through the use of information. Such information reduces uncertainty in decision making and is thus a key factor for the overall decision-making process (Rowley, J. 1998). It can be inferred from this that the professional background, a combination of time and information, has a crucial influence on decision making.

The next aspect is the influence of age structure on decision making. Process models that are concerned with age and decision making have shown that older individuals rely more on emotions and experiences and less on facts than is the case for younger people (Peters, E., Hess, T.M., Västfjäll, D., & Auman, C. 2007). Cognitive ability and everyday experience are drawn on to a greater extent, with rationality playing an ever decreasing role in decision making in old age (Babcock, R. L., & Salthouse, T.A. 1990)(Verhaeghen, P., Marcoen, A., & Goossens, L. 1993).

Intuition backed up by emotional and affective abilities can therefore have increasing significance in old age. Older individuals generally compensate for age-related cognitive decline by relying increasingly on their capacity to react quickly based on their wealth of experience. However, this does not undermine the assertion that, as individuals get older, rationality is increasingly replaced by intuition and spontaneity when it comes to the decision-making profile (Blanchard-Fields, F., Mienaltowski, A., & Seay, R.B. 2007)(Charles, S.T., & Carstensen, L.L. 2010). It is recommended that research into age and decision making additionally takes account of the way in which the processes are designed. Older adults (aged 65-94) delegate decisions more frequently than younger adults (aged 18-64) (Finucane, M. L., Alhakami, A., Slovic, P., & Johnson, S.M. 2000). A further study investigated the influence of age on the outcome of a decision (Slovic, P. 1972). This showed that previous experience in making that particular type of decision had little influence on the outcome of the next decision of the same type.

However, since there are differences in decision-making strategies between older and younger managers which can be ascribed to a greater experience of decision making among older managers, this study takes a statistical approach to strip out the influence of experience. This showed, however, that different types of decision-making process were used to achieve

different outcomes at different levels of management. This can be attributed to the fundamental difference between age and professionalism (Slovic, P. 1972).

The gender-specific differences in the decision-making process are also examined. Research in various academic fields has shown that one of the key factors characterizing individuals and their social and economic behavior is the difference between the genders. Women are classified as "intuitive" while men are classified as "rational". On the other hand, however, research into decision making has found no such clear distinction between intuitive and rational methods of decision making (Sadler-Smith, E. 2011).

When asking people to describe feelings about winning or losing a competition, women use more intuition and men more reason (Sinclair, M., Ashkanasy, N.M., & Chattopadhyay, P. 2010).

Studies dealing with different age structures in decision making also found, as a secondary outcome, no significant differences between the genders (Baiocco, R., Laghi, F., & D'Alessio, M. 2009)(Spicer, D.P., & Sadler-Smith, E. 2005). Gender stereotypes see women as being more interpersonally oriented while men are more independent and individualistic (Gilligan, C. 1982). This points to the fact that men and women also differ when it comes to the extent to which they involve others in the decision-making process. (Phillips, S.D., Pazienza, N.Y., & Ferrin, H.H. 1984). Moreover, women are more inclined to seek support for their decisions than men (Tamres, L.K., Janicki, D., & Helgeson, V.S. 2002). In general, studies have shown that, for women, decision making is more likely to have an interpersonal element than is the case for men.

Corresponding studies and experiments have shown that there are gender-specific differences in risk behavior. Women are more risk-averse than men, more susceptible to social signals and less competitive (Croson, R., & Gneezy, U. 2009). A further interesting finding is that, as a continuation of the corruption experiments, it has been shown that women, when involved in a corrupt transaction, are more likely to let the transaction fail. This is not because women are somehow more honest, but rather because their behavior is more opportunistic when they have the chance to breach an implicitly corrupt contract (Ergun, S., Fernanda Rivas, M., & García-Muñoz, T. 2012). Several studies have shown that differences between the genders are tempered by experience and occupation. A random sample of fund managers has indicated that there are no differences between the genders when it comes to ways of managing risk. Although differences were identified between employees without leadership roles, this was not found in

management positions (Atkinson, S.M., Baird, S.B., & Frye, M.B. 2003)(Powell, M., & Ansic, D. 1997).

The influence of cultural aspects on decision making also requires special consideration. Several studies have determined a link between culture and cognition, emotion and motivation. People from different cultures differ in their perception of the world in general, and more specifically in their preferences, judgments and decisions (Nisbett, R.E., Peng, K., Choi, I., & Norenzayan, A. 2001). In particular, the desire to provide support is based on cultural norms and values. Although helpful behavior is common to all cultures, there are significant differences in motivation between Western and Eastern culture (Barrett, D.W., Wosinska, W., Butner, J., Petrova, P., Gornik-Durose, M., & Cialdini, R.B. 2004)(Levine, R.V., Norenzayan, A., & Philbrick, K. 2001).

Cultural perceptions act as a mental framework for the decision based on moral awareness and political behavior (Tenbrunsel, A.E., & Messick, D.M. 2004). The reaction of the individual to difficult problems or situations such as the use of weapons, abortion or environmental issues such as climate change and pollution are heavily shaped by cultural engagement and involvement (Kahan, D.M., & Braman, D. 2006). Personal viewpoints are influenced and shifted by general perspectives within the same cultural environment, regardless of the actual situation. This is even true to the extent that cultural obligations take precedence over the facts when it comes to important political issues (Kahan, D.M., & Braman, D. 2006). The behavioral ethics of a large social hierarchy are largely based on cultural facts (Mayer, D.M., Kuenzi, M., & Greenbaum, R. 2009) and relate in particular to individual behaviors within the framework of the general moral code of conduct in the specific case (Treviño, L. K., Weaver, G. R., & Reynolds, S. J. 2006).

Table 1.6. Summary on literature results: Theory of Decision Strategies

Main Authors	Findings	Professional Background	Age	Gender	Culture
Chandler, A.D. (1962), Andrews, K.R. (1971), Ansoff, H.I. (1965), Knyphausen-Aufseß, D. (1995)	development of strategies on the basis of an analysis of the corporate environment				

Main Authors	Findings	Professional Background	Age	Gender	Culture
Bamberger, I., Wrona, T. (2004)	different levels of management are closely interlinked by forming an integrated system				
Eisenhardt, K., Zbaracki, M. (1992)	strategies are required wherever new Methods and combinations of ways to implement corporate goals				
Delbecq, A.L. (1967) , Choo, C.W. (2002)	strategic decision making was expanded to professionalism and professional background of group members	X			
Rowley, J. (1998)	professional background, a combination of time and information, has a crucial influence on decision making	X			
Peters, E., Hess, T.M., Västfjäll, D., Auman, C. (2007), Babcock, R. L., Salthouse, T.A. (1990), Verhaeghen, P., Marcoen, A., Goossens, L. (1993)	cognitive ability, experience and rationality playing different age-based roles		X		
Blanchard-Fields, F., Mienaltowski, A., Seay, R.B. (2007), Charles, S.T., Carstensen, L.L. (2010)	compensation of age-related cognitive decline by experience		X		
Finucane, M. L., Alhakami, A., Slovic, P., Johnson, S.M. (2000)	older members delegate decisions more frequently than younger members		X		
Slovic, P. (1972)	fundamental difference between age and professionalism		X		
Sadler-Smith, E. (2011), Baiocco, R., Laghi, F., D'Alessio, M. (2009), Spicer, D.P., Sadler-Smith, E. (2005)	no clear gender-based distinction between intuitive and rational methods of decision making			X	
Sinclair, M., Ashkanasy, N.M., Chattopadhyay, P. (2010)	in certain cases, women use more intuition and men more reason			X	
Gilligan, C. (1982), Phillips, S.D., Pazienza, N.Y., Ferrin, H.H. (1984), Tamres, L.K., Janicki, D., Helgeson, V.S. (2002)	for women, decision making is more likely to have an interpersonal element than is the case for men			X	
Atkinson, S.M., Baird, S.B., Frye, M.B. (2003), Powell, M., Ansic, D. (1997)	risk behavior differences between the genders are tempered by experience and occupation			X	
Nisbett, R.E., Peng, K., Choi, I., Norenzayan, A. (2001), Barrett, D.W., Wosinska, W., Butner, J., Petrova, P., Gornik-Durose, M., Cialdini,	preferences, judgments and decisions are based on cultural norms and values				X

Main Authors	Findings	Professional Background	Age	Gender	Culture
R.B. (2004), Levine, R.V., Norenzayan, A., Philbrick, K. (2001)					
Tenbrunsel, A.E., Messick, D.M. (2004), Kahan, D.M., Braman, D. (2006), Mayer, D.M., Kuenzi, M., Greenbaum, R. (2009)	personal viewpoints are influenced and shifted by general perspectives within the same cultural environment				X

Source: Author's compilation based on literature review

Further differentiation features, based on the analyzes of the literature review on the organization theory in relation to group processes, which have resulted from the importance of group compositions, can be found in the theory of decision strategies.

The literature review on the theory of decision strategies has shown that aspects such as professional background, age, gender and culture have a decisive influence on decision making, among other factors.

A special position has taken the evaluation of the influence of gender in the evaluation of the literature review. The different authors have received partly inverse results in their research. The question whether this is due to the fact that gender-specific behavior is often overlaid by socially-specific behavior remains unanswered. The influence of professional background, age, gender and cultural influences on the composition groups and thus on the decision-making processes shown in the literature and in the research results makes it clear that these four classifications contain further possible latent exogenous variable for the structured expert interview.

1.5 Risk Management Terminology and Theory

An international standard for risk management was published for the first time in 2009. As it is common for international standards, a general framework for implementing risk management was defined. This standard is known as ISO 31000. However, to delve more extensively into the concept, it is necessary to define and explain the individual terms.

1.5.1 Definition of Risk in Relation to Risk Aversion

When considering the definition of risk in relation to risk aversion, reference is often made to a study (Dachraoui, K., Dionne, G., Eeckhoudt, L., & Godfroid, P. 2004), which, in detail, states that: "The link between the structure of an agent's utility function and his risk-reducing actions can be subtle. Further to the input by Ehrlich and Becker (1972), who advanced the concepts of self-protection and self-insurance, Dionne and Eeckhoudt (1985) demonstrated that a more risk-averse person, as proposed by Arrow-Pratt, does not necessarily generate more self-protection activities. The article on willingness to pay (Drèze, 1962; Jones-Lee, 1974; Pratt and Zeckhauser, 1996) proposes another example. It is widely accepted that a more risk-averse decision-maker is not necessarily willing to pay more for lower likelihood of an accident (Eeckhoudt, Godfroid, and Gollier, 1997). In a third example, McGuire, Pratt, and Zeckhauser (1991) proposed that more risk-averse individuals might choose riskier decisions (lower insurance and greater gambling) than less risk-averse individuals. They concluded that this depends on the probability of critical endogenous switching" (Dachraoui, K., Dionne, G., Eeckhoudt, L., & Godfroid, P. 2004).

Another study from Rothschild and Stiglitz shows that in many economic applications involving risk and uncertainty, a simple concave transformation of a von Newmann-Morgenstern utility function or an Arrow-Pratt increase in risk aversion, not always intuitive changes in the decision variables affecting the probability of events or distribution functions. Individual behavior affects the probability of events and also their contingent outcomes. This alters the dispersion of results, but does not necessarily increase the risk as proposed by Rothschild-Stiglitz (Rothschild, M., & Stiglitz, J.E. 1970)(Dachraoui, K., Dionne, G., Eeckhoudt, L., & Godfroid, P. 2004).

Accordingly, to predict (risk-averse) decision-makers' behavior, it is imperative to limit either utility or distribution functions considering account actions, such as self-protection, which can affect all distribution moments. The following chapter deals with the limitations on utility functions. With regard to an analysis of restrictions on distribution functions and with regard to restrictions on loss functions.

Most utility functions commonly used in economics and finance, such as the logarithmic and the power functions, have derivatives with alternating signs showing positive odd derivatives and negative even derivatives. The class of utility functions with this property, which has become known as mixed risk aversion (MRA), has been characterized (Caballè, J., &

Pomansky, A. 1996) by the measure which describes a mix of exponential functions. It has been demonstrated that stochastic dominance and aggravation-of-risk concepts are more operative when applied to this class of utility functions (Caballè, J., & Pomansky, A. 1996).

Although political risk is often cited in articles on international business, no consensus on the precise meaning of the term has been achieved to date. The definitions of political risk range widely between a general risk, exemplified in the definition which suggests that "political risks are all non-business risks such as creeping expropriation" (Truitt, J. F. 1970), and the specific risk, as used by the Commission on Foreign Investments in its survey of international business. The further work in this area discussed the use of information to create quantifiable risk from uncertainty. The fourth category is similar to the third in that the authors discuss political risk within a general environmental context, but differs in that there is no detailed searching for, or definition of, a concept of political risk. Some authors (Drake, R. L., & Prager, A. J. 1977)(Dymsza,W. A. 1972)(Green, R. T. 1972) do not define political risk per se. Rather, they acknowledge a source of risk to international business generated by the political environment. On closer examination, however, the articles are found to define political event risk rather than political risk. This situation is unsatisfactory. Politics is a continuous process rather than a discrete series of events. The definition of political risk would be improved were it to evolve in terms of process variables rather than event variables. In summary, an operational definition for inclusion in the investment decision process of an international company is still in the early stages of development. As has been noted (Kobrin, S. J. 1979), four factors have restricted this. First, a distinction between events in the political environment affecting international business and those that are not ambiguous. Secondly, it has been proved difficult to establish an explicit relationship between environmental processes (continuous versus discontinuous change) and decision-makers' perceptions (uncertainty versus risk) to the extent that it can be incorporated into the investment decision model. Thirdly, research literature has focused on discontinuous change, with the remaining elements of the political environment receiving only superficial treatment. Forth, the focus of the articles on the negative aspects of government intervention implies an assumption of universal validity, something that is doubtful. Implicit in this is the assumption, well supported by literature, that the political environment should be considered as distinct from the economic environment, despite their obvious interrelationship, when analyzing the impact on the international business. Attempts to form a predictive relationship based on stochastic processes (Haendel, D. H., West, G.T., & Meadow, R.G. 1975)(Rummel, R.J., & Heenan, D.A. 1978) assume that the relativity of uncertainty can be converted into risk.

Kobrin enlarges on risk and uncertainty by identifying uncertainty as being either objective or subjective in relation to the associated risk. He quotes that "if uncertainty is objective, the contribution of political events to business risk is a function only of the events themselves," whereas "if uncertainty is subjective, the contribution to business risk is a function of both the events themselves and the decision-makers' perceptions" (Kobrin, S. J. 1979).

With objective uncertainty there is only uncertainty about the outcomes. Subjective uncertainty, on the other hand, considers not only the outcomes, but how likely these are to occur. Typically, international business evaluation and assessment of host country political environments are not formally organized. Although most companies regard political risk as having a serious influence on foreign investment decisions, in general they do not have a structured management function with which to assess its impact. One study (Basi, R.S. 1963) on determinants of foreign investment established that political risk was a major determinant, a finding reinforced in further research (Aharoni,Y. 1966)(Hays, R.D. 1974), which also confirmed Basi's other conclusion about a lack of systematic assessment and evaluation of this risk. An absence of formal risk evaluation procedures has been noted (Piper, J.R. 1971), and identified as a malaise not confined to international business but more common in domestic and foreign investment decision making. The way political risk is dealt with here by the methodologies demonstrates how hard it is to develop real world models. The first step towards achieving this is the establishment of models addressing the ongoing nature of the political environment rather than rationalizing it into a series of events. The consequences of an international business decision do not suddenly appear simultaneously following an "event of political instability." Hence a functional approach to variable analysis is unrealistic. There needs to be an awareness of the nature of political risk as a gradually changing entity, the consequences of which also change gradually and not at the same rate.

1.5.2 Enterprise Risk Management and Underlying Theoretical Concepts

The common ground of risk management and decision theory can be found in the primary issue that both attempt to deal with, which is uncertainties. Furthermore, risk management assesses these uncertainties and manages them, which includes prioritizing of and responses to risks. When information on the decision-maker's risk taking behavior is available, decision theory can prioritize risks and prescribe how to react to them numerically. This prioritization can be done by applying the calculations for various theories such as expected value, expected utility

and prospect theory on the cells of the risk matrix. To gather an adequate amount of information to make these mathematical approaches, indifferences for gains, losses and mixed prospects need to be sought and evaluated.

This dissertation presents a method of assessing risk appetite by applying a risk matrix. This method involves a risk reduction task, where one risk is present in every cell of a 5- by-5 risk matrix. Reduction, though not complete transfer, of these risks is done on a cell by cell basis, with invariable costs per move. The experiment is incentivized to reflect a real organization that manages a portfolio of risks. A realistic situation is realized by introducing:

- An endowment which serves as a budget to reduce risks
- A financial buffer which can absorb impacts to a specific threshold and imposes a goal to reach
- A reward system, which pays out an amount of money based on whether and to what level the goal has been reached

The residual risk matrix presents a measure of risk appetite for specific available resources, difficulty of objective and costs of control.

It shows that risk management forms a husk, in which risks are acknowledged, assessed and dealt with on mostly a qualitative basis. By expanding risk management with decision theory, it is possible to suggest a course of action to deal with risks on a quantitative basis. Establishing part of the basis for this expansion of risk management can be done with the presented experiment.

Theoretical concepts of enterprise risk management also need to be considered. Risk is the possibility that an event will occur and adversely affect the achievement of objectives. Risk management is the process that attempts to manage the uncertainty that influences the achievement of objectives, with the goal of reaching the objectives and thus creating value for the organization in which it is applied (COSO, 2004). In order to accomplish this goal, it is necessary to constantly apply risk management throughout all of the aspects of an entity.

Risk management attempts to identify risks and take appropriate action to diminish their impending effects on an organization. As the process of risk management is rather abstract, several risk management standards, such as COSO from the Committee of Sponsoring Organizations of the Treadway Commission, FERMA from the Federation of European Risk Management Associations and CAS from the Casualty Actuarial Society, have been developed. The guidelines offered by these standards are broadly applicable and make it possible to

approach risks in a great variety of contexts, from financial portfolio risk to health care and from oil drilling to organizing sports events.

1.5.3 Theoretical Analysis of Risk Measurement Methods

Evaluation methods in risk management are divided into two groups: qualitative and quantitative methods.

Qualitative methods concern themselves with the observation and analysis of a risk's causes and effects. An example for qualitative methods is a simple diagram developed by Kaoru Ishikawa in 1943, which is used in the event of problems within a company to provide an effective analysis of cause and effect. The Ishikawa diagram considers the cause and effect of a problem separately from one another. As part of the process, the causes that may lead to a problem are subdivided into main causes and secondary causes. The various groups of causes are structured and drawn up into a diagram. The main variables are usually divided into six areas, which are each represented by a visual grid in the diagram. Methods such as brainstorming, mind mapping and group discussion are very useful for identifying the main variables for a problem (risk), and are often used in practice (cf. Kamiske, G., & Brauer, J. 2003)

One tool for identification and qualitative evaluation of risks is Failure Mode and Effect Analysis (FMEA). This is a systematic methodology that enables subjective assessment of the occurrence of certain logistical risks. Well before risks arise, investigations are carried out as to the likelihood of the risk and the impact thereof in order to develop preventive measures; these can also be applied to risks that have already been identified. For this reason, The FMEA methodology is classed as an inductive method of risk analysis in the supply chain (Richard, O. 1999)(Bobzien, M., Stark, W., & Strauss, F. 1996). One key goal of the FMEA methodology in logistics is to identify errors as early as possible in order to avoid the unnecessary costs associated with rectifying the error.

In accordance with DIN 25424, this is a scientific tool whereby it is possible for a team to locate errors that lead to risks. Fault Tree Analysis is classified as a deductive method of risk analysis. Using a tree structure in the form of a graphical representation, possible causes of risk are

identified on the basis of a final outcome that is not desired (Arnold, D., Isermann, H., Kuhn, A., & Tempelmeier, H. 2002). Fault Tree Analysis is time-consuming and complex but makes it possible to resolve specific problems such as how to deal with secondary failures.

The starting point here is an event that can potentially influence a logistics risk, as a result of which possible consequences are analyzed.
Event Tree Analysis is classed as an inductive methodology for qualitative and quantitative risk analysis. Events that trigger risks can be of an external nature or can result from the failure of an element of the risk management system. Event Tree Analysis is a graphical depiction in the form of a tree with two branches representing the respective alternatives. The upper branch signifies the first alternative, which represents the successful behavior of the protective element of the risk management system. The lower branch represents another alternative that signifies a fault scenario. In complex systems, the trees can become very big, as every additional step in the event analysis doubles the number of branches (alternatives). It is only worthwhile using Event Tree Analysis if all the requirements on the risk management system are known (cf. Knuth, D.E. 1973).

Quantitative methods are the second main group of evaluation methods in risk management and describe the distribution of probabilities for a given risk. Risk quantification is understood to mean the quantitative description of a risk and – as a next step – the derivation of a risk measure (index) so that the risks can be compared. The most commonly used quantitative methods in risk management are the point-based evaluation methods, which are also referred to as scoring methods in the planning literature.

Risk Portfolio Analysis is very easy to demonstrate using an example. It can be used to determine the supply risk when procuring materials, for example. Here, both the market position of the company and the overall market situation are considered. This includes not only the number of suppliers and capacity utilization but also the political and economic risks. In Risk Portfolio Analysis the particular materials, applications or processes are entered into a matrix. A recommendation for action is then provided or determined in accordance with the section reached. The assessment is carried out on the basis of the probability of occurrence and the severity of the impact, i.e. how great the effect on the company will be. Risk Portfolio Analysis is a very time-consuming type of analysis to carry out, but is otherwise very straightforward.

ABC analysis illustrates how important a product, an item or a service is to a company. It also clarifies how high the associated risk is. Using the example of logistics, this would be transportation routes, which are the most obvious initial point of analysis but are relatively unimportant in the whole scope of transportation when compared to other risk relevant indicators. ABC Analysis uses the consumption data of a company as the structuring element. This is the product of the quantity of units consumed and the price per unit. As a result, it is possible to see the share a product has in the overall consumption data of a company. So that these can then be considered differentially, they are divided into 3 groups. A-items that have a high consumption value (70-80%); B-items that have a consumption value of 10-20% and a share of 20-30%; and C-items that have a share of 60-70% and a low consumption value (5-10%) (cf. Hartmann, H. 2002). The advantage of this analysis is that one can focus on the important items and coordinate warehousing activity. It is then possible to significantly reduce the supply risk of the materials in question.

In principle, a risk should first of all be described by a suitable (mathematical) distribution function. Here, risks can often be described in terms of probability of occurrence and extent of damage caused. This corresponds to what is called a binomial distribution (digital distribution). However, some risks, such as variance in maintenance costs or interest payable, which can reach different levels with varying probability, are described using other distribution functions (e.g. normal distribution with expected value and standard distribution). The most important distribution functions in the context of practical risk management are binomial distribution, normal distribution and triangular distribution (Gleissner, W. 2011). The binomial distribution describes the probability that, if a Bernoulli experiment is repeated n times, the event A will occur precisely k times. In a Bernoulli experiment, there are precisely two events, A and B, with respective probabilities of p and 1-p; these probabilities do not change when the trial is repeated, and the individual trials are independent from each other. One example where this type of probability distribution occurs is when you toss a coin multiple times. Normal distribution occurs frequently in practical experience. This results from what is known as the central limit theorem, which states that a random variable approximates to the normal distribution if this variable can be expressed as the sum of a large number of small, independent, individual risks. The triangular distribution allows simple and intuitive quantitative description of the risk of a planning variable, e.g. a cost position, and can be used even by people without

a deep prior knowledge of statistics. All that is required is that three values are specified for the risk-related variable: the minimum value, the most probable value and the maximum value. This means that the user is not required to estimate a probability; this arises implicitly from the three values specified and the nature of the distribution. The use of these three values to describe risk is similar to the scenario technique commonly used in practice.
In addition to the probability distributions mentioned that are of particular importance in risk management in practice, there are a whole range of other distributions. For example, the (generalized) Pareto distribution is used for quantitative description of "extreme risks" (such as crashes or natural catastrophes) (cf. Zeder, M. 2007). Instead of a risk being described directly by means of its (monetary) impacts within a planning period (e.g. one year), it is also possible to describe it by aggregating two probability distributions: one probability distribution for the frequency with which loss will occur and a second for the (equally uncertain) extent of the loss for each instance. This is common practice for insurable risks.

The objective of risk aggregation is to determine the overall risk position of a project or company. To this end, the probability distributions of individual risks are combined to give a probability distribution for the company's target value (e.g. profit or cash flow). Risk measures for the company as a whole can then be calculated on this basis, characterizing the extent of the overall risk. Assessing the extent of the risk makes it possible to come to a conclusion as to whether the company has adequate risk bearing ability to actually bear the extent of the company's risk and thus to ensure the survival of the company in the long term. If the existing extent of a company's risk is too high when measured against its risk bearing ability, additional risk response measures are required.
Using risk simulation methods (Monte Carlo simulation) it is possible to calculate and analyze a large representative number of possible risk-induced future scenarios. It is then possible to draw conclusions as to the overall extent of risk, plan hedging and realistic spread, e.g. in terms of company output. The Monte Carlo simulation provides a large "representative random sample" of possible risk-induced future scenarios for the company which are then analyzed. The realizations of the target value (e.g. profit) ascertained in this way are used to create aggregated frequency distributions (Baule, R., Ammann, K., & Tallau, Ch. 2006)(Gleißner, W. 2010). Taking the frequency distribution of profit values as a starting point, it is then possible to directly derive the risk measures, e.g. the equity capital requirement (RAC) of the company.

Table 1.7. Summary on literature results: Risk Management Terminology and Theory

Main Authors	Findings
Dachraoui, K., Dionne, G., Eeckhoudt, L., Godfroid, P. (2004)	risk aversion bases on concepts of self-protection and self-insurance
Rothschild, M., Stiglitz, J.E. (1970), Dachraoui, K., Dionne, G., Eeckhoudt, L., Godfroid, P. (2004)	individual behavior affects the probability of events and also their contingent outcomes but not necessarily the risk
Truitt, J. F. (1970), Drake, R. L., Prager, A. J. (1977), Dymsza,W. A. (1972), Green, R. T. (1972), Haendel, D. H., West, G.T., Meadow, R.G. (1975), Rummel, R.J., Heenan, D.A. (1978)	interactions between business and financial risks as well as the political environment
Caballè, J., Pomansky, A. (1996)	stochastic dominance and aggravation-of-risk concepts with utility functions are proven and positive tested
Drake, R. L., Prager, A. J. (1977), Dymsza,W. A. (1972), Green, R. T. (1972)	acknowledge a source of risk to international business generated by the political environment
Kobrin, S. J. (1979)	enlargement on risk and uncertainty by identifying uncertainty as being either objective or subjective in relation to the associated risk
Piper, J.R. (1971)	absence of formal risk evaluation procedures
Kamiske, G., Brauer, J. (2003), Richard, O. (1999), Bobzien, M., Stark, W., Strauss, F. (1996)	qualitative methods concern with the observation and analysis of a risk's causes and effects
Gleissner, W. (2011), Zeder, M. (2007)	important quantitative methods are binomial, normal and triangular but also Parteo distribution
Baule, R., Ammann, K., Tallau, Ch. (2006), Gleißner, W. (2010)	using risk simulation methods it is possible to calculate and analyze a large representative number of possible risk-induced future scenarios

Source: Author's compilation based on literature review

The literature review shows that the two groups of risk measurement methods, the qualitative and quantitative methods, occupy a broad field of research. While quantitative methods are characterized by stochastic approaches, scenarios and simulation models, many qualitative methods are determined by human judgment.

Based on this finding, the significance of the group composition of risk assessments and sustainability of risk management supported decision making becomes clear since risk assessments are very often group-based. This underlines the approach of identifying the group composition of risk assessments and their impact on risk management supported decision making.

2 MODELLING THE RELATION OF GROUP COMPOSITION OF RISK ASSESSMENTS AND SUSTAINABILITY OF RISK MANAGEMENT SUPPORTED DECISION MAKING

This chapter looks at the current situation in enterprise risk management in relation to group composition in the risk assessment. Therewith it is possible to infer the relations between group composition of risk assessments and the sustainability of risk management supported decision making as reflected in the causal model. In the area of risk management, groups of employees make cyclical risk assessments to assess the risk potential. A sustainable process includes the extensive independence of the decision result from the composition of the groups. Accordingly, the author considers the sustainability of risk management supported decision making as a situation in which the decision results have an independent basis.

The associated variables and the metrics thereof are determined in the process. Finally, this chapter is concerned with the corresponding derivation of research hypotheses taking account of the theoretical principles set out in the first chapter.

2.1 Decision Making in Risk Management

In the context of decision theory, a distinction is made between risk and uncertainty. Uncertainty is defined as the likelihood that the outcome may differ from the expected value, and can represent both an opportunity and a threat. To an extent, uncertainty is an umbrella term which includes risk (Gleissner, W. 2011). Risk in the sense of decision theory arises where the decision-maker knows the objective or subjective probabilities of the occurrence of possible environmental states (Runzheimer, B., & Drazen, B. 1998); otherwise we speak of uncertainty. The cause and extent of risk can be measured in terms of the ability of those dealing with it to predict developments in the environment with absolute certainty (Wolf, K., & Runzheimer, B. 2009).

In the behavioral science approach, on the other hand, risk is a function of the subjective uncertainty relating to how the decision-maker assesses a particular situation. The alternative selected ultimately depends on the particular risk approach of the decision-maker, i.e. on whether his attitude is more risk-seeking, risk-neutral or risk-averse (Fasse, F-W. 1995).

Risk management can be summarized as a function which helps in preparing decisions in cases of uncertainty through the provision of information but also ensures that decisions that have

been made are implemented. Practically all decisions made by people involve a degree of uncertainty. The result may be affected by cultural, environmental and political influences as, for the most part, it is not possible to predict these influencing factors or their occurrence. Without these risk factors, most decisions would be fairly trivial. Dealing with risk is the key challenge in decision making (cf. Gleissner, W. 2011). Risk analysis makes a significant contribution to improving decisions. Here, risk assessment is a suitable means for carrying out risk analysis for particular risk classes.

The historically most chosen approach for decisions in the area of risk management is the deterministic approach. The approach essentially consists in identifying a group of fault event sequences that lead to credible worst-case risk scenarios and can then also be used to predict the respective consequences.
This means that suitable security barriers can be designed in order to prevent such scenarios and protect them from the associated consequences or mitigate them (Zio, E. 2009).
Within this preventive measure, which is often referred to as a structuralist deep defense approach, security margins against these scenarios are enforced through conservative planning and operational rules (Apostolakis, G.E. 2006).
In recent years, however, a probabilistic approach to risk analysis has established itself as an effective method for analyzing system security. This does not only take worst-case scenarios into account, but also extends to the examination of all realizable scenarios and the associated scenarios. The likelihood of such scenarios occurring becomes an additional key aspect that has to be quantified in order to deal with uncertainties rationally and quantitatively. In particular, this is an integrated approach that combines the knowledge of the deterministic approach and the knowledge of the probabilistic approach with other requirements in decision-making within risk management (Aven, T. 2003)(Bedford, T., & Cooke, R. 2001)(Henley, E.J., & Kumamoto, H. 1992)(Kaplan, S., & Garrick, B.J. 1981)(McCormick, N.J. 1981).

Risk definitions, which follow this procedure are permitted in risk management and supplement the classic definitions, since the mentioned definitions distinguish results with a high probability and low consequence from results with a low probability and high consequence. They point the way to proactive risk management controls, for example by supporting the identification of risk drivers and the screening of results with low probability and low

consequence. Areas are also identified in which investments are required to reduce uncertainty (NASA 2010).

A risk-based decision-making process provides a reasonable basis for decision-making and helps identify the greatest risks and prioritize efforts to minimize or eliminate them. It is primarily based on a narrow set of model-based risk indicators and it mainly has no room for interpretation. In general, considerations of costs, feasibility and concerns of stakeholders are not part of risk-based decision making, which is typically undertaken by technical experts without public consultation or engagement of stakeholders.

In contrast to the before mentioned procedure, risk-informed decision making is a considered process in which several performance measures are used along with other considerations to "inform" decision making (Zio, E., & Pedroni, N. 2012).

The risk-informed decision-making process recognizes that human judgment plays a significant role in decisions and that technical information cannot be the clear basis for decision-making. This is due to the inevitable gaps in technical information and the fact that decision-making is a subjective, value-based task. When dealing with complex decision problems with multiple competing goals, the accumulated knowledge of experienced employees is crucial for the integration of technical and non-technical elements for reliable decisions (NASA 2008)(NASA 2010).

2.2 Influences of Group Compositions in Risk Management Related to Meaningfulness of Risk Assessments

Working company-wide risk management systems are never the responsibility of a single risk manager. Numerous employees with different responsibilities work on their contribution to the implementation of the different risk management processes. Indeed, every single hierarchy level, extending from non-managerial employees, through department managers and top management, to supervisory boards, must play a part in order to ensure that risk management within the company succeeds. However, it is important to note that the factors involved in this success are not limited to internal forces only, as they also include external employees and consultants (certified public accountants, auditors, and external institutions) who have a decisive influence on all aspects related to a company’s risks.

It is precisely these external parties that frequently take over risk management processes and analyses, and they enjoy such a high level of exposure while doing so that one is left with the impression that risk management is the exclusive domain of consultants and supervisory bodies. In reality, however, it is necessary for the risk management process to be influenced by the company's entire business process, which in turn means that a corporate organization will always have involved and non-involved - or internal and external - positions and offices that are relevant to risk management (Brünger, Ch. 2009). In fact, every position within an organization is affected by risk management, and can have a significant impact on the way active risk management approaches evolve. This widespread interrelation makes it necessary to define a clear strategy and structure in order to be able to establish clear risk management roles and responsibilities within a company.

Key characteristics of the organization theory are based on exactly these strategies and structures, which can be filled by the responsibilities and roles. Specially in the financial sector (which risk management is also part of), the following definition applies: "Those who want to improve the value of a company need to know how to organize to achieve organizational goals; those who want to monitor and control performance will need to understand how to achieve results by structuring activities and designing organizational processes." (Hatch, M.J. 2006). The organizational structures in the risk management process are born in particular by those responsible persons who were involved in creating the current state of affairs and that pay their contribution to achieving the corporate objectives. But socio-psychological aspects must also be given a high degree of attention. Decisions within organizational structures are based on the individual and group dynamics. This includes needs such as the participant's feeling of self-worth and need for a precise image of the participant's social surroundings as influence factors for decision making (Aronson, E. 2008).
The individual stands at the center: the better he or she is integrated and the better the specific training, the better the output will be. The more intensive the analysis and processing of group-dynamic processes, the better the groundwork for effective interpretation. Different personnel combinations and group sizes for the decision-making process can produce different results. The proper configuration ensures efficiency of the group (Janis, I.L. 1977). Top decision making is achieved if a group is formed where the members do not behave cohesively and where the members take various roles (expert competencies mixed with decision-makers and participants from the technical departments) (cf. Janis, I.L. 1977). Large groups, bigger than 3-

4 members, do not necessarily bring more facets into decision making, but rather typically lead members to align themselves with the group opinion if it does not match their own (Asch, S. 1955). This is a challenge for the HR department. But based on the pillars of organization theory: "Nearly everything HR specialists do from recruiting to compensation has organizational ramifications and hence benefits from knowledge provided by organization theory; organizational development and change are particularly important elements of HR that demand deep knowledge of organizations and organizing, and organization theory can provide content for executive training programs" (Hatch, M.J. 2006). Providing HR employees with tailored professional development courses gives them the necessary skills to support technical departments when choosing group members. The HR department can also be helpful in conflict management within the group.

The information technology also plays an important role. The amount of data of the individual control points in risk management can simply not be handled without a sophisticated IT organization. The handling of large quantities of data alone solves but one of the many problems. Information flow within an organization also influences the organization's processes, which requires the organization's IT professionals to understand organizational theory while designing and promoting the use of informational systems (Hatch, M.J. 2006).

But let us get back to the strategies in regard to which the only characteristic that must be defined is that they must be in a continuous state of evolution: "the improvement of the original leading thought in accordance with continually changing situations" (Hinterhuber, H.H. 2004). This makes it all the more important for there to be a clear structure when a strategy itself may undergo all manners of evolutionary adjustments. Employees can only identify with their responsibilities if they know what these are exactly, and this is of central importance. After all, one can only perform a task with enthusiasm if they identify themselves with it! Care must always be taken that decisions and evaluations can be reviewed afterwards within the organization. Cognitive dissonance among employees should be a reason to improve risk assessment on an evolutionary basis. Dissonance cannot be eliminated through group pressure, but rather can be minimized through respect, thoughtful questioning and improvements (Festinger, L. 1957).

For a risk management system to work and be sustainable, it is essential to have good leadership. Within this context, the risk awareness (i.e. risk identification and assessment) and risk sensitivity of each level of responsibility creates the crucial added value in a company's

organizational structure. Each role inside and outside a company is strongly affected by the leadership displayed by the next higher role. In fact, the impact of this leadership is even greater than that involved in processes that rely on strictly factual information and are directly measurable. However, it is also important to note that negative leadership behavior related to risk management does not have an immediate effect on the success or profits of a company. Management figures should be aware that the simple statement of their position frequently has a disproportional impact during group-oriented decision-making processes. Group members who are not of a strong opinion on the matter simply adopt their position. The decision-making process is thus not based on facts, opinions, expert testimony or discussion, but rather on an assumed consolidation of a previously held opinion (Hovland, C.I. 1951). Indeed, the damage caused by flippant or ignorant behavior in this regard often becomes evident only several months thereafter (if it does at all, as missing or poor risk assessments do not necessarily mean that something will happen).

At this point, it is important to mention that leadership should not be simply classified as "good" and management as "bad" (Kotter, J.P. 1990), as both play a crucial role in terms of risk management and have an impact on results. Nevertheless, management variables are usually clear and traceable in terms of their impact on overall results (as are those related to many other processes), whereas leadership can rarely be directly measured. On the other hand, it is indisputable that motivational, delegation-based leadership in particular has a direct and positive impact on a company's risk management system when looked upon as an example to be followed. Because of this, responsibilities and roles, within the context of risk management, must be closely analyzed so as to be able to rely on the right positions and interfaces.

The following responsibilities and roles can be identified within a risk management process:

- Employees
- Business unit managers
- Risk manager
- Internal auditing
- General manager/board of management
- Supervisory boards
- Certified public accountants/auditors
- Lawmakers and regulatory agencies

- Suppliers and customers
- Analysts

In order to more precisely explain the roles and responsibilities arising specifically from risk management, it is necessary to go into greater detail regarding each of the identified participants in the process.

As previously mentioned, company-wide risk management is the collective responsibility of all parties. However, a company's employees, who represent staff members without any special roles, bear the greatest portion of this responsibility (in both quantitative and qualitative terms). After all, hazards and risks originate and are found in day-to-day interactions with business processes and the tasks they entail.

Employees who have already been designated as risk owners are bound to have a higher affinity for identifying and assessing risks. But awareness must also be developed in employees who have not yet been integrated into a company's risk management processes. Within this context, it is important to mention that proactive communication is a part of risk management (Pechlaner, H., & Glaesser, D. 2005). Relaying information that is relevant in terms of risks and ensuring that this information is both complete and correct is the cornerstone behind it. The natural continuation of this process - being able to see how a risk situation has changed - must have a solid foundation at the very bottom of the company hierarchy; otherwise, the very foundation of the risk assessment pyramid will be flawed from the beginning. Communication is an important element of organizational structures. This must be observed also in establishing a working risk management organization: "Corporate communication specialists must understand the interpretive processes of organizational stakeholders and need to address the many ways in which different parts of the organization interact with each other and the environment, in order to design communication systems that are effective or to diagnose ways existing systems are misaligned with the organization's needs" (Hatch, M.J. 2006). With reference to dissonances with other members in the decision-making group, care must be taken that the credibility of the communication is maintained at all times. Discrepancies through exaggerated emphasis on one's own viewpoint are to be avoided. The sender should not depict him- or herself as superior to the recipient (Festinger, L. 1957).

Training courses, presentations, and awareness exercises on a company's intranet are some of the helpful measures that can be used in order to increase every employee's level of responsibility and involvement in the overall risk management process, as is exposure to and

interaction with the accumulated data within the company (to a moderate extent). Finally, it should be mentioned that the leadership of supervisors has an especially important effect on employees. Employees who feel that they are being taken seriously and who see how their comments and specific information concerning opportunities and risks are taken into account will be much more engaged in supporting the overall process and furthering it with positive creativity.

Business unit managers include chief financial officers and comptrollers in particular, who are perfectly suited to this field owing to their existing remit of forecasting, budget planning, and setting business objectives. Since the duties of finance departments and comptroller's offices are often of a cross-departmental nature, i.e., are rooted squarely in the company's central management, these entities have an enormous influence on the risk management process. In fact, the internal reporting systems set up in these departments often form the basis for a very high level of risk awareness.

As a result of all of the above, the heads of these departments often become role models in terms of risk management. They are also usually the ones that set up and develop that part of the organizational structure, for which they are responsible. Although this usually happens within the framework of the global organizational structure, they do usually have a certain degree of freedom. The same fundamental principles already discussed for senior management in terms of influence on group-oriented decision-making processes also apply for the business unit leaders. Basic principles of socio-psychological elements, especially in handling of groups and group-dynamic processes are the prerequisite for successful working in the area of risk identification and risk valuation.

To avoid the risk of ending up with several companies within the company, and thereby losing the ability to compare risks and opportunities, clear structural guidelines must be drawn up. So as not to undermine the business unit managers' motivating "entrepreneurial" freedom and thereby stifle their creativity, those degrees of freedom must be defined. The resulting corridor of freedom to act encourages creative activity while at the same time ensuring comparability in risk management.

Organization is not everything; people often fail to take into account the fact that the person who stands out the most should not necessarily be the one that prevails. In fact, it should be remembered that units in charge of production-related activities take on enormous opportunities and risks, while purchasing and sales departments are responsible for providing data used for

assessment purposes in integral risk management systems. Impartial interaction between all business units, without any of them being shoved into the background, is an essential risk management element that rests on the cornerstone already laid by employees. And it is precisely this building block that poses a challenge in terms of leadership. On the one hand, with respect to the employees within the organizational structure under each manager's supervision; on the other, with respect to being impartial in regard to adjacent units; and finally, with respect to providing top management with fair, but concrete, information and comments. A system that offers a neutral, understandable assessment basis must be created. To ensure a broad acceptance of the introduced risk management measurement system, the risk and opportunity weightings must be clearly recognizable and conclusive for all employees within the process and the organizational structure. This allows the responsible business unit managers to stand behind the results and release them for further use.

Appointing a central risk manager serves not only to establish risk management strategies within a corporate organization, but also to ensure that they take root. Accordingly, the sustainable implementation of risk assessment measures, periodic reassessments, central analyses, and coherent decisions are part of their responsibilities. In addition, they must constantly exchange information with the management level (or be a part of it). However, risk managers should not only be assigned responsibilities, but staff and financial resources as well. Otherwise, trying to maintain an effective risk management system will prove to be an impossibility. The risk manager is part of every larger organizational structure, which is to say a company having 50 or more employees with operational structures in place that require risk management. This happens on the one hand through individuals' own initiative and on the other due to legal requirements. The 50 employee threshold is not written in stone: There are also smaller companies who must or want to practice risk management.

Risk managers are also responsible for implementing responsibilities and roles, as well as for deciding on the risk management methods best suited to achieve their goals. They must develop standardized terminologies and concepts, establish a framework for assessments, and define interfaces to other business process systems. The risk environment determined on the basis of these activities must consist of areas that can be subdivided into groups and point out where management is paying attention to the risks in these areas (Brühwiler, B. 2007). The final element of the risk manager's role is periodic reporting and supervising: they should always be

fully cognizant with the company's overall risk situation and aware of the major risks and opportunities (Brünger, Ch. 2009).

In short: risk managers must run a prudent - but always visible - risk policy. While this must be done without stoking any unnecessary fears, it must also be done without closing one's eyes to the truth, even when uncomfortable. Accordingly, a risk manager's leadership qualities must be stronger than most people would think at first. True, risk managers usually have very little responsibility in terms of personnel: they might be in charge of a couple of employees; but in comparison to business unit managers, their responsibility in this area is almost negligible. Compared to adjacent units, they are usually responsible for only a small organizational unit or have responsibility for another area in a combination of functions. Depending on the company organization, this can be the risk manager in joint responsibility with the internal auditor, the controller or the finance manager (although other combinations are possible). The boundaries between these two tasks must then be drawn clearly with foresight and wisdom, and the actors must remain within their respective fields of competence. This is essential in this case to maintain the actors' credibility with regard to their respective activities. He is responsible for serving as half moderator, half expert during group discussions. He is responsible for avoiding distinct group thought so as to promote a comprehensive expression of opinions, one that is in part certainly controversial. He holds the reigns in his hand, without attempting to overly influence the group. He seeks unpopular opinions and provides a non-judgmental overview of the various positions.

In any case, very different leadership qualities are required of the risk managers. They represent the integrative element in the overall risk management process, and are responsible for collecting information in a well-balanced and impartial manner, never giving anyone the feeling that their information is considered to be of less worth than that of others. Indeed, keeping a company's risk management environment in a state of equilibrium requires enormous tact. As a result, the ideal qualities exhibited by a risk manager could be described as "consciously motivational" and "managerially strict and meticulous".

In general parlance, internal auditing is often thought of as being associated with risk management, but this is only accurate to a certain extent. While it does involve the review of risk management systems (and also internal control systems), this is only one of its many functions. Naturally, the results of an internal audit must be used in order to evaluate the sustainability of a risk management strategy, and while this is of great importance to a working

system, it is important to keep in mind that its effect on processes is not operational, but rather regulatory. Even then, however, internal audits must never be disregarded within the big picture of a risk management strategy.
If the auditor is also responsible for risk management within the company, they are likely to have a good insight into the location of the right control points within processes and underlying organizational structures. They must also, however, be careful not to let themselves be drawn into a conflict of interests between auditing and risk management, or to lose sight of issues that lie beyond their auditing role.

General managers (or a board of management, as the case may be) are responsible for managing their company, and are therefore responsible for an integral company-wide risk management strategy as well. More specifically, management determines how risk management is practiced and creates the necessary environment for it. It defines whether risks should be accepted, avoided, diminished, or shifted (Dörner, D. 2000), which requires the establishment of a risk management philosophy, a risk management office (central risk manager), an integral (IT-supported) system, and a risk culture.
Risk management should not simply be used as a fig leaf. Instead, it should be an integral part of a company's culture. Insights gathered from identification, analysis, supervision, and reviews should be discussed with individual groups of responsibility during regular meetings, which should also serve to accumulate and follow up on such insights. On the one hand, this should provide management with an up-to-date overview of things (cf. Gleissner, W. 2008) that goes beyond merely relaying reports and that can also be enriched with nuances. On the other, it should also make it possible to initiate and monitor any necessary measures. It is also important to mention that the focus of these activities should not be limited to risks, but should extend to opportunities as well. After all, those who do not believe in the concept of opportunity management will be hard-pressed to find an argument denying the fact that failure to take advantage of opportunities is a risk in and of itself.
Management should not forget that each organizational area is responsible for its own risks, i.e., that each area should run its own risk management sub processes within the overall process, something that the IT system must also support (cf. Gleissner, W. 2008). More specifically, management should delegate and not dictate, as this is the only way to spread risk awareness throughout a company. The more employees are involved in the risk management process, the more they will be able to contribute with their skills in applying methods and with suggestions.

Active participation increases acceptance and helps put any additional expenses incurred into perspective. Risk management should always form an integral part of the job description, and not be treated as a less important add-on activity. Indeed, the basis for success and for overcoming what will surely be a greater workload at the beginning is to define available time for risk management and reward the activity (a recognition of contributions that does not necessarily have to be monetary in nature). Continuous monitoring and supervision of company risks, together with a clear definition of the readiness to assume risks and adjustments to this readiness as necessary, are an essential part of the responsibilities that management must administer, as well as of the leadership qualities it must exhibit. This also involves coordination with supervisory bodies (supervisory boards, certified public accountants, auditors) and specific strategy adjustments (lawmakers, regulators). Management is responsible for maintaining legal and (hopefully also) ethical guidelines and regulations. Specially in risk management, the company management has the important task of setting an example, which it must fulfil. It must also be able and willing, at any time to adapt the company's organizational structures to the current risk management processes.

The role of the supervisory board is to supervise the management team and to set guidelines and frameworks for them. These guidelines and rules will in turn represent the key factors to take into account for monitoring and supervision purposes later on.

Risk management also plays an important role within this context. By their very nature, legal regulations compel supervisory boards to monitor the sustainability of risk management strategies (or arrange for it to be monitored). Within this context, general management must ensure that A) a risk management system has been implemented, B) a willingness to make adjustments based on coordination with the supervisory board exists, and C) a transparent overview is given so that the supervisory board is able to oversee important company risks and evaluate general management's strategies for them (BilMoG 2009). To this end, supervisory boards should comprise highly-qualified individuals with a high degree of competence in their respective field. Expert risk assessments, experience, up-to-date know-how that is relevant to the company, and a certain level of availability all form the basis for working together with management.

The risk of a unilateral flow of information driven solely by lawmakers, instead of proactive supervision combined with specific inquiries on behalf of the supervisory board, frequently exists at this point. If a supervisory board is not particularly interested in risk management, it

will not only fail to perform its supervisory duties adequately, but will also have a discouraging effect on management in many occasions. In turn, this can cause management to start practicing risk management at the most rudimentary level only, triggering a domino effect throughout the company's hierarchy that will eventually reach individual risk owners, who, as previously mentioned, should form the cornerstone of the entire pyramid. It is thus justified to conclude that supervisory boards are a central element in any effective, integral risk management system.

It is important to mention that the interaction between risk management responsibilities is certainly not limited to a company's internal offices. Indeed, by providing an objective point of view that is fully independent from the company in question, certified public accountants and external auditors provide an important source of information.
Annual financial statements and reports are one of the most important components of financial reporting. During the preceding financial statement analysis, certified public accountants also review the risk management system being applied and, if they detect any shortcomings, give appropriate recommendations for correction, informing management, or the supervisory board if necessary, of the shortcomings depending on the importance of the annotations made. In addition to normal annual financial statement activities (during which risk management is merely a side issue), it is also possible to arrange for a comprehensive review of risk management systems, e.g., in order to check and comply with rules and regulations.
In addition, the socio-psychological influence on the respective group decisions by the company's risk assessment employees must definitely not be underestimated and must also be watched. Accountants and auditors must position themselves as group members (even if only external ones) during the overall risk management process. Polarizing viewpoints should be avoided. A shared improvement and constant review of the company's risk situations must be in the forefront.

Legislation is an additional external element with a direct influence on how risk management strategies should be set up. In fact, laws and regulations with an impact on risk management have long been in effect, especially in the area of financial reporting. In turn, complementary regulatory agencies often check compliance with these regulations, preparing audit reports in the process. As a result, lawmakers can have a significant influence on a company's risk management practices through rules, requirements, laws, and audits. However, this has more to

do with defining frameworks for rules and standards than with having an influence on specific responsibilities and roles.

Aside from external regulatory bodies, there are also external business activity interfaces that deserve and require just as much attention. In other words, the company's suppliers and customers. These entities, as well as the environment surrounding them, provide a plethora of information that directly affects company-wide risk management practices. Relevant data, such as delivery situations, market demand, quality levels, customer solvency, interest rate trends, etc. should be collected and incorporated into the risk management process. However, it is important to note that these interfaces must be identified, listed, and maintained by the relevant risk owners exclusively - only the employee with the necessary skills for applying the relevant methods will be able to identify whether a technical interface or a simple conversation can help achieve these goals.

External service providers also have an enormous impact on a company's risks and opportunities, and for all intents and purposes should be evaluated as if they were the company's own subcontractors or employees. In fact, if they are integrated into the risk management process, the same exact risk awareness will be required of them. This naturally requires a great degree of leadership and tact on the part of those involved on behalf of the company. There is a delicate balancing act needed to ensure external service providers follow the necessary requirements without infringing on their independence. As has been previously mentioned, motivation is decisive when trying to ensure that roles within the risk management system perform their own comprehensive risk assessments. This becomes a tricky, but necessary, balancing act when dealing with external service providers.

If subcontractors cannot be integrated into the overall system, interfaces must be established as an appropriate substitute for risk management purposes so as to support the internal risk management process and provide it with the necessary information. In addition, and if applicable, the corresponding certifications and control mechanisms will be expected on the side of the service provider.

Finally, analysts and the role they play must not be forgotten. Analysts take into consideration a multitude of factors, such as business strategies and business goals, combined with financial statement data and forecasts, in order to provide an assessment regarding a company's development (which very often includes risk assessments as well). These indicators and

assessments from an external, and therefore impartial, analyst can and should be used by general management as additional input for improving company-wide risk management practices. On the other hand, however, general management should not be driven by possibly inflated expectations and tone down, or even do away with, its risk management philosophy. Analyst contributions should be cause for reflection - not for acting blindly.

The aforementioned aspects related to the impact of risk management on hierarchical company organizations show that establishing responsibilities in a structured manner, when coupled with a clear delegation structure, results in an integrated risk management approach, as well as in increased risk awareness. Each employee is responsible for making his or her contribution to risk management. In each case, employees must be given clear roles and remits, which have been explained appropriately. Only then (with the incorporation of a suitable software system) will risk management become a truly living structure.

The company's organization must deal with the demands of risk management and organize itself accordingly. To achieve the corporate goals relating to (among other things) risk management, strategies and organizational structures must be mapped and success factors continually monitored. Efficient communication, guarded by moderate information systems with intuitive user interfaces, is a key pillar of the risk management process.

In the area of risk identification and risk analysis, heterogeneous groups offer many advantages when compared to homogeneous groups. Homogenous groups tend to produce distorted opinions (Ruble, D.N., & Frey, K.S. 1991). Homogenous groups often feature cohesive behavior that tends to involve a distinct group-thought and group polarization. Decisions are more frequently made on a unilateral basis than in heterogeneous groups driven by strong individual opinions. In particular, estimations related to risk identification and risk assessment must be free of group-thought. These evaluations are formed as an amalgamation of founded individual opinions with a view on the essential.

By implementing continuous, audited decision making, this can help certain disenfranchised stakeholders to feel more engaged with the process. They can then continue to bring their own viewpoint to the discussion in comprehensive or modified form.

Human Resources contribute significantly to successful risk management within a company. The right allocation of roles and the offer of a suitable range of specific training measures ensure the right level of responsibility for employees. Special attention must be paid to the leadership qualities of each responsible person. Since, in contrast to other operational business processes,

the added value provided by risk management cannot be measured immediately and therefore errors in leadership behavior become evident only months after the fact, the need for motivational leadership combined with exemplary behavior is enormous.

The incentive for all employees to develop their risk awareness, display sensitivity with respect to risks, and relay information relevant to risks can be essentially found in the leadership roles and in the leadership qualities of all managerial positions – from supervisors to top management. General management must provide enough latitude, firmly establish risk management activities in job descriptions, and reward contributions, as well as hone employees' (as well as their own) skills in applying methods.

Table 2.1. Summary on literature results: Influences of Group Compositions in Risk Management Related to Meaningfulness of Risk Assessments

Main Authors	Findings	Decision determination	Decision efficiency and effectiveness	Decision impact
Brünger, Ch. (2009)	necessary for the risk management process to be influenced by the company's entire business process		X	X
Hatch, M.J. (2006)	key characteristics of the organization theory are based on exactly these strategies and structures	X		X
Aronson, E. (2008)	decisions within organizational structures are based on the individual and group dynamics	X	X	
Janis, I.L. (1977), Hatch, M.J. (2006)	proper configuration ensures efficiency of the group		X	
Janis, I.L. (1977)	top decision making is achieved if a group is formed where the members do not behave cohesively	X	X	X
Asch, S. (1955)	in large groups members align themselves with the group opinion	X	X	X
Hatch, M.J. (2006)	information technology plays an important role for decision makings processes	X		
Hinterhuber, H.H. (2004), Festinger, L. (1957)	clear structure when a strategy itself may undergo all manners of evolutionary adjustments	X	X	X
Hovland, C.I. (1951)	group members who are not of a strong opinion on the matter simply adopt their position	X	X	
Kotter, J.P. (1990)	motivational, delegation-based leadership has a positive impact on risk management systems	X	X	X

Main Authors	Findings	Decision determination	Decision efficiency and effectiveness	Decision impact
Pechlaner, H., Glaesser, D. (2005), Festinger, L. (1957)	proactive communication is part of risk management	X	X	
Gleissner, W. (2008)	each organizational area is responsible for its own risks			X
Ruble, D.N., Frey, K.S. (1991)	in the area of risk identification and risk analysis, heterogeneous groups offer many advantages when compared to homogeneous groups	X	X	X

Source: Author's compilation based on literature review

As highlighted in the literature review, the impact of group composition extends to three main areas: decision determination, decision efficiency and effectiveness, decision impact. While the group composition is represented by different latent exogenous variables, these areas reflect latent endogenous variables.

The literature review has shown a clear dependency, which means that decision determination, decision efficiency and effectiveness and decision impact are included as "latent endogenous variables" in the causal model of the dissertation.

The corresponding assignments to the literature findings can be found in the table above.

2.3 New Technology Influence on Risk Management Communication Workflows

Although people play an essential role, it is not only the composition and responsibilities of the staff stakeholders that have been adapted to the assessment process over recent decades; this has been influenced in particular by the field of new communication technologies.

In information theory, the risk lies in the fact that the decision-maker does not have access to all the information required to give the accurate representation of reality necessary for assessing a decision situation (Fasse, F.-W. 1995). Accordingly, the status of incomplete information is crucial for the risk. This can be further divided into the three components incompleteness (information basis is not exhaustive), indeterminacy (information content too low) and uncertainty (incomplete picture of reality) (Braun, H. 1984).

Written communication creates a barrier, where those who write and read control the evaluations and votes. A written record removes part of the element of trust established between reviewer and evaluator. Reviews are often placed and evaluated after the risk assessment. This often takes place weeks later. Reviewers are no longer involved in the process. They are left only to hope the evaluation is placed correctly. Reviewers become a spectator instead of an active participant in the risk management process.

Command line programs cause users to be illiterate in the language of managing risks. Programs are used with key combinations that take years to learn. These cryptic commands force the risk manager to completely remove the reviewer from the management process.
With the next step in digitization, even more is conducted behind the scenes than before. ERP, CRM & ERM programs provide further cryptic languages and complex interactions. While CRM usage has demonstrated a positive impact on performance and process efficiency (Rodriguez, M., & Yim, F. 2011), the full automation leads to not only the reviewer but also the risk manager being removed from some aspects the process. Digitization breaks down the teamwork during the risk assessment. The risk manager has additional information, but this information is not always passed on to the reviewer. Often, the reviewers' ability to check the process is hindered by the complex programs governing the risk management process.

As risk reviews generally take place in a single conference room, the technology chosen influences the interaction between attendees. Laptops build the ultimate physical and psychological wall. Instead of quickly jotting down notes on a risk, the risk manager types away at the keyboard. Eye contact is lost. Connection is lost. Focus is lost.
Social interaction is greatly reduced. When entering data or searching for an item, the risk manager is not fully engaged in the conversation. The risk manager interacts primarily with the computer during those moments. Taking breaks to allow for data entry disrupts the flow of the meeting.
One solution is to share the laptop but sharing the laptop breaches the comfort-zone of the two parties. Instead of sitting next across from each other, the two parties sit awkwardly next to each other. Even reviewing the assessment can become an uncomfortable affair.
Handing over the laptop removes the risk manager's ability to control the moment, when the reviewer's interest is piqued, to take back the assessment.

The advances in mobile devices offer the reintroduction of presentations and conversations similar to those before laptops. A mobile device offers the ability to hide unnecessary details but have them available when questions arise. There would be no need to show a long list of assessment details to each and every reviewer, for each and every control, as is common in printed risk assessments. Keeping that information only a button push away, a mobile device allows the reviewer to see all the information necessary to make a decision but not the information which would only cloud their judgment and deviate from the risk managers pitch. This gives the possibility to have real-time information about controls and additional information and shift that information to the reviewer. The outcome would be improved teamwork and the removal of physical and psychological barriers between the risk manager and reviewer. The addition of related controls to the mobile device's screen can better catch the reviewer's attention and increase accuracy. Allow the reviewer's eye to be caught by a picture or a trend graph of a control they may not have considered before. Controls should be structured to fit the reviewer, facilitating mutual discovery rather than laying out what it is imagined that they will need.

Visual communication provides a different viewpoint and the option for reconsideration separate from the risk management process. With minimal distractions, the reviewer is also able to view the control again and their attention span has not been fully spent, thus, allowing for the discovery of new and/or unknown controls.

Instead of leaving the reviewer with empty hands, haptic feedback plays a significant role again. Laptops or PCs have created a situation where the user is the only actor in the risk management meeting who involves their hands. All others are forced to sit and passively listen as the user enters data, searches for information and reviews controls. With tablets, there is constant exchange. Both the reviewer and risk manager are involved in gathering information, reviewing controls can involve teamwork and data entry is minimal. No longer does the reviewer need to bring an additional laptop to the risk management meeting, just to keep hands busy.

While jointly creating the risk assessment, search for items in the risk catalog which provide the reviewer with the ideal starting point to launch the assessment. When an open or critical control is found, and the reviewer's mind is made up, allow them to select and review the control.

Turn risk leadership back into a business of relationships and give the risk manager the opportunity to spend information, instead of focusing on typing in his reviews. Providing solutions to reviewers' and companies' most urgent problems, providing valuable information

during the assessment and accomplishing all of this in a timely manner should build a strong relationship between risk management and business goals (Weitz, B.A., & Bradford, K.D. 1999).

Table 2.2. Summary on literature results: New Technology Influence on Risk Management Communication Workflows

Main Authors	Findings	Decision determination	Decision efficiency and effectiveness	Decision impact
Fasse, F.-W. (1995), Braun, H. (1984)	in information theory, the risk lies in the fact that the decision-maker does not have access to all the information required	X	X	X
Rodriguez, M., Yim, F. (2011)	information systems have a positive impact on performance and process efficiency		X	
Weitz, B.A., Bradford, K.D. (1999)	turn risk leadership back into a business of relationships and give the risk manager the opportunity to spend information	X	X	X

Source: Author's compilation based on literature review

New technologies, traditional behavior and working methods change very often, which has to be considered in traditional research areas such as decision-making theory.

The influence of new technologies on communication processes in risk management also makes it clear from the literature review that nothing fundamental changes in the results of the literature review from previous analyzes. The results of the related literature review can also be classified in the areas of decision determination, decision efficiency and effectiveness and decision impact, which secures the resulting causal model.

2.4 Uniform Ratings at Different Decision-Makers or Decision Making Teams

It has long been clear to researchers that effective decision making is of crucial importance to effective leadership. However, it has also been shown that many managers lack the discipline and/or cognitive abilities to do this, although, these are exactly the qualities needed in the fast-moving world of business (Arkes, H.R., & Ayton, P. 1999)(Tversky, A., & Kahneman, D. 1974). Bias and cognitive restrictions limit management when they are looking for information, seeking alternatives and selecting high quality solutions (Kahneman, D., & Klein, G. 2009).

Although they are capable of resolving simple problems, there is a lot of uncertainty when it comes to appraising and dealing with complex issues. Much research in the field of individual decision making supports this reasoning (Busenitz, L.W., & Barney, J.W. 1997)(Cohen, M.D., & March, J.G. 1974).

It has also been shown that, in rapidly changing circumstances, decision-makers find it especially difficult to process all relevant information and assess potential solutions to help in making new decisions (Duhaime, I. M., & Schwenk, C. R. 1985)(McNamara, G., & Bromiley, P. 1997)(McNamara, G., & Bromiley, P. 1999). Many experiments and field studies have identified the cognitive limits of decision-makers as the source of bias in decision making (Barnes, J,H. 1984)(Schwenk, C.R. 1984)(Simon, H. A. 1976)(Tversky, A., & Kahneman, D. 1974). Decision-makers often close their minds to new information which may differ from their own opinion, falling back on their existing patterns of thought and previously acquired information when making decisions (Tversky, A., & Kahneman, D. 1974).

First, the decision distribution is considered as an evaluation criterion. By mapping the decisions of a group on a graph, e.g. plotting the probability of particular financial losses, it is possible to evaluate them statistically. In this assessment, the crucial statistic is the standard deviation, which measures the deviation of a random variable from the mean value for the distribution. This statistic describes how broad or narrow the distribution is. The value for standard deviation can thus be used to establish how greatly the estimations of the various members of the group differ. This is used to identify whether the distribution is broad or narrow, but cannot indicate the actual positions of the values. Care must also be taken with this measurement to ensure that an interval scale applies, i.e. a quantitative representation using numbers with intervals on the ordinal scale.

Variance is also commonly utilized. This is the sum of the square of the deviations of the individual values in a group of data from the mean, divided by n = number of samples. The deviations are squared to prevent deviations to the left and right of the mean from cancelling each other out. Variance is thus a statistic that describes how far the individual values lie, on average, from the mean. The disadvantage of variance - that it uses a different unit to that of the data gathered - is not important in this use case; however, it could be circumvented by using standard deviation, which is the square root of the variance and thus once again has the same unit as the original data (Buttler, G., & Fickel, N. 2002).

The relevance for decision distribution can be explained as follows: if estimations made by group members as part of a risk assessment are available, empirical mean and empirical standard deviation are the two most important measures in statistics for describing the properties of this stream of data. If the standard deviation is very small, this indicates a homogeneous picture of the individual estimations, i.e. the group members are largely in agreement with their assessments. If the standard deviation is large, this indicates a contentious picture of the estimations. In short, the smaller the standard deviation, the more unambiguous the risk assessment.

The effect of imprecision and uncertaintiy in decision making will be considered next. Although it can generally be assumed that uncertainty has a negative impact on decision making (Brockhaus, R.H. 1980)(Busenitz, L.W. 1999), a few studies have identified the positive impact of uncertainty if decision-makers can identify and evaluate this themselves (De Dreu, C.K.W., & Carnevale, P.J.D. 2003). Decision-makers who determine for themselves that their knowledge in a certain area is limited tend to focus on areas in which they have greater understanding (Bukszar, E. 2003). Decision-makers who recognize the limits of their own knowledge then tend to rely on the assessments of actual experts. This considerably reduces the risks associated with the decision (Reynolds, L.A., & Hrudey. S.E. 2006). It can furthermore be determined that individuals who are aware of a gap in their knowledge will put more effort into looking for an effective solution than individuals who feel confident in their own assessment. This difference in behavior intensifies as the complexity of the resolution increases (MacLeod, W.B., & Pingle, M. 2005). Decision-makers who lacked confidence in their own opinion and were confronted with a conflicting opinion clearly showed an interest in the opponent's reasoning. In fact, their line of argument was listened to and incorporated, as shown in a corresponding discussion after the decision had been reached. Decision-makers who felt confident on entering the discussion or had only slightly deviating views were far less likely to consider other viewpoints. Although they stated that they had at least understood the other opinions, it seems as though they had not even heard them. A lack of certainty coupled with the search for an effective solution therefore leads to a more open discussion. These decision-makers do not feel that they must convince someone else of their own opinion. They communicate more and have a better grasp of the complexity and depth of the issue.

Although uncertainty is very often taken to be a barrier to effective decision making, studies very clearly show the positive role that uncertainty plays in the decision-making process (Kahneman, D., & Klein, G. 2010). Managers are well able to recognize their own uncertainty

in a given situation and the limits of their own position. Studies have shown that this recognition leads to curiosity to hear alternative views and to question or adopt these (Tjosvold, D. 1998)(Tjosvold, D. 2008). In particular, such uncertainty can lead to an open discussion that takes account of different ideas, with the aim of reaching a solution that has been thoroughly tried out, debated from all angles and worked on as a joint effort. (Tjosvold, D., Yu, Z.Y., & Hui, C. 2004).

Ultimately, the influences of discussion controversy on effective decision making must be considered. Controversy always arises when decision-makers compare their opposing ideas, opinions, conclusions, theories and information, at least with respect to a particular issue, and there is, at least initially, no consensus. Constructive controversy - an open discussion of viewpoints, setting out variants and alternatives for mutual benefit - can be very useful in helping those involved reach a decision. Research into cooperation and competition theory has shown that participants who prioritize their common goal are also open to opposing views and are able to discuss these constructively (Deutsch, M. 1973). Experiments have documented the dynamics of controversy as well as the possibility of addressing bias and creating an effective decision-making process from this (Tjosvold, D. 2008)(Tjosvold, D., & Sun, H. 2003).

In situations where the controversy threatens to derail the decision entirely, it is possible to find a previously unthought-of solution through mutual discussion of alternatives. Faced with an opposing point of view, openness to question one's own opinion generates interest in the reasoning and views of the counter-opinion, providing access to new areas of knowledge. This information is then taken seriously, and the opposing positions are incorporated into the individual's own thinking and decision-making processes. Studies have shown that, by using controversy in a positive way, it is possible to come up with new, holistic concepts. Opposing ideas help to develop a more complete understanding and to evaluate the complexity of a given problem. Mutual engagement in constructive controversy results in solutions that take account of the greater amount of information available (Tjosvold, D., & Sun, H. 2003).

Table 2.3. Summary on literature results: Uniform ratings at different decision-makers or decision-making teams

Main Authors	Findings	Decision distribution	Discussion imprecision and uncertainty	Discussion controversy
Arkes, H.R., Ayton, P. (1999), Tversky, A., Kahneman, D. (1974), Kahneman, D., Klein, G. (2009)	many managers lack the discipline and/or cognitive abilities	X	X	X
Busenitz, L.W., Barney, J.W. (1997), Cohen, M.D., March, J.G. (1974)	research in the field of individual decision making supports dealing with complex issues	X	X	
Duhaime, I. M., Schwenk, C. R. (1985), McNamara, G., Bromiley, P. (1997), McNamara, G., Bromiley, P. (1999)	rapidly changing circumstances interrupt process all relevant information for decision making	X	X	X
Barnes, J,H. (1984), Schwenk, C.R. (1984), Simon, H. A. (1976), Tversky, A., Kahneman, D. (1974)	cognitive limits of decision-makers as the source of bias in decision making		X	
Tversky, A., Kahneman, D. (1974)	falling back on existing patterns of thought and previously acquired information	X	X	X
Buttler, G., Fickel, N. (2002)	mapping the decisions of a group on a graph it is possible to evaluate them statistically	X		
Brockhaus, R.H. (1980), Busenitz, L.W. (1999), De Dreu, C.K.W., Carnevale, P.J.D. (2003), Reynolds, L.A., Hrudey. S.E. (2006)	uncertainty has an impact on decision making		X	
Bukszar, E. (2003)	focus on areas in which decision makers have greater understanding		X	
Kahneman, D., Klein, G. (2010), MacLeod, W.B., Pingle, M. (2005)	decision makers are able to recognize their own uncertainty in a given situation and the limits of their own position		X	
Tjosvold, D. (1998)(2008)	uncertainty can lead to an open discussion that takes account of different ideas		X	

Main Authors	Findings	Decision distribution	Discussion imprecision and uncertainty	Discussion controversy
Deutsch, M. (1973)	constructive controversy can be very useful in helping reach a decision			X
Tjosvold, D. (2008), Tjosvold, D., Sun, H. (2003)	dynamics of controversy is pushing effective decision-making process			X

Source: Author's compilation based on literature review

The literature review on the "uniform ratings at different decision-makers or decision-making teams" has shown that the results can be separated into different sub-areas. The first subarea is the consideration of the decision distribution as an evaluation criterion. In the second, the effects of imprecision and uncertainty in dissuasion on decision-making, and in the third, the influences of discussion controversy on effective decision making. If one then extracts possible variables from these, the research results focus on decision distribution, discussion imprecision and uncertainty, and discussion controversy. These three areas can thus be included in the causal model of the dissertation as latent endogenous variables.

2.5 Procedural, Behavior and Temporal Decision-Making Analysis

A wide range of research has been carried out into how to measure effectiveness (a measure of effectiveness doing the right things) and efficiency (a measure of economic efficiency to do things right) in decision making. However, there are few publications available that relate specifically to risk management. These focus on three aspects: procedural rationality, political behavior and processing duration. Starting from these areas, there is in each case more in-depth research available into the general decision-making process (cf. Dean, J.W. Jr., Sharfman, M.P., Eisenhardt, K., Mintzberg, H). These aspects have been considered in more detail below with reference to risk management.

The impact of procedural rationality on decision making is the first area of consideration. The concept of procedural rationality demonstrates the desire to reach the best possible decision in the given circumstances. The basis of this concept lies in learning as much as possible about

possible alternatives, and using this to reach a final decision (Simon, H.A. 1978). Procedural rationality can thus be seen as a dimension in which the decision-making process is determined by collecting information relevant to the decision and relying on the analysis of this information to make a decision (Dean, J.W. Jr., & Sharfman, M.P. 1993). If procedural rationality relates to an overarching decision to be made, all the departments involved must contribute to the analysis and to the outcome of the decision (Smart, A., & Dudas, A. 2007). Empirical studies emphasize the assumption that procedural rationality has a positive impact on the effectiveness of the decision and on the success of the company (Eisenhardt, K., & Bourgeois, L.J. 1988).

The next area is organizational decision making and political behavior. When considering the area of political behavior in decision making, it is first of all necessary to create a corresponding overall theoretical context. The theoretical context to procedural rationality and politics in decision making is based on the latest research findings in the field of organizational decision making. The concept of procedural rationality has an impact on organization studies in the fields of economy, organization theory and psychology (Dean, J.W. Jr., & Sharfman, M.P. 1993). In terms of decision making, rationality is defined as the collection of relevant information and the analysis thereof to reach a decision (Dean, J.W. Jr., & Sharfman, M.P. 1993). This definition is based on the implicit understanding that rationality comprises a scale ranging from complete rationality to an absence thereof. This gives rise to the idea that processes and strategic decisions are in part shaped by political behavior. This is also a central theme in decision research and decision making (Dean, J.W. Jr., & Sharfman, M.P. 1996)(Eisenhardt, K., & Zbaracki, M. 1992). It is common within organizations for groups with competing interests to be inclined to deliberately influence the decision-making process, formally or informally, in relation to the outcome or impacts of strategic decisions (Pfeffer, J. 1972). A decision-making process is not only about finding a solution to the problem but also about preservation of interests, about behaving politically to assert one's interests (Hickson, D. J. 1987). Excessive politicking has a negative impact on the intrinsic value
of strategic decision making. A focus on personal interests is at the expense of organizational goals; information is not shared appropriately and, ultimately, a decision is reached that bypasses the corporate goal (Eisenhardt, K., & Bourgeois, L.J. 1988)(Ravasi, D., & Zattoni, A. 2006). Joint actions carried out in secret are also viewed as politically influenced decisions. Improving group performance is used as a smokescreen for personal advantage, lobbying, control, and influencing of information sources. Behind the scenes, coalitions and

collaborations are formed to push a particular agenda. This political behavior is in direct contrast to procedural rationality, which advocates defining the problem, collecting and analyzing data, applying evaluation criteria, and presenting alternatives (Dean, J.W. Jr., & Sharfman, M.P. 1993). While early research into political behavior has shown how damaging this can be for effective decision making (Eisenhardt, K., & Bourgeois, L.J. 1988), other studies have shown that the use of political behavior leads to an increase in efficiency in the context of strategic decisions (Pettigrew, A.M. 2001)(Salancik, G.R., & Pfeffer, J. 1980).

As is the case for procedural rationality, political behavior covers a spectrum from extremely political to not at all political. In almost all cases, procedural rationality and political behavior exist side by side. Strategic decisions are complex decisions that are influenced by existing relationships, lack of confidence, controversy in dialog and a broad range of stakeholders. In this context, political behavior is entirely natural. The attempt to define the relationship between procedural rationality and political behavior gave rise to a study of 61 strategic decisions in which procedural rationality and political behavior were ascertained at independent dimensions in the context of the strategic decision-making process. Both types of strategic decision making – procedural rationality and political behavior– were found in each decision to varying extents (Dean, J.W. Jr., & Sharfman, M.P. 1993). Political behavior can always be distinguished from procedural rationality when it is clear either that there is no overriding organizational goal or when there is no outcome of the decision that can be used to achieve the goal. The extent to which the management makes use of procedural rationality and/or political behavior in decision-making processes defines the decision-making style (Salancik, G.R., & Pfeffer, J. 1980).

Another area is the influence of the processing duration on strategic decision-making processes. There is a range of views on the matter of how quickly strategic decisions are reached. One research stream emphasizes the idea that an excessive degree of detail slows down the strategic decision-making process. If fewer alternatives, fewer sources and a limited analysis are taken into account, this leads to decisions being made faster (Mintzberg, H. 1973)(Nutt, P.C. 1976). Faster process cycles therefore include fewer alternatives (Fredrickson, J. W., & Mitchell, T. R. 1984). It is highly probable that extensive analyses in dialectical investigation will increase the time needed to reach a decision (Schweiger, D., Sandberg, W., & Ragan, J. 1986). Although a rational process ought to be better, this also delays the decision, whereas having a limited number of participants and strong leadership accelerates decision making (Janis, I.L. 1982).

Autocratic decision making is highly advantageous if decision-making processes are to be speeded up. Powerful leadership has the ability to make decisions quickly, although these may naturally be rather one-sided as a result (Vroom, V.H., & Yetton, P.W. 1973). On the contrary, involving a large number of decision-makers prolongs the decision-making process (March, J.G., & Olsen, J.P. 1976). Another viewpoint is that limiting the potential for conflict accelerates the decision-making process. Conflicts trigger disruptions in the decision-making process, increasing the time required (Mintzberg, H., Rainsinghani, D., & Theoret, A. 1976).

Table 2.4. Summary on literature results: Procedural, behavior and temporal decision-making analysis

Main Authors	Findings	Procedural Rationality	Political behavior	Processing duration
Dean, J.W. Jr., Sharfman, M.P. (1993), Eisenhardt, K. (1988), Mintzberg, H. (1973)	procedural rationality, political behavior, processing duration and general decision-making process	X	X	X
Simon, H.A. (1978)	the concept of procedural rationality demonstrates the desire to reach the best possible decision	X		
Dean, J.W. Jr., Sharfman, M.P. (1993), Smart, A., Dudas, A. (2007)	collecting information relevant to the decision and relying on the analysis of this information to make a decision	X		
Eisenhardt, K., Bourgeois, L.J. (1988)	procedural rationality has a positive impact on the efficiency of the decision	X		
Dean, J.W. Jr., Sharfman, M.P. (1993)(1996), Eisenhardt, K., Zbaracki, M. (1992)	processes and strategic decisions are in part shaped by political behavior		X	
Pfeffer, J. (1972), Hickson, D. J. (1987)	political behavior influences the decision-making process in relation to the outcome or impacts of strategic decisions		X	
Eisenhardt, K., Bourgeois, L.J. (1988), Ravasi, D., Zattoni, A. (2006)	excessive politicking has a negative impact on the effectiveness of strategic decision making		X	
Pettigrew, A.M. (2001), Salancik, G.R., Pfeffer, J. (1980) , Eisenhardt,	political behavior influences the efficiency in the context of strategic decisions		X	

Main Authors	Findings	Procedural Rationality	Political behavior	Processing duration
K., Bourgeois, L.J. (1988)				
Salancik, G.R., Pfeffer, J. (1980)	the extent to which the management makes use of procedural rationality and/or political behavior in decision-making processes defines the decision-making style		X	
Mintzberg, H. (1973), Nutt, P.C. (1976), Fredrickson, J. W., Mitchell, T. R. (1984)	fewer alternatives and a limited analysis are taken into account, this leads to decisions being made faster			X
Janis, I.L. (1982), Vroom, V.H., Yetton, P.W. (1973)	limited number of participants and strong leadership accelerates decision making			X
Mintzberg, H., Rainsinghani, D., Theoret, A. (1976)	conflicts trigger disruptions in the decision-making process, increasing the time required			X

Source: Author's compilation based on literature review

As in the case of the literature review on "influences of discussion on controversy on effective decision making", the analysis of the literature on "procedural, behavior and temporal decision-making analysis" again identifies clustering on the individual subject areas. These are reflected here in the section "impact of procedural rationality on decision making" with a possible variable "procedural rationality", in "organizational decision making and political behavior" with the associated variable "political behavior" and for "influence of processing duration on strategic decision-making processes" with "processing duration". These three possible variables are substantiated by literature review and can therefore be included as latent endogenous variables in the causal model.

2.6 Budget and Strategic Responsibility Impacts on Decision Making

The influence of a decision taken as part of a risk assessment is largely reflected through economic variables. The monetary scope and strategic scope are directly related to the impact on the company's affairs.

Budget responsibility and strategic responsibilities within an organizational structure are often an expression of both competence and power. These certainly influence all decisions that are made; this has been considered in greater detail below with reference to risk management.

The effect of budget responsibility as an influencing variable on the company and its strategic orientation is easy to determine. Budgeting forms part of the planning process which, for its part, is a forward planning activity. This leads to corresponding uncertainties. The budget therefore results from expectations and stochastic elements (Burman, L.E, & Phaup, M. 2012). Budget responsibility is based on the planning process and the budget framework included in the plan. The budget determined for the respective sub-area is then managed by those responsible. The higher an individual's budget responsibility, the greater their influence on decisions in the context of risk management.

A further parameter for measuring strategic influence within a business is an individual's personal responsibility within a risk assessment. The greater this is, the greater the influence of their decisions on the orientation of the business. This direct influencing factor is further intensified by the leadership properties of the decision-maker. This can have a significant influence on discussions and decision making within groups (Vroom, V.H., & Yetton, P.W. 1973).

Research carried out in recent years in the area of strategic influences has shown that these always have a relatively large impact on day-to-day operations (Jarzabkowski, P. 2003). Strategic objectives and operational results are increasingly coming into alignment, thereby influencing day-to-day business for the long term. (Ahrens, T., & Chapman, C. 2007). Measured against this, employees with an impact on strategic orientation in the area of risk assessment assume the same importance as those with budget or personal responsibility. These people will likewise be assigned a management position after a fashion, even if this is of a more specialized nature.

Table 2.5. Summary on literature results: Budget and strategic responsibility

Main Authors	Findings	Budget responsibility	Personnel responsibility	Strategic responsibility
Burman, L.E, Phaup, M. (2012)	higher a budget responsibility, the greater the influence on decisions in the context of risk management.	X		X
Vroom, V.H., Yetton, P.W. (1973)	personal responsibility has a direct strategic influence within a business		X	X
J Jarzabkowski, P. (2003), Ahrens, T., Chapman, C. (2007)	strategic objectives and operational results are increasingly coming into alignment, thereby influencing day-to-day business also in the area of risk assessment		X	X

Source: Author's compilation based on literature review

The literature review on "budget and strategic responsibility impacts on decision making" also found a concentration of the analysis results and literature topics on the possible variables "budget responsibility", "personnel responsibility" and "strategic responsibility". Unfortunately, there is currently little literature on this topic, but this does not diminish the importance of the extracted variables. Therefore, budget responsibility, personnel responsibility and strategic responsibility are included in the causal model of the dissertation as latent endogenous variables.

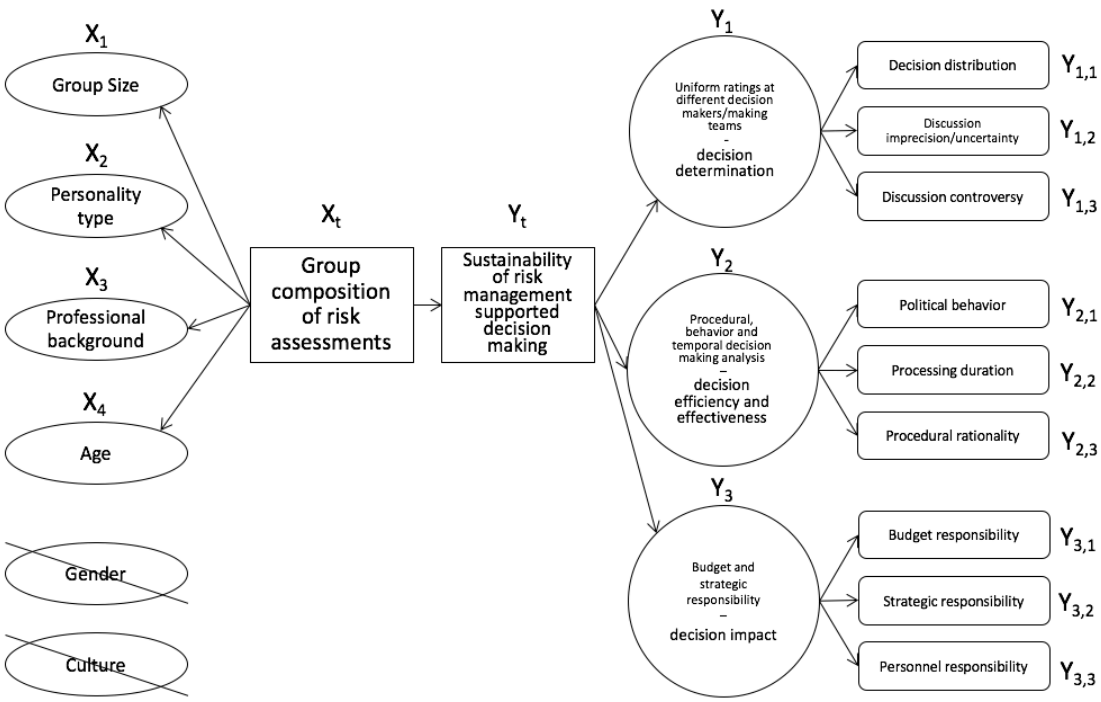
2.7 Modelling the relation between group composition of risk assessments and the sustainability of risk management supported decision making - Structured Equation Model

The principles of decision making are also deeply embedded in risk management. Dealing with uncertainty and the influencing factors that then affect human behavior is admittedly not limited to risk management, but plays a very large role here while allowing the process to be traced logically.

Chapter 2.2 therefore addresses the individuals, in particular the membership of a risk assessment group, and their role in the organizational unit in greater detail. It becomes clear that the different roles also have thoroughly different interests in their assessment of risk. The behavior was also in some cases determined by differences in the available information.

Chapter 2.3 therefore briefly outlines information theory and the impact of new technologies on the communication flow within risk management. Based on this more general overview of decision making in risk management, from chapter 2.4 onward a greater focus has been placed on the dependencies between group composition of risk assessments and the sustainability of risk management supported decision making. Here it has been possible to identify three key dependencies based on chapters 2.4 - 2.6 and the more in-depth literature review. The first area, "decision determination", is concerned with "uniform ratings at different decision-makers/decision-making teams", taking a differentiated approach to the corresponding characteristics. The same is true for the second largest area "decision efficiency and effectiveness" by means of "clarity and derivability in the statement duration decision making" and for the third area "decision impact" by means of "budget and strategic responsibility". The respective associated measurement techniques for the dependent variables created in this way have been validated through further literature reviews and mapped using the causal model.

The use of the measurement techniques and referencing to the corresponding measurements form the core of the following sections. This also covers why certain latent exogenous variables considered in a first analysis are no longer taken into account in the causal model. Further differentiation of the measured values and conversion of these into a mixture of methods also follows.



$X_{1..4}$	=	Latent exogenous variables
$Y_{1..3}$	=	Latent endogenous variables
$Y_{1.1..3.5}$	=	Measurement indicator on latent endogenous variables

Figure 2.1. Postulated Causal Model

Source: Author's own construction

Commonly, a simple correlation analysis is used with a causal model. This is not possible due to secondary factors (see chapter 2.8). It is only possible to get a full understanding of the model and its dependencies by using particular scientific techniques and statistical tools. Starting from the independent variables identified, from the formation of statistical norms through to the measurement of the dependent influencing factors, it is now necessary to work through the corresponding scientific methodology.

2.8 Determination of Variables

With reference to the research question and based on the literature review outlined above, the operationalized measuring elements were analyzed and identified. More specifically, this

research has now dealt the different approaches used by the measurement techniques and the scientific handling of independent and dependent variables.

2.8.1 Determination of Latent Exogenous Variables

To determine the latent exogenous variables of the model, a specific process is required. The research question considers the specific group compositions of risk management. Although there is a fair quantity of literature dealing with group compositions of decision making, the literature review delivered few results relating to risk management. So as to define a structured basis here in spite of this, first of all the key variables for the superset of “decision making” were considered; this delivered a selection of relevant variables for risk management. These were presented to the experts in risk management by means of structured, qualitative and quantitative expert interviews in order to interrogate the validity, plausibility and importance of each variable. The choice fell on ten experts from the respective sectors university, large corporations, and the established Risk Management Association. This gives the possibility to analyze the opinions in reasonable quality and to make a general trend of these opinions.

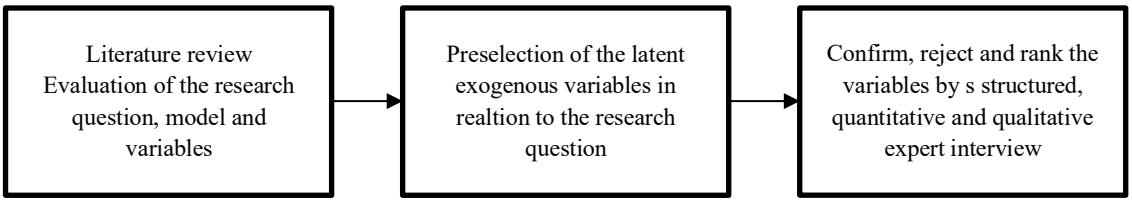


Figure 2.2. Determining Latent Exogenous Variables

Source: Author’s compilation

As discussed above, there is unfortunately a lack of scientifically validated models with corresponding operationalized measuring objects. The possible variables are consolidated in stages by means of the literature review, the specific pre-selection and the expert interviews to achieve a good validity. The pre-selection was also selected such that the associated operationalized measuring objects can be clearly assigned and traced. "Group size" refers to the number of group members in the risk assessment, while "personality type" refers to the Big Five model, for example. "Professional background" is defined by the routine while "age" and "gender" are already contained within the measuring objects. "Culture" is generally classified using geographical areas. The primary purpose of the expert interview was therefore to further

reduce the more broadly defined pre-selection. In the process, the selected latent exogenous variables were disclosed in order that they could be ranked by the experts. This ranking could be used, on the one hand, to perform a further selection process and, on the other hand, to determine an empirical norm for the further statistical evaluations.

However, if all measuring criteria of the latent exogenous variables were to be statistically evaluated, this would not be scientifically valid owing to the very limited number of risk management experts. In order to obtain a statistically significant basis for a qualitative methodology, it would be necessary to interview a large number of experts – more than would even be available in the survey region (Germany/Austria/Switzerland). Since this situation was already known at the time of the conception phase for modeling, the result could be used exclusively for further selection of the latent exogenous variables (calculation of the relevant media) and to form an empirical norm. The scientific framework needed for this and the structured expert interview based on the Likert scale has been discussed in detail below (see also chapter 3.3).

2.8.2 Removing Insignificant Latent Exogenous Variables

The first part of the structured expert interview (see appendix) aims to evaluate/verify the latent exogenous variables of the causal model. The output was performed with the goal of removing insignificant variables.

Table 2.6. Determination Latent Exogenous Variables - Mean / Empiric Norm

	Result counting					
Exogenous variable	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree	Mean (Likert-5-scale)
Group Size	9	18	6	4	3	2.35
Personality Type	7	18	4	1	0	1.9667
Professional Background	13	24	7	5	1	2.14
Gender	0	2	12	4	2	3.30
Age	3	9	11	5	2	2.80
Culture	7	12	5	5	1	2.37

Source: Author's calculations based on the expert interviews with structured survey on the latent exogenous variables

The results regarding the research question and the resulting causal model are based on the output of the structured expert interviews. The latent exogenous variables are proven by the experts and the results shown that the independent variable "gender" is insignificant (Mean 3,3, which states that the experts rate the variable "gender" between "Neither" and "Disagree"). As a result, this variable is removed from the model and no longer taken into consideration in the further method steps.

The variable "culture" (Mean 2,37, which states that the experts rate the variable "culture" between "Agree" and "Neither") could be relevant but in the study difficult to verify, due to potential multicollinearity. Cultural aspects are part of a wide area of similar physiological aspects influenced by many personal behaviors. But in the area of risk management most of these personal behaviors are better covered by professional background and age (e.g. Gleißner, W. 2012). Owing to the aspects mentioned above and the "side notes" from the experts interviewed, the variable "culture" was likewise removed from the model.

To complete the review of the latent exogenous variables it is necessary to bring in one further aspect. As already mentioned, when the model was presented, a simple correlation analysis is not sufficient to investigate the research question. While risk management experts are familiar with the specific technical terminology and know how to apply it, this is not the case for the majority of professionals with operational responsibility (which is to say, often management personnel within a company who are involved in risk assessment). As a result, although it was theoretically statistically valid to interrogate the correlation between exogenous and endogenous variables directly owing to the large number of professionals being interviewed, based on the outcome and the result it was most certainly invalid. If the definition and thus the meaning of specific terms cannot be clearly and comprehensively understood by all participants in the survey, this approach is fundamentally divorced from the scientific method. On the other hand, in risk management there are too few experts to give statistically sustainable outcomes. To be able to carry out sufficient analysis of the research question in spite of this, terms and terminology must be introduced separately when interviewing the professionals. Failure to do this would lead to a discussion of interrelationships rather than of individual variables.

The results of the structured expert interviews show the significance of the exogenous variables, contribute to further reduction of the model and furthermore provide the opportunity to form an empirical norm using the ranking. This empirical norm for the exogenous variables that have been determined can then be incorporated as a key factor into the further tests and make a

crucial contribution to the discussion of the research question. To put it briefly: the experts support and differentiate the prevailing opinion in research while the professionals test this by assessing the interrelationships.

2.8.3 Determination of Latent Endogenous Variables

The area of decision making has been the focus of attention from all sides for several decades now. Numerous scientists have developed models and published papers on the topic. It is now necessary, from this great fund of knowledge and on the basis of a more in-depth literature review based on the research question - i.e. strictly reserved to risk management - to make a corresponding selection of endogenous variables. Each of these variables which corresponds to the model also relies on the creation and identification thereof. The qualitative relevance has, once again, been assessed by the risk management experts. The figure below illustrates the corresponding process.

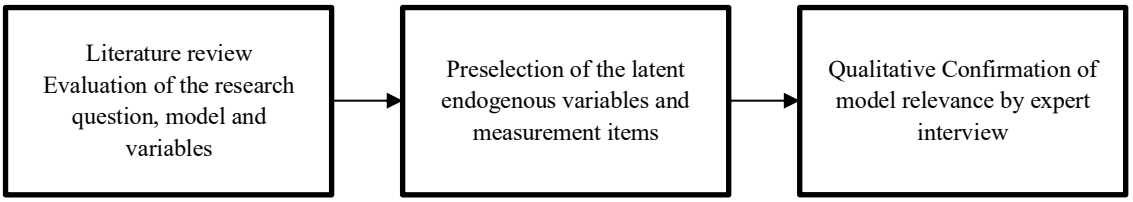


Figure 2.3. Determining Latent Endogenous Variables

Source: Author's compilation

Numerous studies have addressed the topic of effective decision making. Many researchers have investigated this in the context of business, in particular, taking the opportunity to probe more deeply into the details (Tversky, A., & Kahneman, D. 1974)(Arkes, H.R., & Ayton, P. 1999)(Kahneman, D., & Klein, G. 2009). If risk management is now considered to be part of the current and important operational workflow, it is precisely these research results that form the foundation for developing more detailed endogenous variables for the model and measurement items for said variables.

Taking these general research results on decision determination as a starting point, we are faced with the areas of decision distribution, discussion uncertainty, and controversy. The statistical

importance of decision distribution can be clearly deduced from the mean and the standard deviation (Buttler, G., & Fickel, N. 2002). The ambiguity or otherwise of the risk assessment can then be determined directly from the standard deviation. As regards discussion uncertainty, early research quickly established that uncertainty within discussions has a positive impact on decision making, and not a negative one (Brockhaus, R.H. 1980). This is because uncertainty leads people to delve more deeply into the materials and engage in an open discussion on the basis of conflicting ideas (Tjosvold, D., Yu, Z.Y., & Hui, C. 2004). A similar picture plays out in the case of discussion controversy. Experiments have shown that controversy in the discussion and the resulting dynamics with open opinion assessment make the decision-making process more sustainable (Tjosvold, D. 2008)(Tjosvold, D., & Sun, H. 2003). From these points, it is possible to derive the first latent endogenous variable mentioned in the model ($Y_t \Leftrightarrow Y_1 \Leftrightarrow Y_{1.1..1.3}$).

The second latent endogenous variable, clarity and derivability in the statement, duration of decision making, is yet again found in the broad scope of decision efficiency and effectiveness. The first aspect to consider in relation to risk assessments is procedural rationality. Here, empirical studies have shown that procedural rationality has a positive impact on the sustainability of decision making and the outcome of the decision (Dean, J.W. Jr., & Sharfman, M.P. 1993)(Eisenhardt, K., & Bourgeois, L.J. 1988). In recent years, the area of political behavior has been researched at least as intensively in this regard, i.e. in conjunction with procedural rationality. Excessive politicking has a negative impact on the sustainability of strategic decision making. Personal interests, whether one's own or those of another, hinder the flow of information or selectively filter information, thereby circumventing the goals of the group or business (Eisenhardt, K., & Bourgeois, L.J. 1988)(Ravasi, D., & Zattoni, A. 2006). The third key aspect to consider is that of processing duration. Accelerated action looks at fewer alternatives, limiting decision making (Mintzberg, H. 1973)(Nutt, P.C. 1976). Strong leadership also often leads to decisions being made more rapidly, as less discussion is permitted (Vroom, V.H., & Yetton, P.W. 1973). In contrast, the viewpoint on controversy in discussion and the resulting potential for conflict mentioned above leads to longer processing durations, which is beneficial to decision making (Mintzberg, H., Rainsinghani, D., & Theoret, A. 1976).

A further latent endogenous variable for the model can also be derived from the above considerations ($Y_t \Leftrightarrow Y_2 \Leftrightarrow Y_{2.1..2.3}$)

For the third endogenous variable, traditional economic responsibilities and parameters have been extracted from the literature. Their monetary and strategic scope are directly related to the impact on the company's affairs. The first parameter is the budget responsibility of the group members. Even when the budget is drawn up as part of a planning process (Burman, L.E., & Phaup, M. 2012), it still reflects the give and take in day-to-day operations, as well as the impact for decisions. The second parameter for measuring strategic influence within a business is an individual's personal responsibility within a risk assessment. Here too, the weighting of the possible influence owing to prominence within the organization, on the one hand, and the leadership qualities of the decision-maker, on the other, become clear (Vroom, V.H., & Yetton, P.W. 1973). A further parameter is strategic responsibility, which always has a considerable influence on operational matters (Jarzabkowski, P. 2003) and has a level of importance similar to budget or personal responsibility in terms of the risk assessment.
The model is completed by the third latent endogenous variable ($Y_t \Leftrightarrow Y_3 \Leftrightarrow Y_{3.1..3.3}$).

Owing to the scientific evaluations and corresponding literature review, it must be supposed that measured variables are not individually weighted. A uniform distribution is assumed. In other words, each measurement has the same weight factor (load).
The three latent endogenous variables presented above, and their measured variables are applied in the model without specific weight factors (load)($Y_t \Leftrightarrow Y_{1..3} \Leftrightarrow Y_{1.1..3.3}$).

Starting from initial assumptions about relationships, analyses of existing theories, literature reviews and expert interviews, which resulted in a further reduction in latent variables, it was possible to develop a corresponding causal model. The resulting theories arise from the relationship between the latent exogenous (independent) and latent endogenous (dependent) variables in the causal model. The main hypothesis focuses primarily on group compositions in risk assessments, which has an effect on the sustainability of the results which, in turn, expresses the growing importance of risk management for corporate strategy.

The causal model postulated and the resulting theories set the framework for the empirical study. The empirical design and the data collection based upon it are coordinated with the

hypotheses to be tested. Measured variables have been determined for the respective parameters in order to compare the hypotheses with the measured values and to make it possible to evaluate them.

2.9 Construction of Main Hypothesis of the Influence Group Compositions on the Sustainability of Risk Management Supported Decision Making

Starting from initial assumptions about relationships, analyses of existing theories, literature reviews and expert interviews, which resulted in a further reduction in latent variables, it was possible to develop a corresponding causal model. The resulting theories arise from the relationship between the latent exogenous (independent) and latent endogenous (dependent) variables in the causal model. The main hypothesis focuses primarily on group compositions in risk assessments, which has an effect on the sustainability of the results which, in turn, expresses the growing importance of risk management for corporate strategy.

The basic hypothesis is formulated as:

H_0: The group composition of risk assessments has an impact on the sustainability of risk management supported decision making

Further sub hypotheses are defined as:

H_{01}: The larger the group size for risk assessments is, the higher the level of sustainability of risk management supported decision making

H_{02}: The more different the personality types in groups for risk assessments are, the higher the level of sustainability of risk management supported decision making

H_{03}: The higher the professional background of group members for risk assessments is, the higher the level of sustainability of risk management supported decision making

H_{04}: The older the group members for risk assessments are, the higher the level of sustainability of risk management supported decision making

H_{05}: There is no difference in perception between risk management experts and the acting business professionals in terms of group composition in risk assessments

The causal model postulated and the resulting theories set the framework for the empirical study. The empirical design and the data collection based upon it are coordinated with the hypotheses to be tested. Measured variables have been determined for the respective parameters in order to compare the hypotheses with the measured values and to make it possible to evaluate them.

3 SCIENTIFIC METHOD-MIX AS STRATEGY OF INQUIRY FOR TESTING THE RELEATIONSHIP BETWEEN GROUP COMPOSITION OF RISK ASSESSMENTS AND SUSTAINABILITY OF RISK MANAGEMENT SUPPORTED DECISION MAKING

To test the given hypothesis the overall scientific approach is a combination of a scientific-method-mix of five different basic methods.

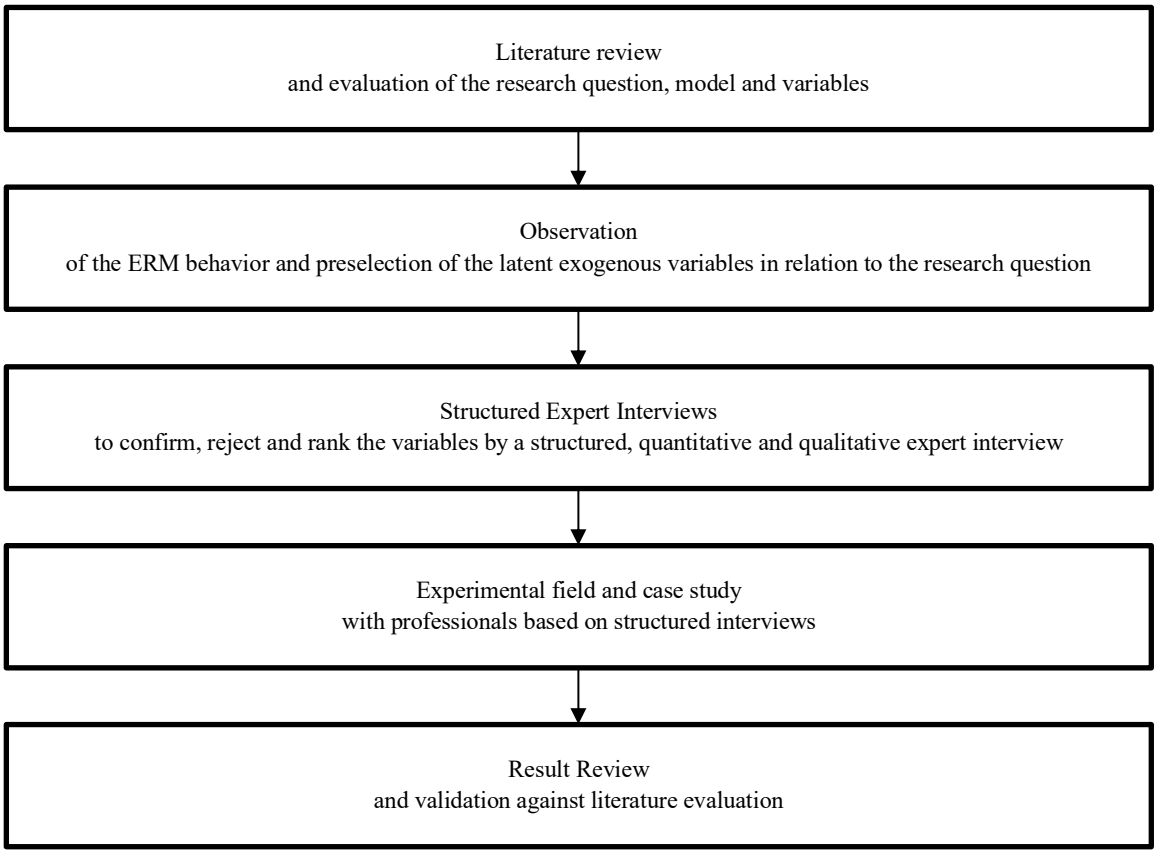


Figure 3.1. Five-Method-Mix – Scientific Approach

Source: Author's compilation

In empirical research there is a variety of qualitative and quantitative investigation methods. In the following sub-chapter the used methods are described, the limitations outlined, and the applicability for this work examined - for detailed overview of the followed methods of this dissertation see Figure 3.1.

3.1 Current State of Research via Literature Review

In general, the academic aim of the literature review method is to gain an overview of the current state of research. It is moreover possible to identify appropriate gaps and new academic questions. Taking an in-depth look at a field of academic research not only expands one's general understanding in relation to the research question, it also serves to reopen issues that were previously considered to be settled.

The research process is designed more spirally than linear in its course. It starts with an idea, collects theoretical information, revises and refines this idea, begins by examining possible designs, re-examining the theoretical assumptions and refining these theoretical assumptions and possibly even the original or refined idea (Lune, H., & Berg, B.L. 2017). The result is no longer a linear progression in a single forward direction that extends beyond the areas of "gathering ideas", "literature review", "design", "data collection", "analysis and results", but a spiral.

Looking more closely at the field of literary review, this method is described as a qualitative content analysis to differentiate it from quantitative content analysis without pursuing the goal of obtaining a holistic population of sources for quantitative analysis (Mayring, P., & Glasses-Zikuda, M. 2005). The degree of reliability of publications is crucial (Mayring, P., & Brunner, E. 2009). Only scientifically proven primary sources and databases can be used and cited. Sources with a high SCI (Scientific Citation Index) must preferably be selected.

Working through the historical development of the research as reflected in the publications is of even greater use in relation to areas that are undergoing rapid change. In particular when considering the present research topic of enterprise risk management, a significant change has been recorded in respect of its importance and influence on business decisions.

It should also be mentioned in passing that sources with a higher Scientific Citation Index are given greater weighting in the analysis, as are sources from prestigious publications.

The qualitative literature research was chosen as the methodology to create a basis for the largely unexplored research question by examining different scientific fields. The formal requirements of the qualitative literature review method were observed and complied with. The results of the literature results were formally listed, classified and the respective sources indicated.

Considering the first step of the developed Five Step Method mix, it is first necessary to work through the relevant basic theories and related publications, as explained in Chapter 1. Based on this, a first reduction is obtained by evaluating the effect of the basic theories on the research topic.

3.2 Characterization of Scientific Questions via Observation

If pre-defined hypotheses have crystallized out of the first step of the method mix, these are now the basis for the second step, the observation method.

In research, observation is used to identify causal factors and to draw conclusions about variables and processes that are not directly observable. In general, the observation method is based on a predefined hypothesis that can be used to validate test results, objectified and recorded (cf. Foster, S.L., & Cone, J.D. 1986) (Adler, P.A., & Adler, P. 1994)(Greve, W., & Wentura, D. 1997).

The background to the method consists in objectivizing the material selected subjectively in the literature review, i.e. the basis for an initial approach to a hypothesis. Observation of the industrial environment in which the research question plays out is also a key starting point. Industrial standards, current developments, and also existing behaviors bear a relation to academic publications. From this alone it is possible to derive requirements as to the scientific methodology to be used below. A further reduction in the indicators for finding a model and improved abstraction ultimately lead to the selection of the model criteria for both exogenous and endogenous variables and measurement items. All these outcomes can now be incorporated into the theoretical model and the formulation of the hypotheses.

The observation method was used in the Five-Method-Mix to characterize scientific questions and to enrich them with further ideas.

Observational studies in general are the one which "involve the systematic recording of observable phenomena or behavior in the natural setting" (Baker, L. 2006).

In social science work, a distinction is generally made between participating and non-participating types of observation. This distinction depends on whether or not the observer shares the life of the group he is observing. If the observer observes by making himself or herself more or less a member of the group, in order to experience how the members of the group behave, the observation is called participant observation. Participant observation allows

for gathering data first-hand about behavior, events, occupational roles, and organizations (cf. Babbie, E. 1992).

However, if the observer observes in an external role without direct participation, the observation of this type is often referred to as a non-participating observation. If the observer observes in such a way that his or her presence may be unknown to the persons he is observing, such an observation would be referred to as a veiled observation. "Observational study of behavior: sampling methods." (Altmann, J. 1974).

The type of observation by participation has several advantages: The observer can record the natural behavior of the group. Furthermore, the observer can even collect information that is not easy to obtain if the observation is uninterested. However, there are also disadvantages to this type of observation. For instance, the observer could lose objectivity to the extent that he participates emotionally. "Participant observation is the process of learning through exposure to or involvement in the day-to-day or routine activities of participants in the researcher setting" (Schensul, S.L., Schensul, J.J., & LeCompte, M.D. 1999).

Observation by participation is used in relation to the five-method mix developed in this dissertation.

3.3 Reinforcement of Hypotheses by Structured Expert Interviews

The hypotheses arising from the first two scientific methods applied are now reinforced by the methodology of the expert interview. This can take a qualitative or quantitative form. The obvious initial approach of a qualitative interview with unstructured recordings has a host of weaknesses: different weightings of topic groups by the different experts surveyed, subjective interpretations of the statements, and the possibility of different levels of detail in the responses are just a few examples that make a comparative evaluation virtually impossible. This is where quantitative forms of interview come in. In this environment, based on the research topic, a structured quantitative method having preformulated questions is recommended in order to get results that can more easily be evaluated. This method uses predefined questionnaires, which are selected to fit with the interview guidelines while being restricted to the research field. The interview guidelines enable free communication with the experts, while the structured survey allows for quantitative evaluation. This helps to ameliorate or eliminate the weaknesses mentioned in connection with other forms of expert interview. The structure makes it possible to relate the interview closely to the variables mapped in the model.

In the method mix underpinning the research question, this section is designed to confirm or reduce the latent exogenous variables in the model. The preselected variables, the mapping thereof in the model and the resulting hypotheses are a fundamental component of the questionnaires in the expert interview. In the process, the experts helped reinforce or discard the hypotheses.

The Likert scale is generally recommended for quantitative evaluation. Selection of the Likert 5-point scale was based on the fact that a clear and not too differentiated response was required, which can be assigned equidistantly to a 20% segment over the entire range of the scale. The range given - Strongly Agree, Agree, Neither, Disagree, Strongly Disagree - also makes it possible to choose the central value, or reserve judgment. In many cases of expert surveys, this ability to not express an opinion is essential. All the data are therefore mapped in both a positive and a negative way. This clearly structured questionnaire with closed and fully formulated questions avoids uncontrolled responses and also supports the interview guidelines thanks to the clear wording. Where there is uncertainty, the interview partners can ask for clarity, further increasing the quality.

The experts were informed that they must fit their responses to the Likert scale provided and that multiple responses were not possible; furthermore, they were asked to leave no questions unanswered. All the interview partners accepted these requirements, so it was possible to make use of the results.

At the start of the interview, the areas extracted from the literature relating to the research question were presented, the observations were incorporated and a confirmation of the fundamental need for this research was unanimously given. The structured interview addressed each of the exogenous variables, and their importance in relation to the model and the research question it is based on were assessed by the experts. Taking this assessment as a starting point, a statistical evaluation was carried out (see chapter 2.8.2) and the model was reduced owing to the identification of irrelevant exogenous variables. Another benefit of the expert interview and associated statistical evaluation was the formation of an empirical norm between exogenous variables, which is a key component of the following method steps and their evaluation.

Overall, 10 risk management experts were surveyed in a one-to-one interview. The selection of candidates focused on those who stood out on account of their specialist knowledge, career experience and current working position in this field. Careful attention was paid to ensuring that the specialist terminology was identical and was leveled through further questioning if

appropriate. The aim of the interview was to obtain very high-quality data and precision in the responses.

The outcome of the 20 questions, relating to 6 original exogenous variables, was to approach the next step in the research question. The confirmation of the literature review and observation, the reduction of the model and determination of an empirical norm formed the basis for the next method step in order to be able to answer the research.

3.4 Setup and Organization of an Experimental Field and Case Study

The experimental field and case study was selected for the next method as other approaches were ruled out by the research question.

The field study deals with the real-world area where this research problem is located in. Based on a questionnaire survey business professionals and practices have been interrogated, because they do not have professional risk management expertise and represent the general empirical area of the major issue. The field study approach in this case is superior to experimental studies or case studies due to its relatively high internal and external validity, based on the structured questioner and the selected sample percipients.

The relatively new field of risk management in the context of decision making, into which very little research has yet been done, makes it impossible to do a simple correlation analysis between two groups (in our case, between the group of experts and the group of business professionals). The risk management experts are predominantly concerned with the topic of risk assessments in terms of scientific or professional expertise, whereas for the business professionals risk assessment is a frequently recurring but rather rare task. The experts reflect the current state of scientific knowledge and use specialist terms in their communication, while the business professionals administer the business necessities of risk management and use more work-related expressions in their communication. This in itself already leads to a difference in terminology and depth of application. Any correlation analysis to be applied would need to compare two completely different groups, which would lead to erroneous interpretations. To resolve this, the experimental field study was chosen for the group of business professionals. As shown in chapter 2, indicators were selected for the latent endogenous variables which are familiar to the test subjects and occur in their day-to-day operations. Owing to the above mentioned lack of penetration of expert experiences in the day-to-day business of risk management, owing to the relatively new field of study, the field study drew on predefined

whole tuples from all endogenous and exogenous variables. This meant that in the assessment, the test subjects could be asked about the strength of the respective tuple in comparison to the other tuple or in relation to their own business experience. This again made use of the Likert 5-point scale. The reason for this special treatment is the possibility of assessing an individual relationship, which is nevertheless easier to assess in isolation than individual criteria of the model. This relationship to be assessed represents a comprehensible connection between the exogenous and endogenous variables and is, moreover, structured on the basis of the criteria to be measured. The knowledge, often limited to experts, of specialist vocabulary and the extent of its meaning in the field of risk management can thus be broken down to the level of the business professionals, thereby delivering usable results that are suitable for evaluation.

Owing to the above mentioned requirement for the data to be statistically evaluated, the experimental field study was supported by a structured questionnaire. The large number of test subjects and the setup of the interviews, which was almost identical, made this rigid structure a necessity. Defining the variables and indicators by means of a case study made it possible to have control over the use of terminology and the definition of outcomes. The complexity of the questionnaire was reduced, and the comparability of the individual surveys was crucially increased. The face-to-face nature of the survey and replies to any questions that arose regarding terminology and definitions also contributed to improving the quality. It is crucial to establish the basic knowledge and conceptual limitations of risk management in advance of the interview. Carrying out a case study in advance is common methodology. In this case study, a fictional case - the Latt-Bikes case study - was used to give a precise definition to the terms and expressions used (based on examples such as the Pipers case study). The described case, based heavily on the reality of an M&A situation, depicts a situation from daily business life, in which the test subject could picture him- or herself, in relation to the respective variables in the model. Here, these situations are presented from two viewpoints which are fundamentally different: the viewpoint of the smaller company being acquired, and that of the large company making the acquisition. Actions, details and backgrounds are given without drawing any conclusions. In this way, a survey that is complex in itself is reduced to a fictional story which, in contrast to real case studies, is tailored precisely to the research question and the underlying model. This facilitates an exact representation of the facts and the potential for a more objective assessment by the test subjects.

As already mentioned previously, after presenting the case study, a structured questionnaire was used, with questions compiled in each case from the tuples formed between exogenous

variable and endogenous variable, incorporating the criteria to be measured. Again, the Likert 5-point scale was used. This allowed the test subjects to restrict themselves to assessing the strength of the relationship without having to delve too deeply into the individual specialist terms. The range given is once again divided into Strongly Agree, Agree, Neither, Disagree, Strongly Disagree. It is important to emphasize here that this selection of methodology made it possible for the test subjects to restrict themselves to assessing the relationship without having to think about precise definitions and expert knowledge; this then gave a comparable picture across all the assessments.

There were a total of 59 questions, and responses were received from 131 test subjects. The results of the structured questionnaire can now be evaluated statistically with the results of the structured expert interviews (see chapter 3.3). In the process, the empirical norm determined in the statistical evaluation of the structured expert interviews has been incorporated and the overall outcome has been subject to a t-test.

To ensure a wide reach of attendees, this experimental field study with business professionals based on structured interviews was also combined with questions from another doctoral student (Mr. Stefan Schwerd). Only blocks 2, 4, 6, and 8 include relevant questions for this dissertation. Blocks 1, 3, 5, and 7 are independent and do not belong to this dissertation work - see Appendix; they are also not considered for any analysis within this dissertation work.

3.4.1 Participants Structure

Great care was taken over the selection of the participants for the field study. The selection exclusively included experienced business professionals with several years of business experience, recruited from business, research, MBA and doctoral programs. Weaknesses in survey results which often arise through evaluation of identical questions with very different group or participant experiences (e.g. young students vs. experienced business professionals) have thus been ruled out in advance. The targeted selection of participants also ensured input from the widest possible range of industries, which should contribute to the balanced nature of the research paper.

For reasons of data protection, personal data was not collected or stored; however, this does not represent a disadvantage as these data have no impact on the research result.

3.4.2 Organization of the Field Study

In organizing the field study, care was taken to ensure that the environmental parameters were kept as constant as possible. The intention was to rule out the likelihood of variation in the information content to the greatest extent possible. A series of interviews were therefore carried out in which the group sizes were kept small, i.e. no group had more than 28 participants. Furthermore, the participants were each given a detailed explanation of how the field study would proceed. Each interview lasted around two hours and began with approx. 10 minutes of introduction, comprising the following points:

1. Professionals receive the case study “Latt-Bikes” - see Appendix
2. Professionals are reminded of the interpretation of the Likert 5-point scale
3. Professionals are instructed to bear in mind direct comparison of pairs
4. Professionals are instructed to read the case study without a time limit
5. Professionals are encouraged to ask questions about definitions, context and understanding
6. Professionals are asked not to talk about preferences and rationale of solution scenarios
7. Professionals are asked to fill out the questionnaire based on their individual background and with consideration of the explicit definitions in the case study
8. Professionals are reminded of the need to consider their personal experience but also the newly learned topics relating to enterprise risk management from the case study.

There followed approx. 30 minutes of working through the case study, approx. 10 minutes of questions and answers on the case study, and the rest of the time was spent responding to the questionnaire. After the questionnaire was handed in, each interview ended with a short summary and individual questions, which have not been included in the study.

3.5 Statistical Analysis Method with One Sample T-Test and Mann-Whitney U Test

The survey results provided a basis for further statistical tests. The latent endogenous variables has been analyzed along with the corresponding sub-variables.

Based on the research question and the resulting causal model, it is first of all necessary to verify the statistical analysis methods. There are fundamentally two groups: the group of nonparametric tests and the group of parametric tests. By comparing the characteristics of the

two groups, it is possible to establish that the parametric tests have a greater significance than the nonparametric tests. On the other hand, with parametric testing it is necessary to make more assumptions about the quality of the data.

"The parametric test is the hypothesis test which provides generalizations for making statements about the mean of the parent population. The statistic rests on the underlying assumption that there is the normal distribution of variable and the mean is known or assumed to be known. The population variance is calculated for the sample. It is assumed that the variables of interest, in the population are measured on an interval scale." (Campbell, M.J., & Swinscow, T.D.V. 2009)

"The nonparametric test is defined as the hypothesis test which is not based on underlying assumptions, i.e. it does not require population's distribution to be denoted by specific parameters. The test is mainly based on differences in medians. Hence, it is alternately known as the distribution-free test. The test assumes that the variables are measured on a nominal or ordinal level. It is used when the independent variables are non-metric." (Campbell, M.J., & Swinscow, T.D.V. 2009)

Making the correct choice between parametric and nonparametric tests in relation to the statistical analysis rests upon multiple factors. In principle, one can assume that for a quantity of information, e.g. a series of measurements, of a population that is fully known and described by parameters (e.g. a normal distribution), the parametric test should be chosen. In contrast, where there is little or no knowledge as to distribution, the nonparametric test should be selected.

As both methods can be applied to the data under consideration, and there are sound arguments for and against, both parametric and nonparametric tests has been used below for evaluation. The respective results has then been compared and interpreted.

The first statistical test, representing the group of parametric tests, is the one sample t-test. Another possibility would be the z-test. The difference is the required known variance of the underlying population for the z-test whereas the t-test estimates it from the sample itself. The second important difference is the increased robustness of the t-test, especially for smaller sample sizes (<30).

A one sample t-test is used to compare the mean difference of the given value of a population mean with that of a sample (Wackerly, D. 2008). The one-sample t-test is a special instance of the general t-test, with the condition that only one sample exists, the other is set to null by definition (Hanley, J.A., Marilyse, J., & Moodie, E.E.M. 2008).
In this case, the responses from the "Structured Expert Interviews" (see chapter 3.3) are the given value and the responses of the 131 participants in the "Experimental Field Study" (see chapter 3.4) are the sample.

The one sample t-test is calculated as follows:

$$t = \frac{\bar{X} - \mu}{\sqrt{\frac{\sum(X - \bar{X})^2}{n-1}}} \sqrt{n} \tag{3.1}$$

where:

t = one sample t-test value

μ = population mean

$\overline{X}$= Sample mean

n = # of observations

In order to make proper use of the given statistics for testing the hypothesis in relation to all parametric statistics, a set of assumptions are given that must be met. The assumptions of the one sample t-test are that it is a random sample from a defined population, interval or ratio scale of measurement is used, and the population is normally distributed. Random samples are difficult to find but required for all statistical inference because of the probability base. Researchers in other fields often use inferential statistics and discuss the specific limitations of sampling (Martin, R., & Chuanhai, L. 2016). Psychologists are known to apply parametric statistics such as the t-test for dependent means on approximately interval scales, even though the tests require interval or ratio data (Little, R.J. 2015). A normal distribution can also be assumed, but if the distribution is unknown then the sample must be of a sufficient size. This helps to contribute to the t-test being robust against violations of normal distribution.
The application of the t-test to the research question is valid since the sample size of 131 for the experimental field study is suitable for the t-test, the use of the Likert scale fulfills the requirement for interval or ratio data and, although the distribution of the survey results is not

known, firstly a normal distribution can be assumed and secondly the sample size is also large enough.

The group of nonparametric tests is represented by the Mann-Whitney U test. This has been used as the second statistical test. The Mann-Whitney U test is a homogeneity test that is used to verify the significance of the correlation between two distributions, i.e. whether two distributions A and B (one uninfluenced and one influenced, for example) belong to the same population. The test was developed by Henry Mann and Donald Whitney (1947) and by Frank Wilcoxon (1945). However, the central idea of the test was developed as early as 1914 by German educational theorist Gustaf Deuchler (Kruskal, W.H. 1957).

Since the Mann-Whitney U test is a nonparametric test, no assumptions are made in relation to the distribution of the scores. However, a few other assumptions are made. First, the sample taken from the population must be random. Second, independence within the samples and mutual independence are assumed. This means that a sample is in one or other of the groups (it must not be in both). And third the ordinal measurement scale is preconditioned. The U test is calculated as follows:

$$U = n_1 n_2 + \frac{n_1(n_1 + 1)}{2} - R_1 \tag{3.2}$$

where:

U = Mann-Whitney U test

n_1= sample-size of group with higher rank-size

n_2 = sample-size of group with lower rank-size

R_1 = both groups' rank-size

Whilst, in the t-test discussed above, a normal distribution of the samples is still assumed, this is not required for the U test. Likert scaling is also not essential since, in the U test, the calculation is based solely on the ranking (higher than or lower than).

"There's no absolute minimum sample size for the t-test, but as the sample sizes get smaller, the test becomes more sensitive to the assumption that both samples are drawn from populations with a normal distribution. The Mann-Whitney U test does not require any assumptions about

the parametric form of the distributions, requiring only the assumption that the distributions of the two groups are the same under the null hypothesis." (Hollander, M., & Wolfe, D. 1999)

This robustness compared to the t-test has been a crucial criterion in the discussion of the test results. Here again, the business professionals, with a sample size of 131, has been tested against the experts, i.e. the empirical norm defined thereby (see chapter 2.8.1).

4 RESEARCH RESULTS IN THE RELATIONSHIP BETWEEN GROUP COMPOSITION OF RISK ASSESSMENTS AND SUSTAINABILITY OF RISK MANAGEMENT SUPPORTED DECISION MAKING

This chapter sets out the data analyses and results from the various different methods and draws these together to give an overall outcome. Beginning with the evaluations of the structured expert interview and the determination of the empirical norm, continuing with the experimental field study and associated specific statistical evaluations, and finishing by testing the results against the hypotheses, all data collected has now been taken into account, assessed and analyzed in terms of the research question. It has been shown that, owing to the research question selected and the specific context of enterprise risk management, the chosen research methods intermesh to add value.

4.1 Results of the Structured Expert Interview

The structured expert interview made it possible to assess, i.e. to confirm or discard, the exogenous variables selected during the literature review. Moreover, the statistical evaluation of the expert interviews can be used to develop an empirical norm, which then feeds into the subsequent statistical method, the t-test. As previously shown, owing to the statistical evaluations of the structured expert interview and the more in-depth literature review, two possible latent exogenous variables were removed from the model. The first of these variables is gender, which owing to a mean < 0.5 was classified as not being relevant. The second of these variables is culture; although, having a mean of 0.6583, this had a certain relevance, the information from the experts and the associated literature meant that this was subsumed into the variable of professional background (see chapter 2.8.2).

Table 4.1. Overview on Statistical Results Structured Expert Interviews

Latent Exogenous Variable	Group Size	Personality Type	Professional Background	Gender	Age	Culture
No. of valid Experts Interviews	10	10	10	10	10	10
Mean over all per variable (Likert-5-scale 1 = max, 5 = min)	2,35	1,9667	2,14	3,3	2,8	2,3667
Mean over all per variable (normalized 1 = max, 0 = min)	,6625	,7583	,7150	,425	,5500	,6583
Standard deviations per normalized varialbe total	,28804	,1766	,2450	,1953	,2614	,2775
Relevance for the model (see chaper 2.8.2)	yes	yes	yes	no	yes	no (cf. Literature)

Source: Author's results

Below, all the evaluations has been carried out using normalized values (transform Likert-5-scale via (4-x+1)/4 to normalized scale). It follows therefrom that the scaling of the mean, as well as that of the median and all other statistical functions referenced, is based on a scaling of the measured values of 1 = Strongly Agree to 0 = Strongly Disagree.

4.1.1 Exogenous Variable: Group Size

Considering the measured value of "Group Size", the experts clearly expressed that this variable has a significant influence on the risk assessment. As was established in question 15, it was consistently shown that smaller groups are considered to be more effective (mean ,75 and a standard deviation ,2236). The outcome of the interview in relation to question 36 associated with the subject group was even more clear: both a relatively high mean value of ,85 and a smaller standard deviation of ,1225 reinforce the statement from the experts. The result of question 50 was rather different: a mean of ,50 and a standard deviation of ,2958 indicate a wide range of opinions. It is clear that group size is merely one criterion of success in a risk assessment, and not the crucial one.

Table 4.2. Exogenous Variable Group Size: Measurements and Results

Question No.	Question	Mean normalized	Median normalized	Standard Deviation	Variance
15	Smaller groups are more effective in risk assessment then bigger groups	0,75	0,75	0,2236	0,0556
36	Risk assessments should be done by single individuals to keep it short and simple	0,85	0,75	0,1225	0,0167
50	The group size is crucial for a good risk assessment	0,50	0,63	0,2958	0,0972

Source: Author's results

The experts confirmed that "Group Size" is a significant factor regarding its influence in risk assessment, but it was also clearly demonstrated that it is not the decisive factor.

4.1.2 Exogenous Variable: Personality Type

Considering the measured value of "Personality Type", the experts strongly emphasized that this is a very important variable. As early as question 5, it was clear that the outcome of risk assessments correlates with the number of different personality types (mean ,75 and a standard deviation ,1581). Interestingly, there was also consensus among the experts about question 21, that different personality types estimate risk differently, with a mean of ,75 and a standard deviation of ,2077. This statement inevitably also has an impact in relation to group size, and is further reinforced by question 34. Here again, the experts agreed with the statement that similar personality types estimate risk equally (mean ,75 and a standard deviation ,1581).

Table 4.3. Exogenous Variable Personality Type: Measurement Results

Question No.	Question	Mean normalized	Median normalized	Standard Deviation	Variance
5	The risk analysis should be performed by groups of people with different personality types	0,75	0,75	0,1581139	0,0277778
21	Different personality types assess risks differently	0,78	0,75	0,2077	0,0479
34	Same personality types estimate risks equal	0,75	0,75	0,1581	0,0278

Source: Author's results

The experts found that different "Personality Types" carry out different risk assessments. This aspect has a decisive influence on the rating. Furthermore, it can have an impact on the group size.

4.1.3 Exogenous Variable: Professional Background

Considering the measured value of "Professional Background", opinions among the experts were strongly nuanced. Although the responses underlined that a professional background arising purely from being part of the company is not very important (question 2 with a mean of ,60 and a standard deviation of ,1658), having in-depth operational knowledge is considered relevant (question 20: mean ,93 and a standard deviation ,1146). This was further refined by question 53, where the opinion of the experts was that although a wealth of experience is important, it is less crucial than being heavily involved with the local organizations (mean ,68 vs. ,93). This statement was soundly backed up by the result from question 28 (mean ,58 and a standard deviation ,3172). Finally, the experts made it clear that, once again, this holds true: the more varied the group composition, the better the outcome of the risk assessment. There is a direct comparison here with the statements regarding group size and the effects thereof.

Table 4.4. Exogenous Variable Professional Background: Measurement Results

Question No.	Question	Mean normalized	Median normalized	Standard Deviation	Variance
2	The value of risk analysis results increases with the company affiliation of the employee	0,60	0,63	0,1658312	0,0305556
20	It is important that these professionals do have a good inside in the local organization and processes and are not only "headquarters functions"	0,93	1,00	0,1146	0,0146
28	Professional background directly influence risk assessment results	0,58	0,63	0,3172	0,1118
29	It is better to form a risk assessment team with different professional background	0,80	0,75	0,1000	0,0111
53	High experience level of staff members is important for the quality of risks analysis	0,68	0,75	0,2512469	0,0701389

Source: Author's results

Here, the experts likewise confirmed that heterogeneous groups composed of different "Professional Backgrounds" perform best in the risk assessment, whereby the insider knowledge is more valuable than a large general experience.

4.1.4 Exogenous Variable: Age

Considering the measured value of "Age", however, the experts consistently felt that this has an impact on assessment of risk (question 45, with a mean of ,75 and a standard deviation of ,2250). Nevertheless, they dismissed the idea that having a range of age groups in the group composition would have an influence in risk assessments (question 24: mean ,38 and a standard deviation ,2795). Following on from this, the statements from question 2 are more likely to reflect professional background than age (see above). In conclusion, it must be observed that age is the influencing factor with the least relevance in the model in terms of the research question.

Table 4.5. Exogenous Variable Age: Measurement Results

Question No.	Question	Mean normalized	Median normalized	Standard Deviation	Variance
2	The value of risk analysis results increases with the company affiliation of the employee	0,60	0,63	0,1658312	0,0305556
24	In risk analysis team forming it is always necessary to also onboard a number of older employees	0,38	0,38	0,2795	0,0868
45	Young people assess risks differently then older people	0,68	0,75	0,2250	0,0563

Source: Author's results

Contrary to the previous findings of the experts, the "Age" should not have a significant influence on the group composition of risk assessments. The "Professional Background" factor plays a crucial role here.

4.1.5 Intermediate Discussion and Conclusion on the Expert Interviews Results

The goal of the expert interview was also to confirm or reject the latent exogenous variables preselected during the literature review in relation to the model and the underlying research question. The qualitative statements were used to create a quantitative evaluation through the use of a structured questionnaire format. By analyzing the mean and standard deviation of each individual question and the summarized topic areas in relation to the latent exogenous variables, the experts' statements not only fed into and confirmed the model, but also influenced it (two of the candidates for latent exogenous variables extracted from the literature review were not confirmed). However, these results cannot be examined further using a correlation analysis (see chapter 3.5). Therefore, only elements thereof were used in the further application of the method mix. In order that the outcome of the expert interview could feed into the method as quantitative data, a quantitative empirical norm was derived, specifically the respective arithmetic mean of all statements based on a given exogenous variable, so that this could then be used in subsequent t-tests. The literature indicated that a number of experts between 3 and 8 would be a sufficiently large group (Linderman, A., Baker, J., & Bosacker, S.C. 2011) (Ganzach, Y. 2000), which was confirmed by the 10 experts surveyed.

The outcome of the structured expert interview was thus a reduction of the model, the confirmation of the remaining latent exogenous variables, and the formation of an accepted empirical norm for the remaining method steps.

4.2 Intermediate Discussion and Conclusion on the Experimental Field Study with Business Professionals Results

In the following chapter, the results of the quantitative analyses of the Experimental Field Study with the 131 business professionals has been investigated in detail. The results of all the interlinked relationships between the latent exogenous and latent endogenous variables has been examined individually. This leads to 12 individual investigations with corresponding evaluations. The t-test has been identified as the most appropriate parametric statistical analysis method (see chapter 3.5). It is now possible to calculate the significant difference in each case between the empirical norm determined from the Structured Expert Interviews and the t-value. In particular, the basic parametric results for N, average mean, standard deviation and mean standard error, t-value, mean difference and 95% confidence interval has been examined. The same approach can be taken for the selected nonparametric test, the Mann-Whitney U test. Here, the asymptotical significance has been considered. However, particular attention is paid to the t-test results (significance (2-tailed)) and to the U test (asymptotical significance (2-tailed)), which are to be interpreted as follows:

- value $\leq$ 0,01 $\stackrel{\text{def}}{=}$ "highly significant difference" between the viewpoint of the experts and the estimation by the business professionals
- value $\leq$ 0,05 $\stackrel{\text{def}}{=}$ "significant difference" between the viewpoint of the experts and the estimation by the business professionals
- value > 0,05 $\stackrel{\text{def}}{=}$ "no significant difference" $\triangleq$ "significant consensus" between the viewpoint of the experts and the estimation by the business professionals, marked below with "ch" (="confirming hypothesis")

The one-sample t-test selected uses the mean of a random sample to test whether the mean of a population differs from a specified target value. This presupposes that the data in the random sample come from a population with a normal distribution and that the size of the random sample is sufficiently large to comply with the central limiting value theorem. Whether or not the respective criteria being considered are supported or rejected does not solely depend on the

"significant consensus" of the t-test result. There is a special case in which the value can be ≤ 0,05 (= "significant difference") or even ≤ 0,01 (= "highly significant difference) without falling outside the scope of positive assessment in respect of the research question. This case occurs whenever the empirical measured value is higher than the empirical norm. In this case, the hypothesis is nevertheless confirmed, as the result is significantly different to, and indeed positively higher than, the empirical norm for the experts. Such cases are likewise identified below with "ch*" (= "confirming hypothesis"), with * indicating the special case. The statistical background for this is that the t-test method being used is 2-tailed. For this reason, differences above the value are also measured (≤ 0,01), whereas the hypothesis is one-sided. The results over fulfil the empirical norm, the business professionals confirm the experts, thereby given the hypothesis even more weight.

For the U test, it is also possible to make a corresponding assumption regarding overfulfilment. Here, the mean rank of the two groups is compared. If the mean rank of the business professionals is higher than the mean rank of the experts then, in this test procedure, the statement of the experts have been confirmed again by the business professionals, and more than just corroborated. The evaluation of the mean ranks is presented below as the ratio of "mean rank experts/mean rank business professionals" (mean rank relation).

The following subchapters addresses the results of the t-tests and the U tests as well as the impacts thereof on the research question. If the results of the t-tests and U tests vary significantly, the Shapiro-Wilk-Test may be employed to analyze the sample data for a normal distribution. Although the t-test is robust, the data should be approximately normally distributed. The U test offers an alternative to the t-test when the sample data do not meet the prerequisites of a t-test, i.e. the underlying distribution fails to display an approximately normal distribution. Thus, the Shapiro-Wilk-Test may be utilized in cases where t-tests and U tests demonstrate contrasting results to determine the applicable test.

4.2.1 Results in the Relation between Group Size and Decision Determination

The detailed evaluation below relates to the relationship between the latent exogenous variable "Group Size" in the case of group compositions of risk assessments and the latent endogenous variable "Decision Determination", relevant to the sustainability of risk management supported decision making (see Table 4.1). The individual test results are listed in the associated table below. This emphasizes the analytically relevant area of significance (t-test/U test).

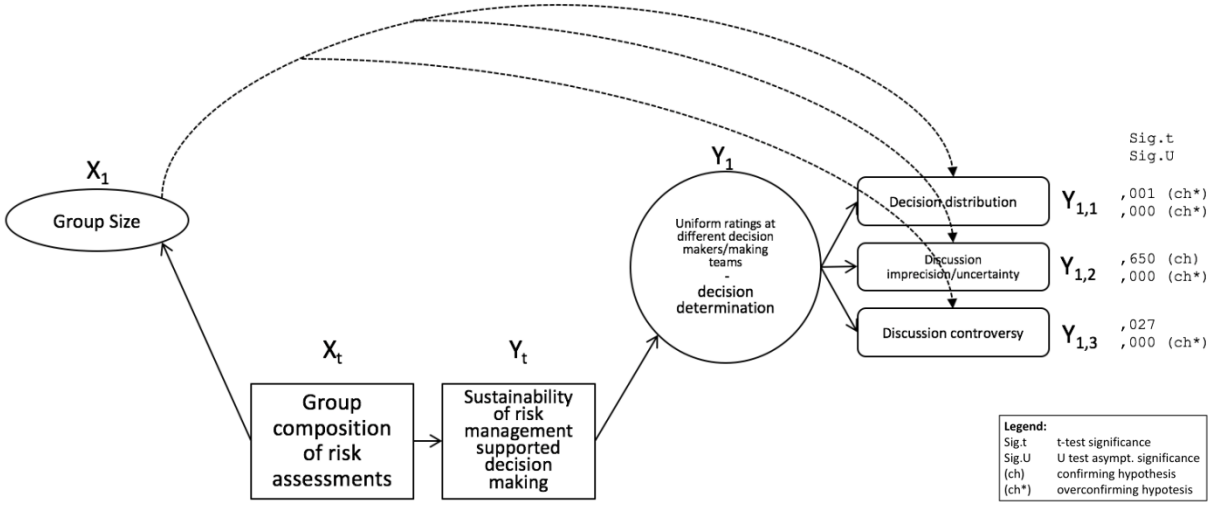


Figure 4.1. Test for "Decision Determination" against the empirical norm of "Group Size"

Source: Author's results

shows the relations and the respective associated significance level between the exogenous variable "Group Size" and the endogenous variable "Decision determination" on a one-to-one basis with the associated individual measurement criteria. Here, the measurement criterion "Discussion imprecision/uncertainty" has the highest value and confirms the associated hypothesis H01. For all tests against the latent exogenous variable "Group Size" the empirical norm ,6625 from the statistical result of the structured expert interviews is used (Table 4.1).

Table 4.6. Test Results: Group Size (X1) – Decision Determination (Y1)

		t-test				U test	
Decision determination (Y1)	N	Mean	Std. Deviation	t	Significance (2-tailed)	Mean Rank Relation	Asympt. Significance (2-tailed)
Decision distribution (Y1.1)	131	,7385	,26650	3,266	,001 (ch*)	96/167	,000 (ch*)
Discussion imprecision/uncertainty (Y1.2)	131	,6737	,28061	,455	,650 (ch)	107/156	,000 (ch*)
Discussion controversy (Y1.3)	131	,7118	,1993	2,233	,027 (ch*)	101/162	,000 (ch*)

empirical norm: ,6625

Source: Author's calculation

For the relationship between "Group Size" and "Decision determination", the t-test does not give a uniform result, although on closer consideration it is in fact unambiguous. In the assessment of the business professionals, the measurement criteria "Discussion imprecision/uncertainty" and "Discussion controversy" are on average even above the empirical norm of ,6625 for the experts. The business professionals assess "Decision distribution" to have the most importance, with a mean of ,7385, even though the mean difference has turned out to be the greatest. The assessment for "Discussion imprecision/uncertainty" with a significance level of ,650 is unambiguous, the largest inhomogeneity showing a standard deviation of ,28061.

In contrast, the Mann-Whitney U test shows an absolutely consistent result. Although the asymptotical significance is below the threshold value of ,05, in these instances even below ,000, the relation of the mean ranks of the business professionals for the measurement criteria "Decision distribution", "Discussion imprecision/uncertainty" and "Discussion controversy" show a clear overfulfilment of the experts' statements.

The experts corroborate the business professionals in the results of both test procedures for all measurement criteria. For the measurement criteria overfulfilled by the business professionals, the trends are also the same in both test procedures. This means that the measurement criterion "Decision distribution" is the most overfulfilled in both test procedures, the measurement criterion "Discussion controversy" is in the middle in terms of overfulfilment, and the

measurement criterion "Discussion imprecision/uncertainty" has the least degree of overfulfilment.

Interpretation of results and impacts on the research question: the exogenous variable "Group size" has a clear influence on the measurement criterion "Decision determination" and hence on the sustainability of risk management supported decision making. Specifically, the business professionals take the view that assessments in groups, when compared to each other, have less variance than individual assessments, when compared to each other. When considering the influence of the exogenous variable "Group size" on the measurement criterion "Discussion imprecision/uncertainty", the estimates of the business professionals are closest to those of the experts, that group decisions are more accurate. However, the influence of the exogenous variable "Group size" on the measurement criterion "Discussion controversy" is also estimated to be higher by the business professionals than by the experts. Nevertheless, there is clear confirmation of the fact that, with groups, there is the danger of having unnecessary, controversial discussions.

The business professionals confer too great a significance on the exogenous variable "Group size" in relation to the endogenous variable "Decision determination".

4.2.2 Results in the Relation between Group Size and Decision Efficiency and Effectiveness

The next detailed evaluation relates to the relationship between the latent exogenous variable "Group Size" in the case of group compositions of risk assessments and the latent endogenous variable "Decision efficiency and effectiveness", relevant to the sustainability of risk management supported decision making (see Table 4.1). The individual test results are listed in the associated table below. This again emphasizes the analytically relevant area of significance (t-test/U test).

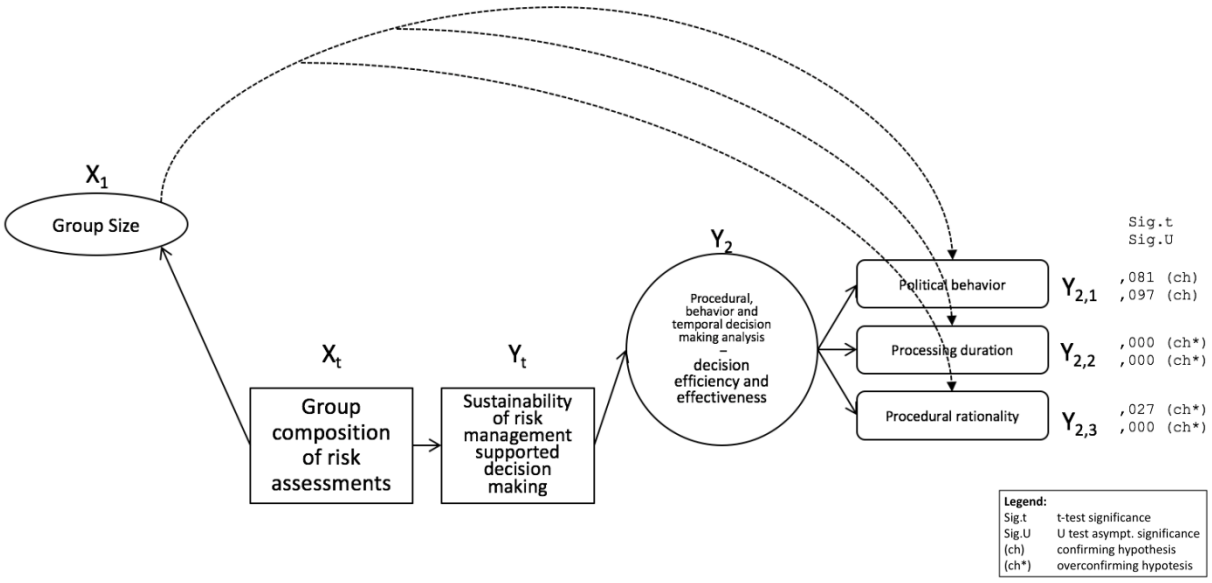


Figure 4.2. Test for "Decision Efficiency and Effectiveness" against the empirical norm of "Group Size"

Source: Author's results

Figure 4.2 shows the relations and the respective associated significance level between the exogenous variable "Group Size" and the endogenous variable "Decision efficiency and effectiveness" on a one-to-one basis with the associated individual measurement criteria. Here, the measurement criterion "Political behavior" has the highest value and confirms the associated hypothesis H01. For all tests against the latent exogenous variable "Group Size" the empirical norm ,6625 from the statistical result of the structured expert interviews is used (Table 4.1).

Table 4.7. Test Results: Group Size (X1) – Decision Efficiency and Effectiveness (Y2)

		t-test				U test	
Decision efficiency and effectiveness (Y2)	N	Mean	Std. Deviation	t	Significance (2-tailed)	Mean Rank Relation	Asympt. Significance (2-tailed)
Political behavior (Y2.1)	131	,6202	,30000	-1,531	,081 (ch)	119/144	,097 (ch)
Processing duration (Y2.2)	131	,8034	,25001	6,452	,000 (ch*)	92/171	,000 (ch*)
Procedural rationality (Y2.3)	131	,7468	,23495	4,385	,027 (ch*)	96/167	,000 (ch*)

empirical norm: ,6625

Source: Author's calculation

For the relationship between "Group Size" and "Decision efficiency and effectiveness", the t-test again does not show a uniform picture. Looked at in detail, here too, in the assessment of the business professionals, two criteria are above the empirical norm of ,6625 for the experts. The measurement criteria "Processing duration" and "Procedural rationality" received a correspondingly high assessment. The business professionals assess "Processing duration" to have the most importance, with a mean of ,8034, even though, here again, the mean difference has turned out to be the greatest. Although the assessment for "Political behavior" with a significance level of ,081 is significant, it is below the empirical norm on average and, moreover, has the largest inhomogeneity, showing a standard deviation of ,30000. It can be concluded from this that, although the measurement criterion "Political behavior" is clearly defined from an academic perspective, it is not so tangible in daily business activities.

The Mann-Whitney U test confirms the results of the t-test in all aspects. The measurement criteria "Processing duration" and "Procedural rationality" received a correspondingly high assessment, too. The absolute relations of the mean ranks (experts/business professionals) for the U test correspond in qualitative terms to the relations between empirical norm and t-test mean. The significance of the assessment for "Political behavior" again confirms the hypothesis in the U test, with no deviation from the t-test.

The experts likewise corroborate these assessments by the business professionals in the results of both test procedures for all measurement criteria. For the measurement criteria overfulfilled by the business professionals, the trends are once again the same in both test procedures. This means that the measurement criterion "Processing duration" is the most overfulfilled in both test procedures, the measurement criterion "Procedural rationality" is in the middle in terms of overfulfilment, and the measurement criterion "Political behavior" has the least degree of overfulfilment.

Interpretation of results and impacts on the research question: the exogenous variable "Group size" has a clear influence on the endogenous variable "Decision efficiency and effectiveness" and hence on the sustainability of risk management supported decision making. It is particularly noticeable that a significantly larger proportion of the business professionals consider that the "Processing duration" (the time required to make an individual decision is shorter) has an

impact on decision efficiency and effectiveness. The issue of "Procedural rationality" (e.g. in group decisions, information is more thoroughly analyzed than in individual decisions) is also assessed to be comparatively more significant. When considering the influence of the "Group size" on the political behavior (e.g. the decision-maker more strongly follows their own personal goals during individual decisions, while company goals are followed more strongly in group decisions), the estimates of the business professionals are closest to those of the experts.

It should be highlighted here that, although the business professionals confer too great a significance on the exogenous variable "Group size" in relation to "Decision efficiency and effectiveness", they assess the measurement criterion "Political behavior" to be less significant in relation to the other two measurement criteria.

4.2.3 Results in the Relation between Group Size and Decision Impact

This detailed evaluation relates to the relationship between the latent exogenous variable "Group Size" in the case of group compositions of risk assessments and the latent endogenous variable "Decision impact", relevant to the sustainability of risk management supported decision making (see Table 4.1). The individual test results are listed in the associated table below; the significance (t-test/U test) is emphasized accordingly.

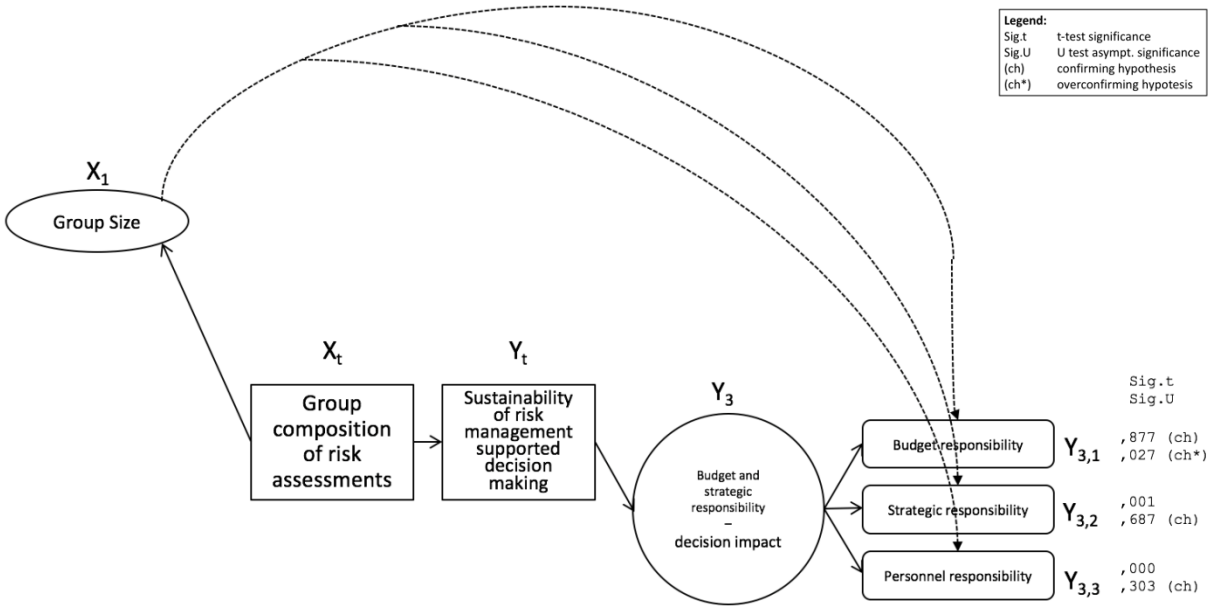


Figure 4.3. Test for "Decision Impact" against the empirical norm of "Group Size"

Source: Author's results

Figure 4.3 shows the relations and the respective associated significance level between the exogenous variable "Group Size" and the endogenous variable "Decision impact" on a one-to-one basis with the associated individual measurement criteria. Here, the measurement criterion "Budget responsibility" has the highest value and confirms the associated hypothesis H01. For all tests against the latent exogenous variable "Group Size" the empirical norm ,6625 from the statistical result of the structured expert interviews is used (Table 4.1).

Table 4.8. Test Results: Group Size (X1) – Decision Impact (Y3)

		t-test				U test	
Decision impact (Y3)	N	Mean	Std. Deviation	t	Significance (2-tailed)	Mean Rank Relation	Asympt. Significance (2-tailed)
Budget responsibility (Y3.1)	131	,6170	,27888	-1,630	,877 (ch)	125/138	,027 (ch*)
Strategic responsibility (Y3.2)	131	,5464	,30548	-4,226	,001	133/130	,687 (ch)
Personnel responsibility (Y3.3)	131	,4472	,29118	-8,783	,000	158/105	,303 (ch)

empirical norm: ,6625

Source: Author's calculation

The last t-test for "Group Size", this time for its relationship to the variable "Decision impact", again does not show a uniform picture, here with a completely different presentation. Looked at in detail, in the assessment of the business professionals two criteria are below the empirical norm of ,6625 for the experts. The measurement criteria of "Strategic responsibility" and "Personnel responsibility" were viewed as being less important. In contrast, the assessment for "Budget responsibility", with a mean of ,6170, is relatively close to the empirical norm, albeit a little lower. Based on the exogenous variable "Group Size", the measurement results for business professionals were furthest from the lower limit of the empirical norm. This showed the largest discrepancy in relation to the research question.

The Mann-Whitney U test shows a very informative result. For the measurement criterion "Budget responsibility", the statement is only identical with the t-test in that, through overfulfilment, the business experts have clearly determined that the measurement criterion is significant. The result is quite different for the other two measurement criteria "Strategic responsibility" and "Personnel responsibility". While significance and thus confirmation of the hypothesis could have been evident from the U test, the relation of the mean ranks for the measurement criterion "Personnel responsibility" rather contradicts this.

The experts corroborate the business professionals in the results of both test procedures only for the measurement criterion "Budget responsibility". The result in terms of significance is quite different for the other two measurement criteria "Strategic responsibility" and "Personnel responsibility". Although there is a clear discrepancy between the two test procedures for "Strategic responsibility", for "Personnel responsibility" this discrepancy is somewhat weakened by the comparison of the mean ranks from the U test (158/105) in relation to the comparison of the empirical norm/mean of the t-test (,6625/,5464).

Interpretation of results and impacts on the research question: "Group size" has less influence on the sustainability of risk management supported decision making than the two other endogenous variables "Decision determination" and "Decision efficiency and effectiveness". Only the measurement criterion "Budget responsibility" is assessed to be significant by both test procedures. For "Strategic responsibility", the discrepancy between the test procedures weakened the statement of the business professionals in all aspects and for "Personnel

responsibility" the hypothesis is virtually disproved even though the Shapiro-Wilk-Test shows a preference for the U test, due to the low significance when testing for normal distribution.

The business professionals consider that the exogenous variable "Group size" has a rather weak or undefined impact in relation to "Decision impact". "Group size" has no direct relation to strategic and personnel responsibility for the sustainability of risk management supported decision making.

4.2.4 Results in the Relation between Personality Type and Decision Determination

This detailed evaluation relates to the relationship between the latent exogenous variable "Personality type" in the case of group compositions of risk assessments and the latent endogenous variable "Decision determination", relevant to the sustainability of risk management supported decision making (see Table 4.1). The individual test results are listed in the associated table below; the significance (t-test/U test) is emphasized accordingly.

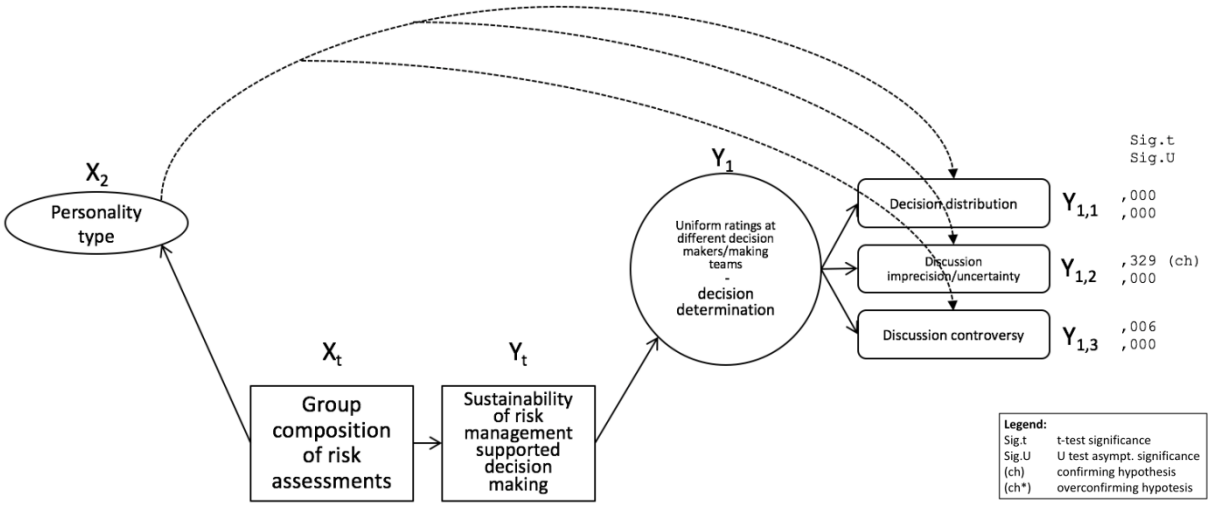


Figure 4.4. Test for "Decision Determination" against the empirical norm of "Personality Type"

Source: Author's results

Figure 4.4 shows the relations and the respective associated significance level between the exogenous variable "Personality type" and the endogenous variable "Decision determination"

on a one-to-one basis with the associated individual measurement criteria. Here, the measurement criterion "Discussion imprecision/uncertainty" has the highest value and confirms the associated hypothesis H02. For all tests against the latent exogenous variable "Personality Type" the empirical norm ,7583 from the statistical result of the structured expert interviews is used (see Table 4.1).

Table 4.9. Test Results: Personality Type (X2) – Decision Determination (Y1)

		t-test				U test	
Decision determination (Y1)	N	Mean	Std. Deviation	t	Significance (2-tailed)	Mean Rank Relation	Asympt. Significance (2-tailed)
Decision distribution (Y1.1)	130	,6115	,35227	-4,751	,000	162/100	,000
Discussion imprecision/uncertainty (Y1.2)	130	,7365	,25349	-,980	,329 (ch)	157/105	,000
Discussion controversy (Y1.3)	130	,6942	,26278	-2,781	,000	163/99	,000

empirical norm: ,7583

Source: Author's calculation

The t-test for the relationship between "Personality type" and "Decision determination" does not show a uniform picture. In the assessment of the business professionals, the measurement criteria "Decision distribution" and "Discussion controversy" are on average, as for the test with the exogenous variable "Group Size", some distance from the empirical norm for the experts (,7583); in this case, however, they are below it, i.e. outside the significance that is of relevance to the research question. The business professionals assess "Decision distribution", with a mean of ,6115, as the weakest and least uniform (standard deviation of ,35227). The assessment for "Discussion imprecision/uncertainty" with a significance level of ,329 is unambiguous, while the homogeneity, with a standard deviation of ,25349, is the highest when compared to the other two measurement criteria.

In terms of the relationship between "Personality type" and "Decision determination", in contrast, the Mann-Whitney U test shows an absolutely consistent result. The asymptotical significance is below the threshold value of ,05 and below ,000 in fact in all instances. Of further interest is the fact that the relation of the mean ranks of the business professionals for the

measurement criteria "Decision distribution", "Discussion imprecision/uncertainty" and "Discussion controversy" are well below those of the experts.

Both test procedures demonstrate that the statements of business professionals for the measurement criteria "Decision distribution" and "Discussion controversy" did not achieve the necessary significance level. For the measurement criterion "Discussion imprecision/uncertainty", differing results were determined, it being possible to establish that the two mean ranks are closest together here by contrast with the two measurement criteria "Decision distribution" and "Discussion controversy" mentioned previously.

Interpretation of results and impacts on the research question: the experts highlighted that "Personality type" has a very large influence on the variable "Decision determination". However, assessment of the results relating to the business professionals clearly shows that the relevance is underestimated here. Statements such as "Groups made up of members with different personality types, when compared to each other, have less variance than groups made up of members with similar personality types, when compared to each other" are evaluated as weaker by the business professionals than by the experts.

The business professionals assessment of the influence of the exogenous variable "Personality type" on the sustainability of risk management supported decision making is too weak in relation to decision determination, leading to an error of judgment in daily business!

4.2.5 Results in the Relation between Personality Type and Decision Efficiency and Effectiveness

This detailed evaluation relates to the relationship between the latent exogenous variable "Personality type" in the case of group compositions of risk assessments and the latent endogenous variable "Decision efficiency and effectiveness", relevant to the sustainability of risk management supported decision making (see Table 4.1). The individual test results are listed in the associated table below; the significance (t-test/U test)) is emphasized accordingly.

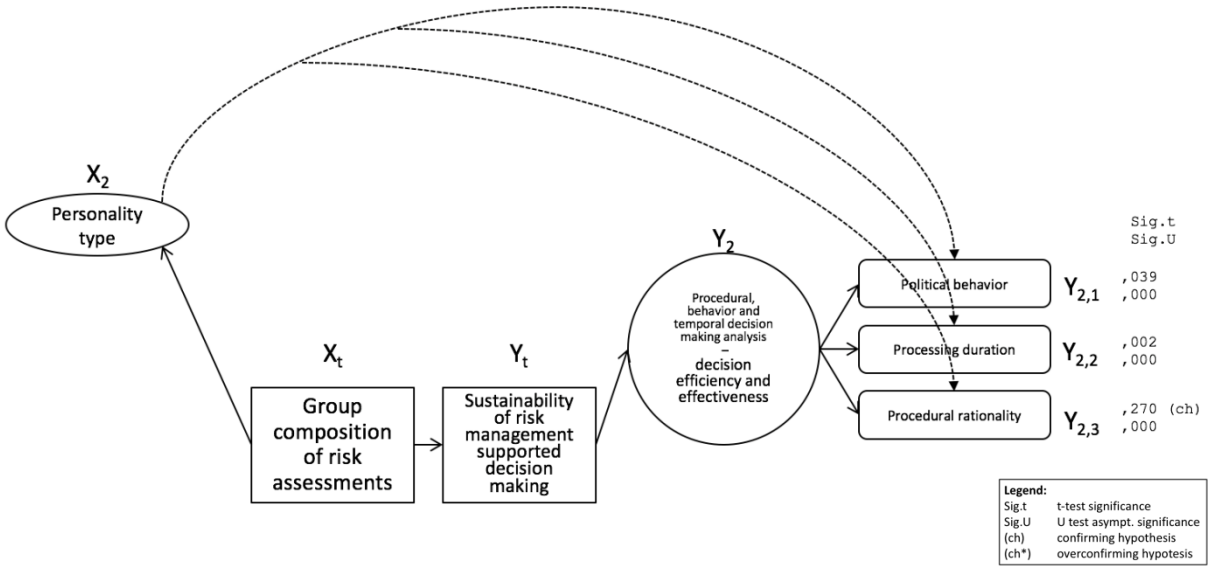


Figure 4.5. Test for "Decision Efficiency and Effectiveness" against the empirical norm of "Personality Type"

Source: Author's result

Figure 4.5 shows the relations and the respective associated significance level between the exogenous variable "Personality type" and the endogenous variable "Decision efficiency and effectiveness" on a one-to-one basis with the associated individual measurement criteria. Here, the measurement criterion "Procedural rationality" has the highest value and confirms the associated hypothesis H02. For all tests against the latent exogenous variable "Personality Type" the empirical norm ,7583 from the statistical result of the structured expert interviews is used (Table 4.1).

Table 4.10. Test Results: Personality Type (X2) – Decision Efficiency and Effectiveness (Y2)

		t-test				U test	
Decision efficiency and effectiveness (Y2)	N	Mean	Std. Deviation	t	Significance (2-tailed)	Mean Rank Relation	Asympt. Significance (2-tailed)
Political behavior (Y2.1)	130	,6884	,26112	-7,745	,039	160/102	,000
Processing duration (Y2.2)	130	,6750	,30124	-3,154	,002	157/105	,000
Procedural rationality (Y2.3)	130	,6987	,26183	-2,485	,207 (ch)	161/101	,000

empirical norm: ,7583

Source: Author's calculation

For the relationship between "Personality type" and "Decision efficiency and effectiveness", the t-test shows a uniform picture, although it deviates from the empirical norm, being consistently below it. Looked at in detail, here too, in the assessment of the business professionals, two criteria are clearly below the empirical norm of ,7583 for the experts. The measurement criteria "Political behavior" and "Processing duration" received a correspondingly low assessment. Although the business professionals assess "Procedural rationality" below the empirical norm, with a mean of ,6987, this is still in the significance level. Furthermore, the assessment for "Processing duration" has the largest inhomogeneity, showing a standard deviation of ,30124.

A further finding from this test series is that, yet again, although the measurement criterion "Political behavior" is clearly defined from an academic perspective, it is not so tangible in daily business activities.

The Mann-Whitney U test confirms the results of the t-test in all aspects here too. All measurement criteria again received a correspondingly low assessment. The mean ranks of the business professionals are all below the mean ranks of the experts. All significance values are below the significance level, being ,000 in all instances.

Both test procedures demonstrate that the statements of business professionals for the measurement criteria "Political behavior" and "Processing duration" did not achieve the necessary significance level. Differing results were determined for the measurement criterion "Procedural rationality". The t-test determined a significance while the U test did not. If the results are considered in relation to the empirical norm, there is a significance, but the mean is below the empirical norm. The same picture emerges when considering the ranks from the U test. Here, the rank of the business professionals, at 101, is significantly below that of the experts, at 161. From this it can be concluded that the significance is only very weak, including for the measurement criterion "Political rationality".

Interpretation of results and impacts on the research question: the experts once again highlighted that "Personality type" has a very large influence on the variable "Decision efficiency and effectiveness". However, the assessment of the results relating to the business professionals clearly shows that the relevance is underestimated here too. Statements such as "Groups made up of members with different personality types discuss their decisions more than groups made up of members with similar personality types" are evaluated as weaker by the business professionals than by the experts.

The business professionals´ assessment of the influence of the exogenous variable "Personality type" on the sustainability of risk management supported decision making is once more too weak (here in relation to "Decision efficiency and effectiveness"), reinforcing the picture of an error of judgment in daily business!

4.2.6 Results in the Relation between Personality Type and Decision Impact

This detailed evaluation relates to the relationship between the latent exogenous variable "Personality type" in the case of group compositions of risk assessments and the latent endogenous variable "Decision impact", relevant to the sustainability of risk management supported decision making (see Table 4.1). The individual test results are listed in the associated table below; the significance (t-test/U test) is emphasized accordingly.

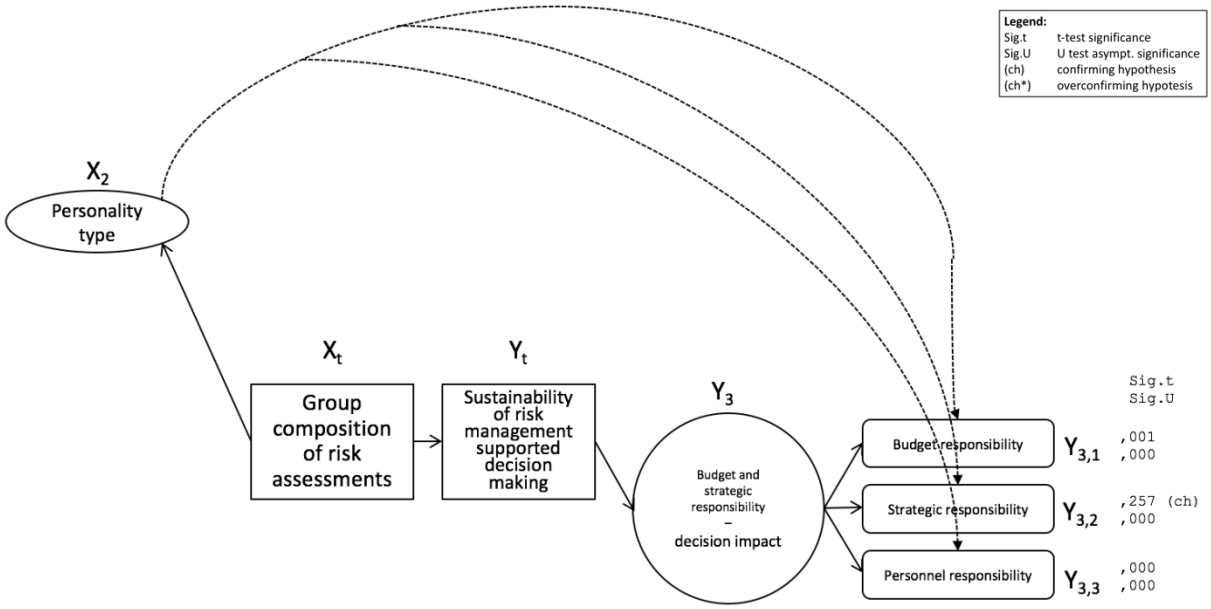


Figure 4.6. Test for "Decision Impact" against the empirical norm of "Personality Type"

Source: Author's result

Figure 4.6 shows the relations and the respective associated significance level between the exogenous variable "Personality type" and the endogenous variable "Decision impact" on a one-to-one basis with the associated individual measurement criteria. Here, the measurement criterion "Strategic responsibility" has the highest value and confirms the associated hypothesis H02. For all tests against the latent exogenous variable "Personality Type" the empirical norm ,7583 from the statistical result of the structured expert interviews is used (see Table 4.1).

Table 4.11. Test Results: Personality Type (X2) – Decision Impact (Y3)

		t-test				U test	
Decision impact (Y3)	N	Mean	Std. Deviation	t	Significance (2-tailed)	Mean Rank Relation	Asympt. Significance (2-tailed)
Budget responsibility (Y3.1)	130	,6692	,30850	-3,293	,001	160/102	,000
Strategic responsibility (Y3.2)	130	,7308	,27600	-1,138	,257 (ch)	153/109	,000
Personnel responsibility (Y3.3)	130	,6462	,33059	-3,869	,000	159/103	,000

empirical norm: ,7583

Source: Author's calculation

The last t-test for "Personality type", this time for its relationship to the variable "Decision impact", once again lies below the empirical norm for the experts in all areas, but is in the significance level in one area. Looked at in detail, in the assessment of the business professionals, the following two criteria are below the empirical norm of ,7583 for the experts and outside the significance level. The measurement criteria of "Budget responsibility" and "Personnel responsibility" were viewed as being less important. In contrast, the assessment for "Strategic responsibility", with a mean of ,7308, is also below the empirical norm, but within the significance level, at ,257. Based on the exogenous variable "Personality type", these measurement results for business professionals lie exactly in the same trend. In terms of the research question, only the business professional assessment for "Strategic responsibility" was positive.

The Mann-Whitney U test confirms the results of the t-test for the measurement criteria of "Budget responsibility" and "Personnel responsibility" here too. All measurement criteria again received a correspondingly low assessment. The mean ranks of the business professionals are all below the mean ranks of the experts. The mean rank of the experts and the mean rank of the business professionals are closest together in the case of the assessment of "Strategic responsibility", but are still considerably different. All significance values are below the significance level, being ,000 in all instances.

Both test procedures demonstrate that the statements of business professionals for the measurement criteria "Budget responsibility" and "Personnel responsibility" did not achieve the necessary significance level. Differing results were determined for the measurement criterion "Strategic responsibility". The t-test determined a significance while the U test did not. If, here too, the results are again considered in relation to the empirical norm, there is a significance, but the mean is slightly below the empirical norm. The same picture emerges when considering the ranks from the U test, albeit more strongly. Here, the rank of the business professionals, at 109, is significantly below that of the experts, at 153. From this it can be concluded that the significance is not as great as it may have appeared from the t-test alone, including for the measurement criterion "Strategic responsibility".

Interpretation of results and impacts on the research question: here too, the experts highlighted that "Personality type" has a very large influence on the variable "Decision impact". As in the case of the endogenous variables "Decision efficiency and effectiveness" and "Decision determination", it is again clear here in relation to the influence of the exogenous variable "Personality type" that the business professionals underestimate the relevance. Even statements such as "Where there is higher strategic impact, groups should be made up of different personality types" are evaluated as weaker by the business professionals than by the experts. Other statements such as "Where there is greater personnel impact, groups should be made up of different personality types" are more or less completely overlooked.

The business professionals´ assessment of the influence of the exogenous variable "Personality type" is once more too weak for all tested endogenous variables (here also in relation to "Decision impact"), once again reinforcing the picture of an error of judgment in daily business!

4.2.7 Results in the Relation between Professional Background and Decision Determination

This detailed evaluation relates to the relationship between the latent exogenous variable "Professional background" in the case of group compositions of risk assessments and the latent endogenous variable "Decision determination", relevant to the sustainability of risk management supported decision making (see Table 4.1). The individual test results are listed in the associated table below; the significance (t-test/U test) is emphasized accordingly.

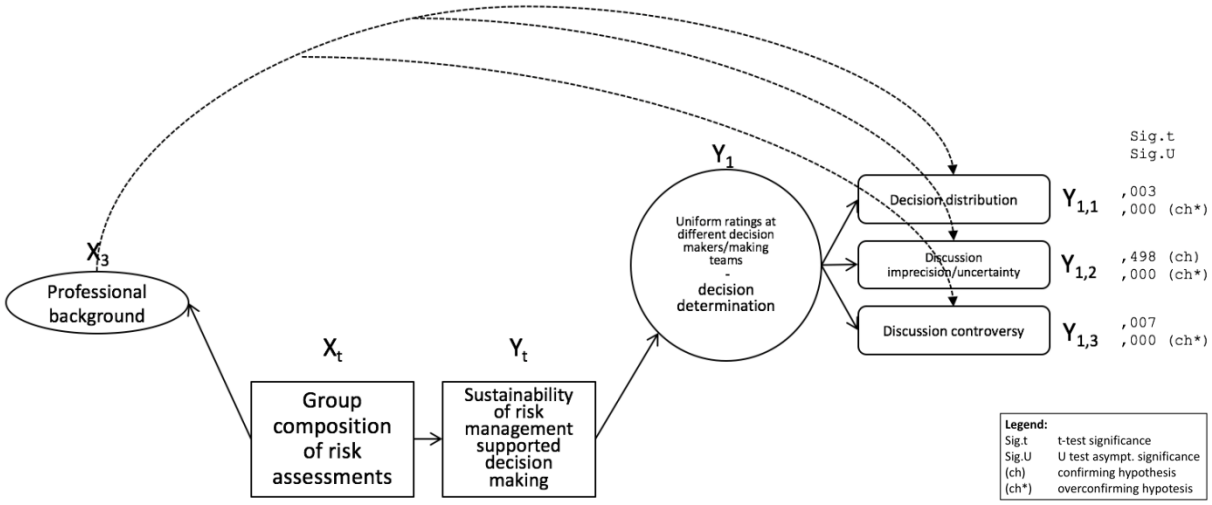


Figure 4.7. Test for "Decision Determination" against the empirical norm of "Professional Background"

Source: Author's results

Figure 4.7 shows the relations and the respective associated significance level between the exogenous variable "Professional background" and the endogenous variable "Decision determination" on a one-to-one basis with the associated individual measurement criteria. Here, the measurement criterion "Discussion imprecision/uncertainty" again has the highest value and confirms the associated hypothesis H03. For all tests against the latent exogenous variable "Professional Background" the empirical norm ,7150 from the statistical result of the structured expert interviews is used (Table 4.1).

Table 4.12. Test Results: Professional Background (X3) – Decision Determination (Y1)

		t-test				U test	
Decision determination (Y1)	N	Mean	Std. Deviation	t	Significance (2-tailed)	Mean Rank Relation	Asympt. Significance (2-tailed)
Decision distribution (Y1.1)	131	,6317	,31975	-2,982	,003	112/151	,000 (ch*)
Discussion imprecision/uncertainty (Y1.2)	131	,6985	,27859	-,679	,498 (ch)	103/160	,000 (ch*)
Discussion controversy (Y1.3)	131	,6527	,26050	-2,739	,007	110/153	,000 (ch*)

empirical norm: ,7150

Source: Author's calculation

The t-test for the relationship between "Professional background" and "Decision determination" shows a picture that is very familiar from the analyses of the exogenous variable "Personality type". Here too, in the assessment of the business professionals, the measurement criteria "Decision determination" and "Discussion controversy" lie on average some distance from the empirical norm for the experts (,7150) and outside the significance that is of relevance to the research question. The business professionals again assess "Decision distribution", with a mean of ,6317, as the weakest and least uniform (standard deviation of ,31975). The assessment for "Discussion imprecision/uncertainty" with a significance level of ,498 is unambiguous; however, the homogeneity, with a standard deviation of ,27859, is in the middle when compared to the other two measurement criteria.

In terms of the relationship between "Professional background" and "Decision determination", in contrast, the Mann-Whitney U test again shows an absolutely consistent result. The results in the U test only correspond in part to those of the relationship with the exogenous variable "Personality type". The asymptotical significance is below ,000 throughout. However, here the relation of the mean ranks of the business professionals for the measurement criteria "Decision distribution", "Discussion imprecision/uncertainty" and "Discussion controversy" are well above those of the experts.

Both test procedures again demonstrate that the statements of business professionals for the measurement criteria "Decision distribution" and "Discussion controversy" did not achieve the necessary significance level. For the measurement criterion "Discussion imprecision/uncertainty", differing results were determined here as well, with the two mean ranks being furthest apart here by contrast with the two measurement criteria "Decision distribution" and "Discussion controversy" mentioned previously.

Interpretation of results and impacts on the research question: the experts highlighted that "Professional background" has a large influence on the variable "Decision determination" (second greatest empirical norm in the test). Assessment of the results relating to the business professionals shows a very inconsistent pattern here. While the measurement criteria "Decision distribution" and "Discussion controversy" are assessed very inconsistently by the business professionals even though the Shapiro-Wilk-Test shows—as in chapter 4.2.3—a preference for the U test, due to the low significance when testing for normal distribution, the evaluations for "Discussion imprecision/uncertainty" produce a clear significance in respect of the t-test and a clear overfulfilment in respect of the U test. Statements such as "Groups made up of members with different professional backgrounds make more accurate decisions" are evaluated as stronger by the business professionals than by the experts, whereas statements such as "Groups made up of members with different professional backgrounds, when compared to each other, have less variance than groups made up of members with similar professional backgrounds, when compared to each other" or "Where there are groups made up of members with different professional backgrounds there is the danger of having unnecessary, controversial discussions" are assessed very inconsistently.

The business professionals do not have a clearly differentiated picture as regards the influence of "Professional background" on the sustainability of risk management supported decision making. The extent of the relationship between "Professional background" and "Decision determination" is not known, and only partial areas of influence are considered in daily business, which can lead to a false basis for a decision!

4.2.8 Results in the Relation between Professional Background and Decision Efficiency and Effectiveness

This detailed evaluation relates to the relationship between the latent exogenous variable "Professional background" in the case of group compositions of risk assessments and the latent endogenous variable "Decision efficiency and effectiveness", relevant to the sustainability of risk management supported decision making (see Table 4.1). The individual test results are listed in the associated table below; the significance (t-test/U test) is emphasized accordingly.

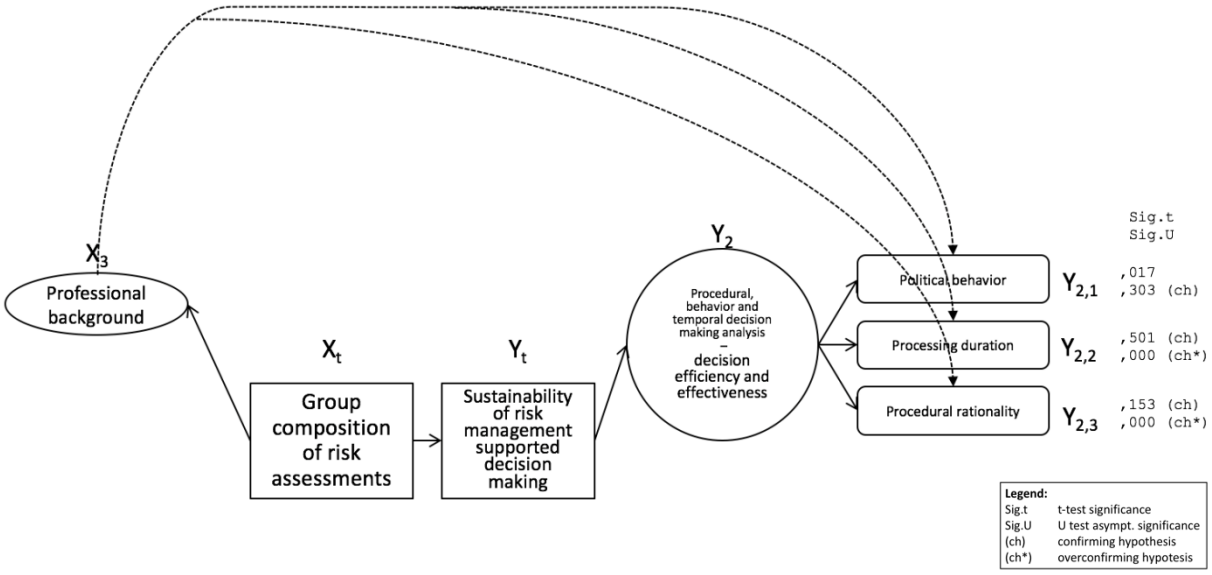


Figure 4.8. Test for "Decision Efficiency and Effectiveness" against the empirical norm of "Professional Background"

Source: Author's results

Figure 4.8 shows the relations and the respective associated significance level between the exogenous variable "Professional background" and the endogenous variable "Decision efficiency and effectiveness" on a one-to-one basis with the associated individual measurement criteria. In this evaluation, two measurement criteria are distinguished for the first time by achieving the significance level. The measurement criterion "Processing duration" and the measurement criterion "Procedural rationality" thus confirm the associated hypothesis H03. For all tests against the latent exogenous variable "Professional Background" the empirical norm ,7150 from the statistical result of the structured expert interviews is used (see Table 4.1).

Table 4.13. Test Results: Professional Background (X3) – Decision Efficiency and Effectiveness (Y2)

		t-test				U test	
Decision efficiency and effectiveness (Y2)	N	Mean	Std. Deviation	t	Significance (2-tailed)	Mean Rank Relation	Asympt. Significance (2-tailed)
Political behavior (Y2.1)	131	,6666	,26813	-1,794	,017	110/153	,303 (ch)
Processing duration (Y2.2)	131	,6985	,28031	,675	,501 (ch)	107/156	,000 (ch*)
Procedural rationality (Y2.3)	131	,7194	,24502	,451	,153 (ch)	101/162	,000 (ch*)

empirical norm: ,7150

Source: Author's calculation

The t-test for the relationship between "Professional background" and "Decision efficiency and effectiveness" is distinguished by the fact that two measurement criteria achieve the significance level. The measurement criterion "Processing duration", with a significance level of ,501, and the measurement criterion "Procedural rationality", at ,153, thus confirm the research question. In contrast, the business professionals give a low assessment to "Political behavior", with a mean of ,6666, i.e. below both the empirical norm and the significance level. Furthermore, the assessment for "Processing duration" has the largest inhomogeneity, with a standard deviation of ,28031.

This test series also confirms the results for the measurement criterion "Political behavior". Either the business professionals do not see the importance, or there is no consensus in their estimation, as was the case for the measurement series with the variable "Group Size".

The Mann-Whitney U test confirms the results of the t-test for the two measurement criteria "Processing duration" and "Procedural rationality" through overfulfilment measured using the mean ranks of the U test (107/156 and 101/162, respectively). For the measurement criterion "Processing behavior", the U test shows a different result to the t-test. With a value of ,303, a clear significance is determined, thereby confirming the hypothesis, in contrast to the t-test.

The results of the two test procedures are not completely consistent. Differing significance values were determined for the measurement criterion "Processing behavior". However, based

on the endogenous variable "Decision efficiency and effectiveness", it can be established that 5 of 6 measurement results (3 measurement criteria * 2 different tests) have clear significance.

Interpretation of results and impacts on the research question: the exogenous variable "Professional background" has a clear influence on "Decision efficiency and effectiveness" and hence on the sustainability of risk management supported decision making. In spite of the fact that the results of the two test procedures are not completely consistent, it can be established that the assessments of the business professionals are in line with those of the experts.

4.2.9 Results in the Relation between Professional Background and Decision Impact

This detailed evaluation relates to the relationship between the latent exogenous variable "Professional background" in the case of group compositions of risk assessments and the latent endogenous variable "Decision impact", relevant to the sustainability of risk management supported decision making (see Table 4.1). The individual test results are listed in the associated table below; the significance (t-test/U test) is emphasized accordingly.

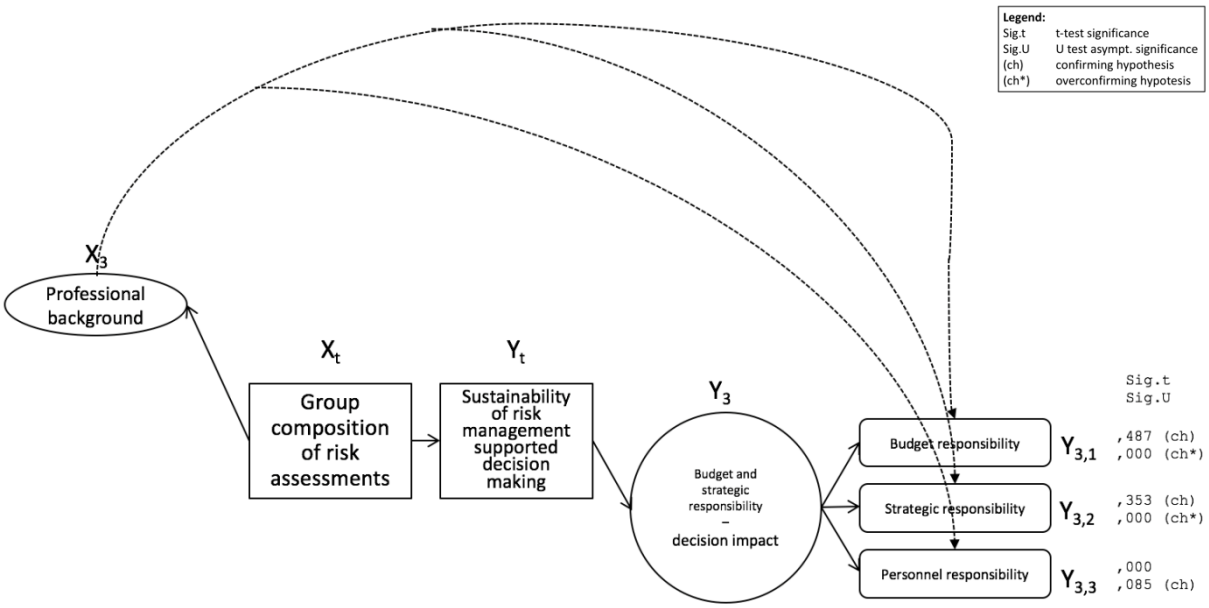


Figure 4.9. Test for "Decision Impact" against the empirical norm of "Professional Background"

Source: Author's result

Figure 4.9 shows the relations and the respective associated significance level between the exogenous variable "Professional background" and the endogenous variable "Decision impact" on a one-to-one basis with the associated individual measurement criteria. In this evaluation, two measurement criteria are again distinguished by achieving the significance level. The measurement criterion "Budget responsibility" and the measurement criterion "Strategic responsibility" thus confirm the associated hypothesis H03. For all tests against the latent exogenous variable "Professional Background" the empirical norm ,7150 from the statistical result of the structured expert interviews is used (Table 4.1).

Table 4.14. Test Results: Professional Background (X3) – Decision Impact (Y3)

		t-test				U test	
Decision impact (Y3)	N	Mean	Std. Deviation	t	Significance (2-tailed)	Mean Rank Relation	Asympt. Significance (2-tailed)
Budget responsibility (Y3.1)	131	,6985	,27160	-,696	,487 (ch)	103/160	,000 (ch*)
Strategic responsibility (Y3.2)	131	,7366	,26551	,933	,353 (ch)	99/164	,000 (ch*)
Personnel responsibility (Y3.3)	131	,6221	,29314	-3,626	,000	124/139	,085 (ch)

empirical norm: ,7150

Source: Author’s calculation

The t-test for the relationship between "Professional background" and "Decision impact" is again distinguished by the fact that two measurement criteria achieve the significance level. The measurement criterion "Budget responsibility", with a significance level of ,487, and the measurement criterion "Strategic responsibility", at ,353, thus confirm the research question. In contrast, the business professionals give a very low assessment to "Personnel responsibility", with a mean of ,6221, i.e. below the empirical norm and well below the significance level. Furthermore, the assessment for "Personnel responsibility" has the largest inhomogeneity, with a standard deviation of ,29314.

The Mann-Whitney U test confirms the results of the t-test for the two measurement criteria "Budget responsibility" and "Strategic responsibility" through overfulfilment measured using

the mean ranks of the U test (103/160 and 99/164, respectively). For the measurement criterion "Personnel responsibility", the U test shows a different result to the t-test. With a value of ,085, a significance is determined, albeit not a particularly strong one.

The results of the two test procedures are not completely consistent here, either. Differing significance values were determined for the measurement criterion "Personnel responsibility". However, based on the endogenous variable "Decision impact", as already seen for the test "Decision efficiency and effectiveness" against the empirical norm of "Professional background", here too it can be established that 5 of 6 measurement results (3 measurement criteria * 2 different tests) have clear significance.

Interpretation of results and impacts on the research question: the exogenous variable "Professional background" has a clear influence on "Decision impact" and hence on the sustainability of risk management supported decision making. In spite of the fact that the results of the two test procedures are not completely consistent, it can once again be established that the assessments of the business professionals are in line with those of the experts.

4.2.10 Results in the Relation between Age and Decision Determination

This detailed evaluation relates to the relationship between the latent exogenous variable "Age" in the case of group compositions of risk assessments and the latent endogenous variable "Decision determination", relevant to the sustainability of risk management supported decision making (see Table 4.1). The individual test results are listed in the associated table below; the significance (t-test/U test) is emphasized accordingly.

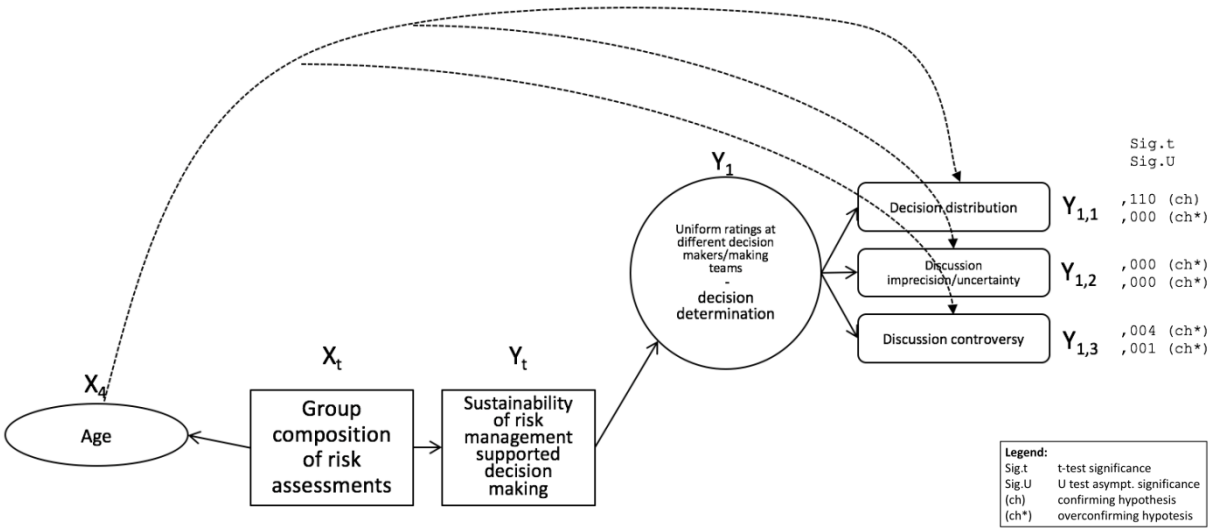


Figure 4.10. Test for "Decision Determination" against the empirical norm of "Age"

Source: Author's result

Figure 4.10 shows the relations and the respective associated significance level between the exogenous variable "Age" and the endogenous variable "Decision determination" on a one-to-one basis with the associated individual measurement criteria. Here, the measurement criterion "Discussion distribution" again has the highest value and confirms the associated hypothesis H04. For all tests against the latent exogenous variable "Age" the empirical norm ,5500 from the statistical result of the structured expert interviews is used (see Table 4.1).

Table 4.15. Test Results: Age (X4) – Decision Determination (Y1)

		t-test				U test	
Decision determination (Y1)	N	Mean	Std. Deviation	t	Significance (2-tailed)	Mean Rank Relation	Asympt. Significance (2-tailed)
Decision distribution (Y1.1)	131	,5973	,33623	1,611	,110 (ch)	115/148	,000 (ch*)
Discussion imprecision/uncertainty (Y1.2)	131	,7500	,24219	9,452	,000 (ch*)	90/173	,000 (ch*)
Discussion controversy (Y1.3)	131	,6202	,27796	2,892	,004 (ch*)	117/146	,001 (ch*)

empirical norm: ,5500

Source: Author's calculation

The t-test for the relationship between "Age" and "Decision determination" shows a picture that is completely different to the analyses of the exogenous variable "Personality type". In the assessment of the business professionals, the measurement criteria "Decision imprecision/uncertainty" and "Discussion controversy" lie on average some distance from the empirical norm for the experts (,5500); however, being well above this at ,7500 and ,6202, they are thus also to be evaluated positively in terms of the research question. The business professionals again assess "Decision distribution", with a mean of ,5973, as the weakest and least uniform (standard deviation of ,33623), although this time it is within the significance level. This means that all three measurement criteria are assessed positively, although this is caused in part by the low empirical norm.
In contrast, the Mann-Whitney U test shows a consistent result. Although the asymptotical significance is below the threshold value of ,05, the relation of the mean ranks of the business professionals for the measurement criteria "Decision distribution" (115/148), "Discussion imprecision/uncertainty" (90/173) and "Discussion controversy" (117/146) show a clear overfulfilment of the experts' statements.

The experts corroborate the business professionals in the results of both test procedures for all measurement criteria. For the measurement criteria overfulfilled by the business professionals, however, the trends are the same in both test procedures. This means that the measurement criterion "Discussion imprecision/uncertainty" is the most overfulfilled in both test procedures, the measurement criterion "Decision distribution" is in the middle in terms of overfulfilment, and the measurement criterion "Discussion controversy" has the least degree of overfulfilment.

Interpretation of results and impacts on the research question: the exogenous variable "Age" has a clear influence on the measurement criterion "Decision determination" and hence on the sustainability of risk management supported decision making, although it has the weakest empirical norm of all exogenous variables in the model. When considering the influence of the exogenous variable "Age" on the measurement criterion "Discussion imprecision/uncertainty", the estimates of the business professionals are furthest from those of the experts, they are the most overfulfilled. For example, the business professionals ascribe the most additional importance to the statement "Groups made up of members with different ages make more accurate decisions".

The business professionals confer far too great a significance on the exogenous variable "Age" in relation to the endogenous variable "Decision determination". This can lead to a major error of judgment in daily business.

4.2.11 Results in the Relation between Age and Decision Efficiency and Effectiveness

This detailed evaluation relates to the relationship between the latent exogenous variable "Age" in the case of group compositions of risk assessments and the latent endogenous variable "Decision efficiency and effectiveness", relevant to the sustainability of risk management supported decision making (see Table 4.1). The individual test results are listed in the associated table below; the significance (t-value) is emphasized accordingly.

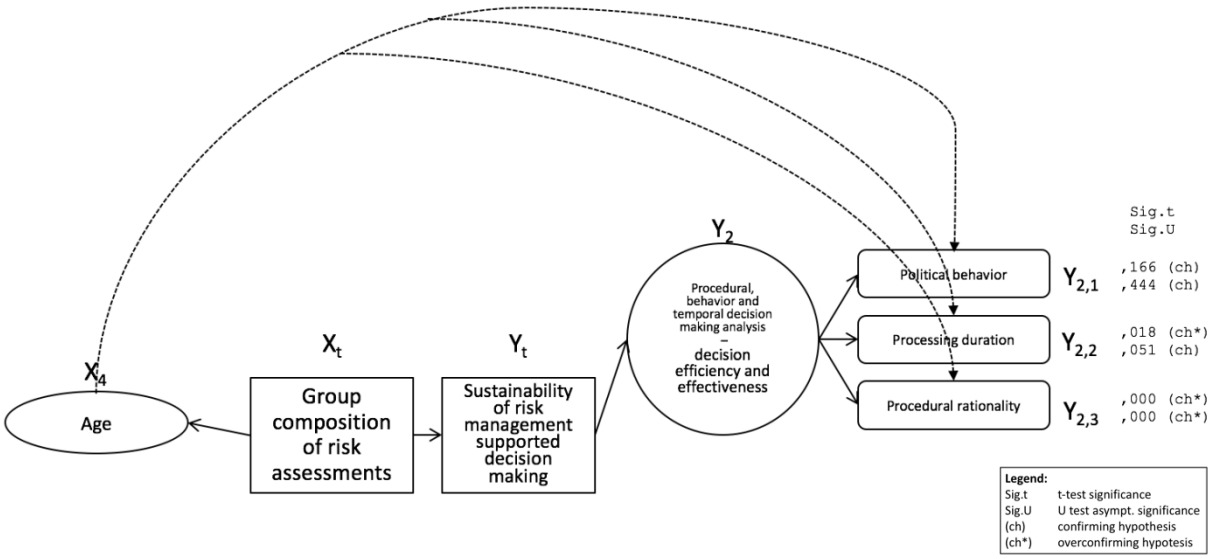


Figure 4.11. Test for "Decision Efficiency and Effectiveness" against the empirical norm of "Age"

Source: Author's result

Figure 4.11 shows the relations and the respective associated significance level between the exogenous variable "Age" and the endogenous variable "Decision efficiency and effectiveness" on a one-to-one basis with the associated individual measurement criteria. Here, the measurement criterion "Political behavior" has the highest value and confirms the associated

hypothesis H01. For all tests against the latent exogenous variable "Age" the empirical norm ,5500 from the statistical result of the structured expert interviews is used (Table 4.1).

Table 4.16. Test Results: Age (X4) – Decision Efficiency and Effectiveness (Y2)

		t-test				U test	
Decision efficiency and effectiveness (Y2)	N	Mean	Std. Deviation	t	Significance (2-tailed)	Mean Rank Relation	Asympt. Significance (2-tailed)
Political behavior (Y2.1)	131	,6221	,28209	3,162	,166 (ch)	125/138	,444 (ch)
Processing duration (Y2.2)	131	,6107	,28950	2,399	,018 (ch*)	123/140	,051 (ch)
Procedural rationality (Y2.3)	131	,6851	,27728	5,889	,000 (ch*)	107/156	,000 (ch*)

empirical norm: ,5500

Source: Author's calculation

The t-test for the relationship between "Age" and "Decision determination" shows a uniform picture. In the assessment of the business professionals, the measurement criteria "Processing duration" and "Procedural rationality" lie on average some distance from the empirical norm for the experts (,5500); however, being well above this, they are thus also to be evaluated positively in terms of the research question. The business professionals assess "Political behavior" with a mean of ,6221, within the significance level. This means that all three measurement criteria are assessed positively, although this is caused in part by the low empirical norm.

The Mann-Whitney U test confirms the results of the t-test in all aspects. The measurement criterion "Processing rationality" is strongest in respect of the relations of the mean ranks (experts/business professionals) for the U test corresponding in qualitative terms to the relations between empirical norm and t-test mean. The significance values for the assessment for "Political behavior" and "Political duration" in the U test also corroborates the assessment by the experts.

The experts likewise corroborate these assessments by the business professionals in the results of both test procedures for all measurement criteria; although a very large overfulfilment is

found for the measurement criterion "Processing rationality", the trends are once more the same for both test procedures.

Interpretation of results and impacts on the research question: the exogenous variable "Age" has a clear influence on the endogenous variable "Decision efficiency and effectiveness" and hence on the sustainability of risk management supported decision making. However, the business professionals are considerably more likely to believe that "Processing rationality" (e.g. "When groups made up of members with different ages make decisions, information is more thoroughly analyzed than by groups made up of members with similar ages") has influence on "Decision efficiency and effectiveness".

It should be highlighted here that, although the business professionals confer too great a significance on the exogenous variable "Age" in relation to "Decision efficiency and effectiveness", they assess the measurement criterion "Political rationality" to be more significant in relation to the other two measurement criteria.

4.2.12 Results in the Relation between Age and Decision Impact

This detailed evaluation relates to the relationship between the latent exogenous variable "Age" in the case of group compositions of risk assessments and the latent endogenous variable "Decision impact", relevant to the sustainability of risk management supported decision making (see Table 4.1). The individual test results are listed in the associated table below; the significance (t-value) is emphasized accordingly.

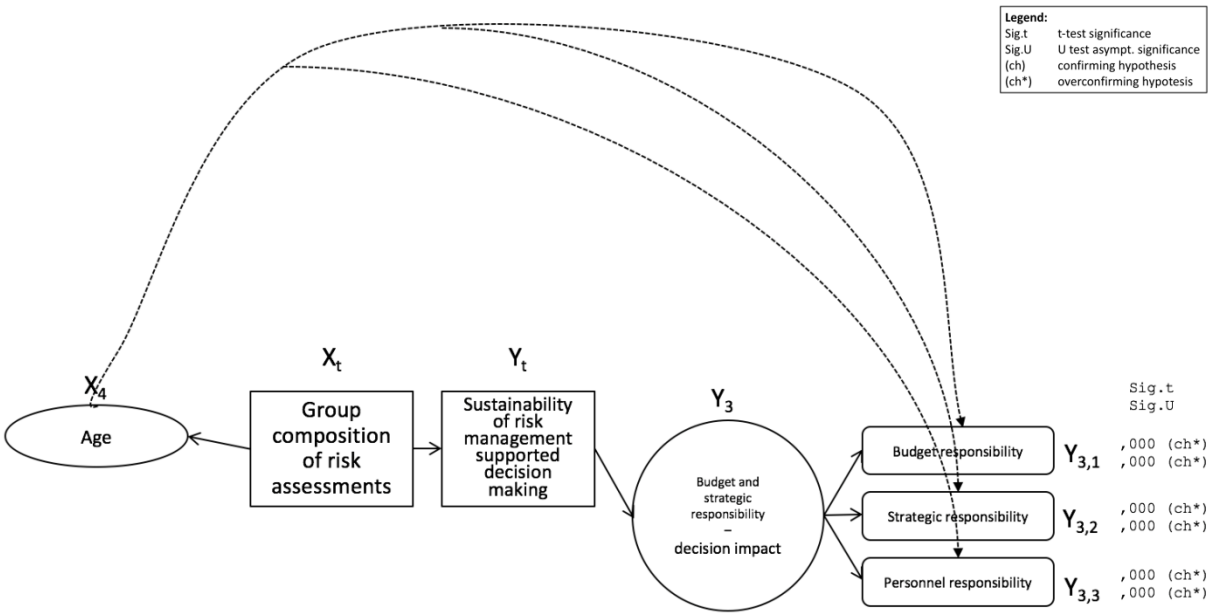


Figure 4.12. Test for "Decision Impact" against the empirical norm of "Age"

Source: Author's result

Figure 4.12 shows the relations and the respective associated significance level between the exogenous variable "Age" and the endogenous variable "Decision impact" on a one-to-one basis with the associated individual measurement criteria. None of the measurement criteria can achieve the significance level, therefore the associated hypothesis H04 is not confirmed by means of the significance level. For all tests against the latent exogenous variable "Age" the empirical norm ,5500 from the statistical result of the structured expert interviews is used (see Table 4.1).

Table 4.17. Test Results: Age (X4) – Decision Impact (Y3)

		t-test				U test	
Decision impact (Y3)	N	Mean	Std. Deviation	t	Significance (2-tailed)	Mean Rank Relation	Asympt. Significance (2-tailed)
Budget responsibility (Y3.1)	131	,7137	,30243	6,197	,000 (ch*)	101/162	,000 (ch*)
Strategic responsibility (Y3.2)	131	,7042	,28555	6,181	,000 (ch*)	103/160	,000 (ch*)
Personnel responsibility (Y3.3)	131	,6889	,28435	5,592	,000 (ch*)	112/151	,000 (ch*)

empirical norm: ,5500

Source: Author's calculation

The t-test for the relationship between "Age" and "Decision impact" shows a uniform picture. In the assessment of the business professionals, all measurement criteria lie on average some distance from the empirical norm for the experts (,5500); however, being well above this, they are thus also to be evaluated positively in terms of the research question. This means that all three measurement criteria are assessed positively, although this is caused in part by the low empirical norm. The business professionals assess the exogenous variable "Age" as having a greater influencing factor on "Decision impact" than the experts assigned to it.

The Mann-Whitney U test confirms the results of the t-test for all measurement criteria through clear overfulfilment measured using the mean ranks of the U test (101/162, 103/160 and 112/151, respectively). The U test shows the greatest overfulfilment for the measurement criterion "Strategic responsibility" (103/160).

The results of the two test procedures are absolutely consistent here. However, as regards the low empirical norm, it must be noted that the business professionals entirely overrate the influence of "Age" on "Decision impact".

Interpretation of results and impacts on the research question: the exogenous variable "Age" has a clear influence on "Decision impact" and hence on the sustainability of risk management supported decision making. In spite of the fact that the results of the two test procedures are completely consistent, it must be highlighted that the assessments of the business professionals

are in line with those of the experts only as regards influence. The extent of the influence is comprehensively overestimated by the business professionals, contributing to errors of judgment in daily business!

4.3 Result View on Aggregated Variables

Table 4.18 below shows the overall result of the measured values in relation to the exogenous variables. Here, it is not only a t-value/U-value > 0,05 $\stackrel{def}{=}$ "no significant difference" $\hat{=}$ "significant consensus" between the viewpoint of the experts and the estimation by the business professionals that is marked with "ch" (="confirming hypothesis"), but also values at which the empirically measured value is higher than the empirical norm. In this case, as already mentioned at the outset, the hypothesis is also confirmed as the result is significantly different to, and indeed positively higher than, the empirical norm for the experts. Such cases are, as usual, identified below with "ch*" (= "confirming hypothesis"), with * indicating the special case. Indications or possible reasons for these results are discussed in the next section by way of conclusion.

Table 4.18. Overall test results with significance comparison

Significance t-test Asympt. Significance U test		Group Size	Personality type	Professional background	Age
Decision determination (Y1)					
	Decision distribution (Y1.1)	,001 (ch*) ,000 (ch*)	,000 ,000	,003 ,000 (ch*)	,110 (ch) ,000 (ch*)
	Discussion imprecision/uncertainty (Y1.2)	,650 (ch) ,000 (ch*)	,329 (ch) ,000	,498 (ch) ,000 (ch*)	,000 (ch*) ,000 (ch*)
	Discussion controversy (Y1.3)	,027 (ch*) ,000 (ch*)	,006 ,000	,007 ,000 (ch*)	,004 (ch*) ,001 (ch*)
Decision efficiency and effectiveness (Y2)					
	Political behavior (Y2.1)	,081 (ch) ,097 (ch)	,039 ,000	,017 ,303 (ch)	,166 (ch) ,444 (ch)

Significance t-test Asympt. Significance U test		Group Size	Personality type	Professional background	Age
	Processing duration (Y2.2)	,000 (ch*) ,000 (ch*)	,002 ,000	,501 (ch) ,000 (ch*)	,018 (ch*) ,051 (ch)
	Procedural rationality (Y2.3)	,027 (ch*) ,000 (ch*)	,207 (ch) ,000	,153 (ch) ,000 (ch*)	,000 (ch*) ,000 (ch*)
Decision impact (Y3)					
	Budget responsibility (Y3.1)	,877 (ch) ,027 (ch*)	,001 ,000	,487 (ch) ,000 (ch*)	,000 (ch*) ,000 (ch*)
	Strategic responsibility (Y3.2)	,001 ,687 (ch)	,257 (ch) ,000	,353 (ch) ,000 (ch*)	,000 (ch*) ,000 (ch*)
	Personnel responsibility (Y2.3)	,000 ,303 (ch)	,000 ,000	,000 ,085 (ch)	,000 (ch*) ,000 (ch*)

Legend: marked box = t-test and U test with same test result

Source: Author's calculation

Group Size and Sustainability of Risk Management Supported Decision Making

The experts assess the exogenous variable "Group size" as a variable with moderate influence on the sustainability of risk management supported decision making. This is expressed by the empirical norm ,6625, which is moderate in relation to the model. For the business professionals, this influence is in some cases overestimated, but also underestimated in some areas. The two test procedures applied show broadly the same result.

Table 4.19. Summary t-test results: exogenous variable "Group Size"

Summary t-test	positive/total measurement results	of over fulfilment	max. std. deviation	min. relation empirical norm/mean	max. relation empirical norm/mean
Group Size	7/9	4	,30548	,6625/,4472	,6625/,8034

Source: Author's calculation

Evaluation of the results of the t-test shows that, on the basis of the empirical norm, 7 of the 9 values determined for the business professionals exhibit a significance. In four cases, there is overfulfilment, which is to say that the empirically measured value is higher than the empirical norm. Although the maximum standard deviation for all the measurement criteria relating to this exogenous variable, with a value of ,30548, is not the smallest within the model, it is in the lower range, indicating that the results can be considered as nearly uniform.
With a relation of ,6625/,4472 in the range of the min. individual relation and, at the other end of the scale, of ,6625/,8034 in the range of the max. individual relation of the empirical norm to the mean of the business professionals, it is clear that in some areas there are significance values which are above. Other areas are below the empirical norm, although they can also be described as being nearly uniform. This sets apart the results for this exogenous variable within the model, as all the other results fall clearly on one side or the other.

Table 4.20. Summary U test results: exogenous variable "Group Size"

Summary U test	positive/total measurement results	of over fulfilment	max. relation mean rank
Group Size	9/9	6	92/171

Source: Author's calculation

The corresponding results of the U test show significance throughout. All determined values are within the significance level or overfulfil this. The largest individual relation between the two mean ranks of the U test (experts versus business professionals) is 92/171, making it the second largest in the model. The business professionals assess the influence of the exogenous

variable "Group size" on the sustainability of risk management supported decision making as significant, with a tendency to overrating it in some cases.

Interpretation of results and impacts on the research question: the experts indicate that "Group size" has a significant influence on the sustainability of risk management supported decision making. Assessment of the results relating to the business professionals specifically shows that the relevance is slightly underestimated here but, on the other hand, in the sub area of "Decision impact" there is an underestimation that is still in the significance range. The assessments of the business professionals are therefore closest to those of the experts in terms of the model.

Personality Type and Sustainability of Risk Management Supported Decision Making

The experts assess the exogenous variable "Personality type" as having the strongest influence on the sustainability of risk management supported decision making. This is documented by the high empirical norm of ,7583. For the business professionals, in contrast, this influence is significantly underestimated. The two test procedures applied give a clear picture here.

Table 4.21. Summary t-test results: exogenous variable "Personality type"

Summary t-test	positive/total measurement results	of over fulfilment	max. std. deviation	min. relation empirical norm/mean
Personality type	3/9	0	,35227	,7583/,6115

Source: Author’s calculation

The results of the t-test show that, on the basis of the empirical norm, only 3 of the 9 values determined for the business professionals exhibit a significance. None of the individual cases shows overfulfilment, which is to say that the empirically measured value is higher than the empirical norm.

The largest standard deviation for all measurement criteria can be found in these results assigned to the exogenous variable and moreover exhibits the weakest and least uniform results in conjunction with the underestimation. This finding is emphasized by the evaluation of the smallest individual relation between the empirical norm and the associated mean. With a relation of ,7583/,6115, this is still closer to the empirical norm by comparison with other

evaluations of the exogenous variables, although in many cases no significance was achieved. This also indicates a less uniform result.

Table 4.22. Summary U test results: exogenous variable "Personality type"

Summary U test	positive/total measurement results	of over fulfilment	max. relation mean rank
Personality type	0/9	0	163/99

Source: Author’s calculation

The results of the U test show no significance whatsoever. All determined values are outside the significance level and there is no overfulfilment. The largest individual relation between the two mean ranks of the U test (experts versus business professionals) is 163/99, which supports and clearly expresses the idea that the business professionals greatly underestimate the influence of the exogenous variable "Personality type" on the sustainability of risk management supported decision making.

Interpretation of results and impacts on the research question: the experts indicate that "Personality type" has a very large influence on the sustainability of risk management supported decision making. However, the assessment of the results relating to the business professionals makes it clear that the relevance is considerably underestimated here. The business professionals´ assessment of the influence of the exogenous variable "Personality type" on the sustainability of risk management supported decision making is too weak. In daily business, it is therefore likely that this aspect is given little weighting in group compositions for risk assessments. A group that is not properly balanced in terms of "Personality type" can lead to false results and errors of judgments in risk assessments.

Professional Background and Sustainability of Risk Management Supported Decision Making

The experts assess the exogenous variable "Professional background" as having the second greatest influence on the sustainability of risk management supported decision making. This is documented here by the empirical norm of ,7150. This influence is also estimated to be of a similar level by the business professionals. However, the two test procedures applied tend to show an inhomogeneous picture.

Table 4.23. Summary t-test results: exogenous variable "Professional background"

Summary t-test	positive/total measurement results	of over fulfilment	max. std. deviation	min. relation empirical norm/mean
Professional background	5/9	2	,31975	,7150/,6221

Source: Author's calculation

The results of the t-test show that, on the basis of the empirical norm, only 5 of the 9 values determined for the business professionals exhibit a significance. However, in two cases there is overfulfilment, which is to say that the empirical measured value is higher than the empirical norm.

It is also clear from the relatively high standard deviation that the t-test results are at least less uniform. It is likewise possible to draw conclusions from the smallest individual relation between empirical norm and the associated mean, with a relation of ,7150/,6221. In principle, it is possible to establish a tendency for consensus from the assessment by the experts. The picture is muddied owing to the less uniform results.

Table 4.24. Summary U test results: exogenous variable "Professional background"

Summary U test	positive/total measurement results	of over fulfilment	max. relation mean rank
Professional background	9/9	7	99/164

Source: Author's calculation

In contrast, the results of the U test give a clear picture. All determined values are within the significance level, and even overfulfil this in 7 cases. The largest individual relation between the two mean ranks of the U test (experts versus business professionals) is 99/164, which clearly indicates that the business professionals greatly overestimate the influence of the exogenous variable "Professional background" on the sustainability of risk management supported decision making.

Interpretation of results and impacts on the research question: the experts indicate that "Professional background" has a large influence on the sustainability of risk management supported decision making. However, the assessment of the results relating to the business professionals makes it clear that there is a broad consensus here, although the relevance is to an extent underestimated or overestimated, depending on the test procedure. The business professionals´ assessment of the influence of the exogenous variable "Professional background" on the sustainability of risk management supported decision making is in some cases too strong. It may therefore be the case in some situations that the aspect "Professional background" is given too much weighting in group compositions for risk assessments.

Age and Sustainability of Risk Management Supported Decision Making

In the case of the assessment of the experts, it can be stated for the exogenous variable "Age" that although this clearly has an influence on the sustainability of risk management supported decision making, in contrast to the other exogenous variables in the model it plays a rather subordinate role, as documented by the low empirical norm of ,5500. The business professionals considerably overestimate the influence of the exogenous variable "Age".

Table 4.25. Summary t-test results: exogenous variable "Age"

Summary t-test	positive/total measurement results	of over fulfilment	max. std. deviation	max. relation empirical norm/mean
Age	9/9	7	,33623	,5500/,7500

Source: Author's calculation

The results of the t-test show that, on the basis of the empirical norm, all 9 of the 9 values determined for the business professionals exhibit a significance, with 7 cases additionally showing overfulfilment, which is to say that the empirical measured value is higher than the empirical norm.

Although the maximum standard deviation of all measurement criteria based on this exogenous variable has a high value within the model, at ,33623, the variance essentially occurs in the range of overfulfilment, which is further emphasized by the largest individual relation between empirical norm and the associated mean. With a relation of ,5500/,7500, this is very far above the empirical norm, in contrast to the other evaluations of the exogenous variables.

Table 4.26. Summary U test results: exogenous variable "Age"

Summary U test	positive/total measurement results	of over fulfilment	max. relation mean rank
Age	9/9	7	90/173

Source: Author's calculation

The results of the U test confirm these results from the t-test. All determined values are within the significance level, and overfulfil this in 7 cases. The largest individual relation between the two mean ranks of the U test (experts versus business professionals) is 90/173. This highlights the extent to which the business professionals overestimate the influence of the exogenous variable "Age" on the sustainability of risk management supported decision making.

Interpretation of results and impacts on the research question: the exogenous variable "Age" has a much smaller influence on the sustainability of risk management supported decision making than is assumed by the business professionals. They see the direct influence exactly the same as the experts, but the strength thereof is comprehensively and widely overestimated. This leads to a dangerous error of judgment in daily business and inevitably to poor group compositions for risk assessments.

4.4 Testing Causal Model and Summarizing Examined Results

Below, an overall result is deduced from the intermediate and partial results determined in the previous chapters. Starting from the formulated hypothesis H_0 with sub-hypotheses H_{01} to H_{04} and the special sub-hypothesis H_{05}, this chapter deals with the partial results in order to create a uniform overall picture.

By consolidating the partial results from the chapter 4.3, it is possible to trace a spider chart showing the four relevant exogenous variables, taking account of the respective empirical norms of the experts and the associated parametric test for the group of business professionals (note: two candidates for exogenous variables have already been removed from the model in an earlier phase owing to lack of significance, see 2.8.2). While, in the above-mentioned parametric t-test, a normal distribution of the samples is assumed, a second nonparametric test procedure was additionally used as a control (Mann-Whitney U test); this test does not require a normal distribution and is very robust (see chapter 3.5). As can be seen from the results in chapter 4.3, in spite of the differing test procedures the results are similar to a large extent. The spider chart was then enhanced using this second group of results by superimposing an area of tendency onto the line representing the t-test. This polyline/-area is thus a qualitative representation of the sum of the test results for the group of business professionals and is contrasted in the spider chart with the experts. All the measured values can be found in detail in chapter 4.2 and aggregated in chapter 4.3.

Based on the aim of the promotional work, the investigation of the group composition impact, assessing the risk potential of business decisions and its impact on the sustainability of executed decisions based those risk assessments, the results are as follows: the identified independent variables of the causal model all have an impact on the group composition with regard to the sustainability of risk assessments. However, the influences of the respective independent variables are different. The experts as well as the business professionals see a significant

influence on group size and professional background, but the independent variables age and personality type are judged differently. Business professors underestimate the influence of personality type and overestimate age. These deviations of the assessment of the business professionals from the empirical norm then lead to negative effects in the risk assessment.

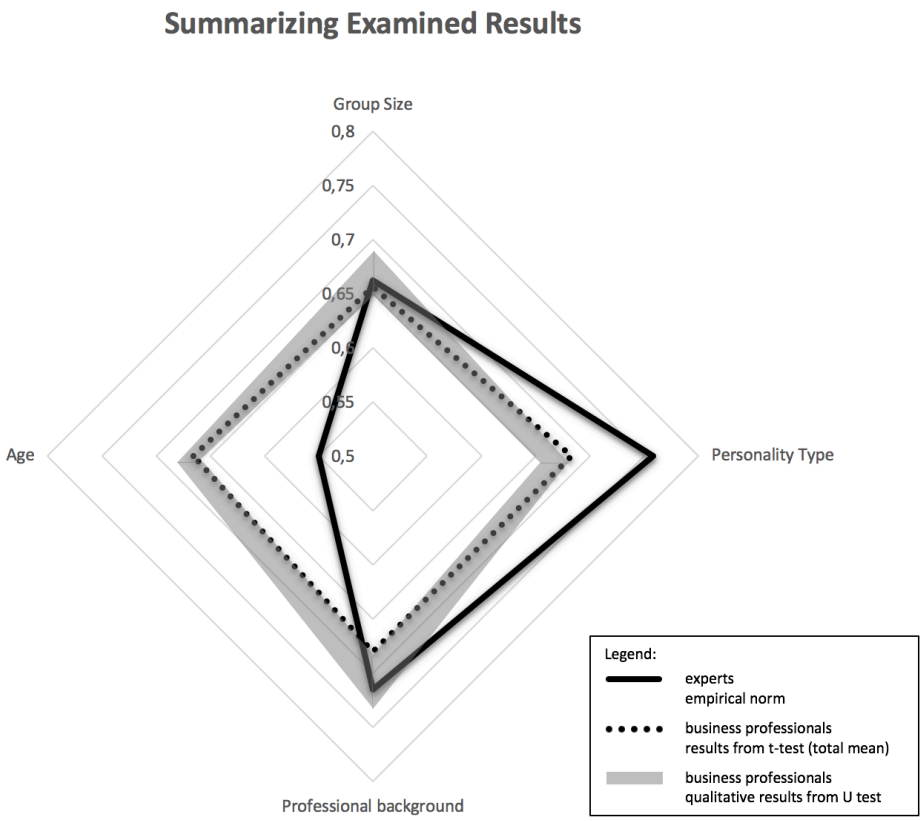


Figure 4.13. Summarizing Examined Results

Source: Author's results

Starting from this overall depiction of the results, we can now look at the respective hypotheses in detail.

H_0: The group composition of risk assessments has an impact on the sustainability of risk management supported decision making

By means of the overall scientific approach and the five-method mix used (see chapter 3) with literature review, observation, structured expert interviews, experimental field and case studies and results review, it is possible to confirm without exception that group compositions for risk assessments have a substantial impact on the sustainability of risk management supported decision making. Furthermore, it can be demonstrated unequivocally that the different exogenous variables have different levels of influence. This has been considered more closely in the sub-hypotheses. However, the fact remains that the main hypothesis H_0 must be comprehensively confirmed.

H_{01}: The larger the group size for risk assessments is, the higher the level of sustainability of risk management supported decision making

While the experts identified "Group size" as a variable with moderate influence on the sustainability of risk management supported decision making, the business professionals even overestimate this influence. In particular, it should be mentioned that in one partial area ("Decision impact) the business professionals make an underestimation of the influence which nevertheless is within the significance range. Summarized, it can be stated that both experts and professionals determine “Group Size” as an important, exogenous variable. Hypothesis H_{01} is therefore deemed to be confirmed.

H_{02}: The more different the personality types in groups for risk assessments are, the higher the level of sustainability of risk management supported decision making

The experts identify the exogenous variable "Personality type" as the factor having the greatest influence on the sustainability of risk management supported decision making. What is striking here is the evaluation of the results of the business professionals. They show a considerable

underestimation of the relevance. Although the business professionals also recognized the relevance, this error of judgment would lead to a group that is not properly balanced in terms of "Personality type" and thus to the danger of false results and errors of judgments in risk assessments. Hypothesis H_{02} is nevertheless deemed to be confirmed.

H_{03}: The higher the professional background of group members for risk assessments is, the higher the level of sustainability of risk management supported decision making

Here too, the experts note a large influence of "Professional background" on the sustainability of risk management supported decision making. Assessment of the results relating to the business professionals shows differences depending on test procedure for the first time. While, in the t-test, the relevance is underestimated, the U test shows an overestimation. Regardless of this, the results for the business professionals exhibit an increased significance compared to those for the experts. Hypothesis H_{03} is therefore deemed to be confirmed.

H_{04}: The older the group members for risk assessments are, the higher the level of sustainability of risk management supported decision making

The experts assess the influence of the exogenous variable "Age" on the sustainability of risk management supported decision making as low and of only weak significance. In contrast, the business professionals greatly overestimate the strength of its influence. This must inevitably lead to a dangerous error of judgment in group compositions for risk assessment. Owing to the fact that there is still significance here, hypothesis H_{04} can be considered to be confirmed, although this must be treated with great care and explanation is required.

H_{05}: There is no difference in perception between risk management experts and the acting business professionals in terms of group composition in risk assessments

The estimation of the business professionals deviates from those of the experts and the empirical norm derived therefrom in significant areas. Even if the relevance of the influencing factors remaining in the model is equally accepted by the business professionals, the strength of the influence is differently, i.e. incorrectly, estimated in many areas. This can lead to a dangerous error of judgment and thus inevitably to poor group compositions for risk assessments. In

addition to the spider chart depicted above, the conformity matrix below gives an exact overview of the assessments made by the business professionals.

Table 4.27. Conformity matrix experts/business professionals

	Group Size (X1)	Personality type (X2)	Professional background (X3)	Age (X4)
Decision determination (Y1)	overconfirm	Non-conformity	partly confirm	overconfirm
Decision efficiency and effectiveness (Y2)	confirm	Non-conformity	confirm	overcofirm
Decision impact (Y3)	partly confirm	Non-conformity	confirm	overconfirm

Source: Author's calculation

On the basis of these evaluations, which deviate fundamentally from the empirical norm of the experts particularly in regard to the exogenous variables "Personality type" and "Age", it must be noted that hypothesis H_{05} cannot therefore be confirmed.

Conclusions

The author presents conclusions of this thesis taking into consideration theoretical and analytical part of the work:

1. The two groups of risk measurement methods, the qualitative and the quantitative group, are identified by scientists and international experts as a current and important research area. While quantitative methods are characterized by stochastic approaches, scenarios and simulation models, many qualitative methods are determined by human judgment. The influence of human judgment within the qualitative methods has not been subject to extensive research until now. Approaches are therefore required that take the group composition in risk assessments into account.

2. Scientific work indicates that the group size, personality type, professional background, age, gender, and cultural influences have an impact on the group composition and therefore, on the decision-making processes shown in the literature and in the research results. However, scientists have not yet made a deeper reference to risk management and the influence on execution of the risk assessments, which requires further scientific research.

3. A qualitative analysis of the literature in the fields of decision-making theory, organization theory and group processes, theory of personality types, theory of decision strategies and risk management theory showed that there is no evidence in this research area of similar or identical models with regard to group composition of risk assessments and their effects on the sustainability of risk management-supported decisions gives.

4. The theoretical model which has been developed in the dissertation can be used to determine the deviations of risk assessments of a surveyed group of people from the empirical norm at the level of the exogenous variables present in the model.

5. This work combines existing research on general group compositions in decision-making processes and the risk management-related research on the subject of stochastic risk assessments versus group-based risk assessments, as investigations into the area of group compositions were not present in the last mentioned field.

6. The result of structured quantitative and qualitative expert interviews served as the basis for a new theoretical model for specific improvement of enterprise risk management. A new method mix consisting of literature review, observation, structured expert interviews, experimental field and case studies as well as results review has been developed, which makes it possible to compare different populations (size, specialist education, mode of expression).

7. The structured quantitative and qualitative expert interviews have made it possible to determine an empirical norm by means of which the assessments of the business managers can be validated using an experimental field study and associated specific statistical evaluations. This is what makes is possible to compare two completely different populations.

8. The results of the dissertation indicate that it is very important to take account of personality type in the group composition for risk assessments, in terms of the sustainability of risk management supported decision making.

9. It can be clearly demonstrated that the group composition in risk assessments has a substantial influence on the sustainability of risk management supported decision making.

10. The estimation of the business professionals deviates from those of the experts and the empirical norm derived therefrom in significant areas. Even if the relevance of the influencing factors presented in the model is equally accepted by the business professionals, the strength of the influence is differently, i.e. incorrectly, estimated in many areas.

11. The influence of the group size is somewhat overestimated by the business professionals in the "Decision Impact" area, but the ratings are basically within the scope of the given empirical norm.

12. With regard to the independent variable "Group Size", it can thus be stated that the impact on the group composition of risk assessments with regard to the sustainability of risk management supported decision making is largely estimated by the business professionals.

13. Similar is the assessment of the independent variable "Professional Background", whereby here the different test methods show different deviations from the empirical norm for the first time. Overall, however, it should be noted that business professionals slightly overestimate the meaning of the variable "Professional Background" measured by the U-test that is more relevant in this case.

14. While the experts rate the independent variable "Personality Type" as the factor with the greatest influence on the sustainability of risk management supported decision making, thus the empirical norm is greatest, there is a significant underestimation of the relevance by the business professionals.

15. Exactly the opposite assessment, but with the same result can be found in the estimation of the independent variable "Age". Business professionals overestimate the impact on sustainability of risk management supported decision making. For the experts, this variable has the least importance within the given causal model.

Suggestions

This dissertation clearly demonstrates that the group composition in risk assessments has a substantial influence on the sustainability of risk management supported decision making. Incorrect group compositions can lead to business-critical errors of judgment. The author therefore makes the following suggestions:

1. The business managers must be made aware of targeted group composition for risk assessments through appropriate training measures. This can prevent incorrect group compositions from leading to business-critical assessment errors.

2. Group leaders should take account of the four influencing factors: the latent exogenous variables "Group Size", "Personality Type", "Professional Background" and "Age" must be weighted appropriately in the group composition. Every risk assessment but also every participant has to be classified in this regard.

3. The error of judgment relating to the importance of seniority (age of participants in the assessment) should be corrected by ascribing more importance to the personality types of assessment participants by the group leaders.

4. The responsible human resources should carry out personality analyses on the assessment participants, to determine their respective personality types and enable a balanced group composition.

5. Risk managers should be aware of the influence of the group size on risk assessments. Various studies show an optimal group size of up to 6 assessment participants, but it can also be stated that the group size must increase with increasing importance. This is not due to the fact that more participants are always delivering better results but is based on the knowledge that the groups should be balanced in terms of age, personality type and professional background, whereby the respective influencing factors are still to be weighed. The personality type has the most important influence, the age the weakest influence, which is misjudged by business professionals. The balanced composition of the groups then reveals that more is better then.

6. Standard processes in enterprise risk management must be adapted by risk managers to ensure that even less experienced business managers have tools and processes at their disposal to help avoid errors of judgment in group compositions for risk assessments.

7. IT departments, selecting software systems for risk management, should take the results of the dissertation into account regarding the master data and the workflows in order to improve the quality of the risk assessments.

Implications for future research

1. Very early on in the process of scoping out the model, the cultural background of assessment participants was ruled out of consideration. The literature indicates that taking account of cultural background is generally better covered by taking account of professional background. Future research could address this point again.

2. The surveys were restricted to the area of Germany/Austria/Switzerland. As a result, the cultural circle under consideration is limited, and there may also be a corresponding educational status of the experts and of the business professionals. Future research could additionally look at other regions and compare the results with the research results presented.

3. The beforementioned restriction limits the area of research to the European legislation. Whether or not this fact affects the weighting of the influencing factors has not been considered in this dissertation. Further research could take this fact into the respective observation and examine if the made statements also apply to other regions such as e.g. America and Asia.

4. Future research should consider group size in relation to the scope of the risk assessment. This dissertation shows that the selection process must be coordinated with the extent of the importance of the respective assessment and should be balanced. The exact group size in relation to the risk volume will still have to be researched in the future.

5. The theory of personality types was comprehensively addressed in the literature review. Future research could look more closely at a possible positive impact on the sustainability of risk management supported decision making through the use of differing type weightings in the group composition in risk assessments.

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APPENDIX

ERM Experts Interviewed

First Name	Name	Job Title	Reference to CV at "linkedin.com" and to "xing.com"
Johan	Wera	Global Head Information Governance and Management Assessment and Risk Management	http://www.linkedin.com/profile/view?id=4066050&locale=en_US&trk=tyah&trkInfo=tas%3AJohan%20wera%2Cidx%3A1-1-1
Anthony	Bramwell	Executive Director at Ernst & Young	http://www.linkedin.com/profile/view?id=3804156&locale=en_US&trk=tyah&trkInfo=tas%3Abramwell%20anth%2Cidx%3A1-1-1
Tim	Wulgaert	CEO at FJAM Consulting	http://be.linkedin.com/in/timwulgaert
Bostja	Senica	Regional IGM Head at LEK ltd.	http://www.linkedin.com/profile/view?id=146949582&authType=NAME_SEARCH&authToken=KwWD&locale=en_US&srchid=276646561389177524582&srchindex=1&srchtotal=3&trk=vsrp_people_res_name&trkInfo=VSRPsearchId%3A276646561389177524582%2CVSRPtargetId%3A146949582%2CVSRPcmpt%3Aprimary
Alexander	Sturz	Senior Consultant at Atos IT Solutions and Services GmbH	http://de.linkedin.com/pub/alexander-sturz/b/96/33a
Markus	Dreimann	Director Operations at Sennheiser Australia Pty Ltd	https://de.linkedin.com/in/markus-dreimann-a0464210
Marco	Wolfrum	Partner and Senior Analyst	https://www.xing.com/profile/Marco_Wolfrum
Wilfried	Polin	Partner and Riskmanager	https://at.linkedin.com/in/wilfried-polin-1858bb52
Frank	Romeike	Funder and Partner at RiskNET	https://www.xing.com/profile/Frank_Romeike
Christian	Weissensteiner	Consultant at Avande	https://www.xing.com/profile/Christian_Weissensteiner6

Structured Expert Interview - Questionnaire and Comprehensive Result

			Group Composition						Result Counting						
No.	Question	Sequence Randomizer	Group Size	Personality Type	Professional Background	Gender	Age	Culture	Strongly Agree	Agree	Neither	Dissagree	Strongly Dissagree	Not answered	Checksum
1	**It is essential for companies, that IT department provides an up to date IT security back-bone (anti-virus, Intrusion detection, fire-wall etc.)**	1							8	2	0	0	0		10
2	**The value of risk analysis results increases with the company affiliation of the employee**	1			x		x			5	4	1			10
3	**For mobile devices there is NO need to encrypt the hard drive because all employees are trained and reliable in handling critical information (to avoid unauthorised information access in case of theft) (->INVERTED RESULT COUNTING)**	3							5	5					10
4	**It is important to distinguish between information, that could be stored on public storage locations and information that should be stored on restricted storage locations**	3							6	4					10
5	**The risk analysis should be performed by groups of people with different personality types**	4		x					2	6	2				10
6	**An INTERNAL information crisis is less negative impacting the company than an EXTERNAL information crisis**	4							1	6	2	1			10
7	**Women are more sensitive in risk analysis and better in review**	5				x					6	3	1		10
8	**Formal rules and guidelines (Standard Operating Procedures and e.g. "how-to" guidelines) need to be in place to ensure that "business controls" are understood and executed in the correct way**	5							1	9					10
9	**An INTERNAL information crisis would cause a significant negative impact to the company (e.g. loss of relevant information, non-integer information etc.)**	6							2	4	4				10
10	**A review on the fulfillment-level could also be done by the people being responsible for the execution**	7								3	2	3	2		10
11	**To ensure better awareness /preparedness in "Information Risk Management" within companies, it is important to do good "Information Security and/or Management" awareness programs to all associates**	8							6	3	1				10
12	**Risk assessment team members should have different cultural backgrounds**	9						x	2	4	3	1			10
13	**Employees should not have "local administrative" accounts on their PCs**	##							5	4	1				10
14	**"New-joiners" should be trained automatically if applicable for their new role**	##							5	4	1				10
15	**Smaller groups are more effective in risk assessment then bigger groups**	##	x						3	5	1	1			10
16	**A reason for not fully implemented "Information Risk Management" Awareness / Preparedness could be that there are no significant risks at all (as an outcome of a formal evaluation within the company)**	##								2	3	1	4		10
17	**A good "tracking system" on the fulfillment level of the "business controls" should be in place**	##							3	7					10
18	**To ensure better awareness /preparedness in "Information Risk Management" within companies, it is important to have a formal "Learning and Training System" in place**	##							1	7	2				10
19	**Formal "business controls" need to be agreed and sponsored by the executive board of the company to ensure that they are taken serious and are executed**	##							7	3					10

20	It is important that these professionals do have a good inside in the local organization and processes and are not only "headquarters functions"	##			x			7	3					10
21	Different personality types assess risks differently	##		x				3	6		1			10
22	If office doors are not locked in big companies, it is important NOT to leave classified information on the work desks	##						8	2					10
23	It is good to involve these professionals in the classification process with a formal approval of all classifications to also ensure the "mandatory involvement"	##						2	2	4	2			10
24	In risk analysis team forming it is always necessary to also onboard a number of older employees	##				x		1		4	3	2		10
25	The risk analysis results are depending on where the assessment was performed (country, continent)	##					x	1	2	2	4	1		10
26	Regarding "Information Risk Management" it is important to ensure, that the executive board is playing "a significant role" in this (general management buy in – e.g. as part of the crises team etc.)	##						4	6					10
27	To avoid unauthorised access to PCs, it is important to lock the PCs logically (Screensaver with password) and physically (fix the PC to the desk with e.g. a steel cable)	##						5	4	1				10
28	Professional background directly influence risk assessment results	##			x			2	3	2	2	1		10
29	It is better to form a risk assessment team with different professional background	##			x			2	8					10
30	When putting together your risk assessment team a balanced gender choice is important	##	x					2	2	3	2	1		10
31	The information controls should be up to date (according laws etc.) but not changed too often – to avoid confusions and demotivation at the employee level	##						6	4					10
32	To be transparent to the executive board, a register of ALL CRITICAL information assets and all related risks should be in place and up to date at any time	##						4	4	1	1			10
33	A consistent and sustainable "information classification" scheme is KEY to identify Information related risks at all (e.g. Confidentiality/Integrity/Availability/Privacy/Legal requirements)	##						4	6					10
34	Same personality types estimate risks equal (->INVERTED RESULT COUNTING)	##		x				2	6	2				10
35	In general, there is NO need to have an overview on enterprise level on all classified information asset types (the types only, not the instanced assets themselves!) (->INVERTED RESULT COUNTING)	##						3	4	3				10
36	Risk assessments should be done by single individuals to keep it short and simple (->INVERTED RESULT COUNTING)	##	x					4	6					10
37	However classified information should be only accessible by limited number of people	##						5	5					10
38	Also for critical applications it is possible to outsource this to 3rd party vendors - unauthorized information theft is covered/avoided by contractual terms and conditions	##							6	2		2		10
39	A lack of transparency in particular on "Information Risks" on executive management level could be a reason for not fully implemented "Information Risk Management" Awareness / Preparedness	##						4	5	1				10
40	Cultural influences have no effect on the risk assessments (->INVERTED RESULT COUNTING)	##					x	4	6					10
41	Men rate risks differently than women	##				x			2	6	1	1		10
42	To ensure, that the controls are executed in an appropriate way, this should be part of the "role description" of the employees affected	##						2	6	1	1			10

43	The “NSA Affair” (disclosure of many secrets by Mr. Snowden in Summer 2013) proved that “Information Risks" are only relevant for Military and Government etc. only (->INVERTED RESULT COUNTING)	##						9	1					10
44	Because of the rules and guidelines are formally in place and could be read at any time, it is NOT important to actively train employees affected by the business controls (->INVERTED RESULT COUNTING)	##						8	2					10
45	Young people assess risks differently then older people	##				x		2	4	3	1			10
46	An EXTERNAL information crisis would cause a significant negative impact to the company (e.g. Information Breach, stolen intellectual property)	##						6	4					10
47	To ensure better awareness /preparedness in “Information Risk Management” within companies, it is important to have a formally implemented communication and decision map (defined communication streams and mandates for decision making in crises)	##						5	5					10
48	Regarding “Information Risk Management” it is important to have a “crises Team” implemented – being able to respond immediately to any threats	##						3	6	1				10
49	There is NO need to have a number of professional people (e.g. Information Risk Managers) helping the information asset owners with the classifications to ensure an enterprise wide well balanced and calibrated classification over all asset types (->INVERTED RESULT COUNTING)	##						6	2	1	1			10
50	The group size is crucial for a good risk assessment	##	x						5	2	1	2		10
51	It is important to distinguish in particular between this different dimensions (e.g. Confidentiality/Integrity/Availability/Privacy/Legal requirements)	##						4	3	2	1			10
52	It is important to have exact definitions on how to classify each of this dimensions (e.g. for confidentiality: public use, internal use, confidential, strictly confidential)	##						4	5	1				10
53	High experience level of staff members is important for the quality of risks analysis	##			x			2	5	1	2			10
54	“Time/Costs” constraints could be a reason for not fully implemented “Information Risk Management” Awareness / Preparedness	##						5	4	1				10
55	The “information asset owner” should be the person to define the group of people which should have access to the information	##						2	6	1	1			10
56	IT department should implement an automated “backup” for specific local (on local PC) folders to avoid data-loss in case of hardware-crashes etc.	##						4	4	1	1			10
57	Formal “business controls” (like SOX, etc.) help to manage “Information Risk Management” activities in an appropriate way in big enterprises	##						1	6	3				10

Latt-Bikes – Case-Study and Business Professionals Survey

Richard Mayr and Stefan Schwerd, May. 2014

Latt-Bikes – Case Study

The Company

Latt-Bikes is a medium sized manufacturing company of all kinds of e-Bikes (City-e- bikes, Mountain-e-Bikes, etc.) and also for e-wheelchairs with all over 1500 employees in Europe and North America. The Headquarters with the Management board is in central Europe – The pre-fabrication of all Metal and Carbon Hardware is done in the North American sites –the final assembly and finishing is done in central Europe. Latt-Bikes is Market leader in Europe for both market segments.

At Latt-Bikes the hierarchy was grown organically and is very typically flat for a med-sized company. There are very direct and short communication and decision making processes paired with a high dynamic decision making culture. The focus is on Business success less on formalities. "We don't see threats neither from inside nor from outside of the company" – CEO and founder of Latt-Bikes- Josef Latt (58 Year old).

The R&D area of Latt-Bikes is led by Josef Latt's confidant – Giuseppe Petrocci (51 Years old). The CFO position was taken over 15 months ago by Margret Miller (38 years old), Margret was joining in from Latt-Bikes' most important supplier for "breaks and gear-shifting" to success Josef Latt in the nearer future (about 2-3 years) as CEO of the company.

Latt-Bike had a total revenue of 55 MUSD at a return of 2,3%, the total market share for e-bikes in Europe was5,4% and for e-wheel chairs 7,9%. Because of the ongoing price pressure from Far East and the need for higher quantity of units sold, a more global setup (purchasing and Markets) has to be taken in consideration.

Present Situation on the other side of the Globe

Currently the Trans-APAC-Scooter Inc. is the world market leader for e-Scooter – Headquarters in Hong Kong and with a total number of employees of 16000 and yearly revenue in 2012 of 320 MUSD in the key markets in Asia Pacific area. Trans-APAC Scooter is a typical stock exchange company with a well-defined internal organizational structure, standard processes and procedures, internal trainee programs, security infrastructure, a number of patents, a yearly SOX attestation and a very well developed PR-, Communication- and Marketing department.

The Idea

To cover up the price pressure Latt-Bikes is evaluating a strategy to extend the current portfolio to achieve the necessary synergy effects on the Cost of goods by opening a cooperation with Trans-APAC-

Scooter. In particular the focus is on a joint venture with Trans-APAC-Scooter to reduce the Cost of Goods for the e-engine and the power supply units of the e-Bikes as well as the further development, registration and marketing of the e-Scooters on the European market (where Trans-APAC-Scooter is currently not present).

The CEOs of both companies are convinced that this could be a "win-win" situation for both. The Idea is to found a "joint Venture company" through which all the cooperation is channeled.

THE CASE

Trans-APAC-Scooter had serious issues with information and data breach in the last years – including industry espionage on their intellectual property – so, they launched a series of initiatives to protect their intellectual property and reputation.

Awareness Program:

- Awareness activities and trainings for all employees on how to deal correctly with "Information" as a valuable asset of the company (e.g. how/where to store sensible information, training of new joiners, ongoing curriculum for all employees)
- Board Members took personally the responsibility for the implementation and control of all counter activities (the correct classification, the ongoing transparency and the adequate protection of critical information)
- Special security controls esp. for SOX were implemented
- All rules and procedures were made accessible to all employees
- Explicit communication plans and crises-plans were set up as well as crises team in the unlikely event of a new crises – equipped with the necessary decision making mandates
- The on top necessary resources were approved by the Executive Board and were seen as a reasonable investment

Information Classification

- Professional "Information Risk Managers" were on-boarded to support all levels of the company with the applicable know-how
- A consistent "information classification scheme" (Confidentiality/Availability/Integrity/Privacy/ Legal) was introduced all over the company
- Information access was restricted physically and logically – the decision on this was given to the internal information asset owners based on a corporate policy framework

Technical Protection

- The IT-Landscape was lifted to the newest security standards and baselines
- "local Admin" rights were taken away from the users PCs
- Simple protection measurements were implemented e.g. screensavers with password protection, steel cables to fix the PCs to the desks and "lock the door when you leave" policy

- Automated Back-up of defined data areas of the local PCs were implemented and is replicating the content to back-bone servers now on a daily base.

Controls Framework

- All introduced controls are checked regularly on their "up to date status" by the legal department
- The level of fulfilling of all controls is also checked and reported regularly to the Executive Board

Organization

- Intentionally "Steering Committees" were implemented on all levels in the organization
- The size of this groups was actively adjusted to the organizational structure
- The group composition is intentionally based on the professional background of the individuals as well as on the Personality type
- The age and the origin was also taken into account

All this was taken into consideration to achieve most effective and efficient decision making with a minimum of future risk in these groups.

THE JOB:

Margret Miller and the Lee Young (CFO of Trans APAC-Scooter) were appointed as PMs to come up with business and structural plans for the new Joint Venture company (3 Month Plan, next Year Plan).

This plans must contain explicit proposals for dealing in particular with the present situations in Enterprise (Information) Risk Management.

To get a professional view and advice on this topic – Margaret and Lee decided to reach out to (Information Risk Management) Professionals with a survey to get the right priorities set based on a large scale of attendees.

YOU are asked to help Margaret and Lee to reach their goal by giving your input and returning the attached survey based on your own personal experience and view.

THANKS IN ADVANCE!

Improvement of Strategic Decision Making in Enterprise (-Information) Risk Management

- SURVEY -

Survey ID:	CREATION DATE:

First Name:	Name:
Professional Background:	Date of Birth:

INSTRUCTIONS

Please indicate how much you agree or disagree with each of the following statements
Please respond as spontaneously as possible!
There are no correct or wrong answers.
Please make sure not to miss a statement.

No.	Questions:	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree
	Do you think, by also doing a structured "Awareness Program" in the new Joint Venture from the beginning on (as it was done in Trans-APAC-Scooter) would help the new JOINT VENTURE...					
1	... to be seen from the inside and outside as a company with more COMPETENCE, EXPERTNESS and DYNAMISM?	☐	☐	☐	☐	☐
2	... to improve the GOODWILL, BENEVOLENCE and RESPONISVENESS on customer/stakeholder side?	☐	☐	☐	☐	☐
3	... to be seen as more CREDABIL, MORAL, INTEGER and RELIABLE from the inside and outside?	☐	☐	☐	☐	☐
4	... to be seen as more ATTRACTIVE, PREDICTABE, CAREFUL, OPEN from the inside and outside?	☐	☐	☐	☐	☐
5	... to increase EARNINGS (indirect/in general)? = "information" also as "Good Sold"	☐	☐	☐	☐	☐
6	... to increase PROFITABILITY (indirect/in general) = better protect "information" as INTELECTUAL PROPERTY?	☐	☐	☐	☐	☐
7	... to improve EMPLOYEES' INDIVIDUAL/PERSONAL EFFICIENCY in information handling? = MORE EFFICIENT COMMUNICATION?	☐	☐	☐	☐	☐
8	... to improve TEMPORAL EFFICIENCY (speed up) in information processes? = improve ACCURACY/INTEGRITIY of INORMATION?	☐	☐	☐	☐	☐

9	... to improve flexibility in organizational processes according COMMUNICATION and GROWTH? = improve level of READYNESS for usage of MULTIPLE ADDITIONAL "information"-sources	☐	☐	☐	☐	☐
10	... to improve SOCIO-ECONOMIC EFFICIENCY = "need to know"-principal in information selection and information aggregation	☐	☐	☐	☐	☐
11	... to IMPROVE INFORMATION CONTROL ACCESS, (intrusion detection, supervisioning)	☐	☐	☐	☐	☐
12	... to DECREASE RISKS e.g. by utilizing managers, reducing anonymity, extending guard-ship, strengthening formal surveillance?	☐	☐	☐	☐	☐
13	... to REDUCE REWARDS FOR INFORMATION THEFT/DISCLOSURE by e.g. identifying/concealing/removing potential information TARGETS and denying potential benefits for it	☐	☐	☐	☐	☐
14	... to REDUCE PROVOCATIONS e.g. frustration and stress, avoid disputes, reduce emotional arousal, discourage imitations	☐	☐	☐	☐	☐
15	... to REMOVE EXCUSES e.g. by clear rules, alerting conscience, assisting compliance, controlling interfering variables	☐	☐	☐	☐	☐

	Latt-Bikes team members would like to do risk assessments normally alone; Trans-APAC-Scooter would like to form groups for each decision because of the joint venture. You are the Risk Manager and should rate the statements in regards to the risk assessment:					
16	Assessments in groups have, when compared to each other, less variance than individual assessments, when compared to each other	☐	☐	☐	☐	☐
17	Individual decisions are more accurate	☐	☐	☐	☐	☐
18	With groups there is the danger of having unnecessary, controversial discussions	☐	☐	☐	☐	☐
19	In group decisions, the decision will be made through the exchange between group members	☐	☐	☐	☐	☐
20	In group decisions, the use of power and influence on other group members is pronounced	☐	☐	☐	☐	☐
21	The decision maker follows more strongly their own personal goals during individual decisions, with group decisions the company goals are more strongly followed	☐	☐	☐	☐	☐
22	The time required to make an individual decision is shorter	☐	☐	☐	☐	☐
23	The decision maker spends more time searching for information than is the case with group decisions	☐	☐	☐	☐	☐
24	In group decisions, information is more thoroughly analyzed than in individual decisions	☐	☐	☐	☐	☐
25	In group decisions, irrelevant information has more influence than in individual decisions	☐	☐	☐	☐	☐
26	With higher budget impact, individual decisions are advisable	☐	☐	☐	☐	☐
27	With lower budget impact, individual decisions are advisable	☐	☐	☐	☐	☐
28	With medium budget impact, group decisions are advisable	☐	☐	☐	☐	☐
29	With high strategic impact, group decisions are advisable	☐	☐	☐	☐	☐
30	With lower strategic impact, individual decisions are advisable	☐	☐	☐	☐	☐
31	With medium strategic impact, individual decisions are advisable	☐	☐	☐	☐	☐
32	With greater personnel impact, individual decisions are advisable	☐	☐	☐	☐	☐
33	With little or no personnel impact, group decisions are advisable	☐	☐	☐	☐	☐
34	With middle personnel impact, individual decisions are advisable	☐	☐	☐	☐	☐

	Do you think, by also working on the Classification of "Information Assets" (=Information Classification) in the new Joint Venture from the beginning on (as it was done in Trans-APAC-Scooter) would help the new JOINT VENTURE ...					
35	... to be seen from the inside and outside as a company with more COMPETENCE, EXPERTNESS and DYNAMISM?	☐	☐	☐	☐	☐
36	... to improve the GOODWILL, BENEVOLENCE and RESPONISVENESS on customer/stakeholder side?	☐	☐	☐	☐	☐
37	... to be seen as more CREDABIL, MORAL, INTEGER and RELIABLE from the inside and outside?	☐	☐	☐	☐	☐
38	... to be seen as more ATTRACTIVE, PREDICTABE, CAREFUL, OPEN from the inside and outside?	☐	☐	☐	☐	☐
39	... to increase EARNINGS (indirect/in general)? = "information" also as "Good Sold"	☐	☐	☐	☐	☐
40	... to increase PROFITABILITY (indirect/in general) = better protect "information" as INTELECTUAL PROPERTY?	☐	☐	☐	☐	☐
41	... to improve EMPLOYEES' INDIVIDUAL/PERSONAL EFFICIENCY in information handling? = MORE EFFICIENT COMMUNICATION?	☐	☐	☐	☐	☐
42	... to improve TEMPORAL EFFICIENCY (speed up) in information processes? = improve ACCURACY/INTEGRITIY of INORMATION?	☐	☐	☐	☐	☐
43	... to improve flexibility in organizational processes according COMMUNICATION and GROWTH? = improve level of READYNESS for usage of MULTIPLE ADDITIONAL "information"-sources	☐	☐	☐	☐	☐
44	... to improve SOCIO-ECONOMIC EFFICIENCY = "need to know"-principal in information selection and information aggregation	☐	☐	☐	☐	☐
45	... to IMPROVE INFORMATION CONTROL ACCESS, (intrusion detection, supervisioning)	☐	☐	☐	☐	☐
46	... to DECREASE RISKS e.g. by utilizing managers, reducing anonymity, extending guard-ship, strengthening formal surveillance?	☐	☐	☐	☐	☐
47	... to REDUCE REWARDS FOR INFORMATION THEFT/DISCLOSURE by e.g. identifying/concealing/removing potential information TARGETS and denying potential benefits for it	☐	☐	☐	☐	☐
48	... to REDUCE PROVOCATIONS e.g. frustration and stress, avoid disputes, reduce emotional arousal, discourage imitations	☐	☐	☐	☐	☐
49	... to REMOVE EXCUSES e.g. by clear rules, alerting conscience, assisting compliance, controlling interfering variables	☐	☐	☐	☐	☐

	The policy makers at Latt-Bikes decide using already existing structures. Due to the company size and resulting fluctuation, Trans-APAC-Scooter takes professional background into consideration. You are the Risk Manager and should rate the statements in regards to the risk assessment:					
50	Groups made up of members with different professional backgrounds have, when compared to each other, less variance than groups made up of members with similar professional backgrounds, when compared to each other	☐	☐	☐	☐	☐
51	Groups made up of members with different professional backgrounds make less accurate decisions	☐	☐	☐	☐	☐
52	With groups made up of members with different professional backgrounds there is the danger of having unnecessary, controversial discussions	☐	☐	☐	☐	☐
53	Groups made up of members with different professional backgrounds discuss their decisions more than groups made up of members with similar professional backgrounds	☐	☐	☐	☐	☐
54	In groups made up of members with similar professional backgrounds, authority and influence will be used more so than in groups made up of different professional backgrounds	☐	☐	☐	☐	☐
55	Groups made up of members with different professional backgrounds concentrate more on the company goals, a group made up of members with similar professional backgrounds concentrate more on their own goals	☐	☐	☐	☐	☐
56	Less time is required to make a decision when a group is made up of members with similar professional backgrounds	☐	☐	☐	☐	☐

57	Groups made up of members with different professional backgrounds spend more time searching for information than is the case with groups made up of members with similar professional backgrounds	☐	☐	☐	☐	☐
58	When groups made up of members with different professional backgrounds make decisions, information is more thoroughly analyzed than by groups made up of members with similar professional backgrounds	☐	☐	☐	☐	☐
59	In groups made up of members with similar professional backgrounds, irrelevant information has a greater influence than in groups made up of members with different professional backgrounds	☐	☐	☐	☐	☐
60	With higher budget impact, groups should not be made up of members with different professional backgrounds	☐	☐	☐	☐	☐
61	With higher strategic impact, groups should be made up of members with different professional backgrounds	☐	☐	☐	☐	☐
62	With greater personnel impact, groups should not be made up of members with different professional backgrounds	☐	☐	☐	☐	☐

	Do you think, by implementing strong (technical) "Information Protection Mechanisms" in the new Joint Venture from the beginning on (as it was done in Trans-APAC-Scooter) would help the new JOINT VENTURE...					
63	... to be seen from the inside and outside as a company with more COMPETENCE, EXPERTNESS and DYNAMISM?	☐	☐	☐	☐	☐
64	... to improve the GOODWILL, BENEVOLENCE and RESPONISVENESS on customer/stakeholder side?	☐	☐	☐	☐	☐
65	... to be seen as more CREDABIL, MORAL, INTEGER and RELIABLE from the inside and outside?	☐	☐	☐	☐	☐
66	... to be seen as more ATTRACTIVE, PREDICTABE, CAREFUL, OPEN from the inside and outside?	☐	☐	☐	☐	☐
67	... to increase EARNINGS (indirect/in general)? = "information" also as "Good Sold"	☐	☐	☐	☐	☐
68	... to increase PROFITABILITY (indirect/in general) = better protect "information" as INTELECTUAL PROPERTY?	☐	☐	☐	☐	☐
69	... to improve EMPLOYEES' INDIVIDUAL/PERSONAL EFFICIENCY in information handling? = MORE EFFICIENT COMMUNICATION?	☐	☐	☐	☐	☐
70	... to improve TEMPORAL EFFICIENCY (speed up) in information processes? = improve ACCURACY/INTEGRITIY of INORMATION?	☐	☐	☐	☐	☐
71	... to improve flexibility in organizational processes according COMMUNICATION and GROWTH? = improve level of READYNESS for usage of MULTIPLE ADDITIONAL "information"-sources	☐	☐	☐	☐	☐
72	... to improve SOCIO-ECONOMIC EFFICIENCY = "need to know"-principal in information selection and information aggregation	☐	☐	☐	☐	☐
73	... to IMPROVE INFORMATION CONTROL ACCESS, (intrusion detection, supervisioning)	☐	☐	☐	☐	☐
74	... to DECREASE RISKS e.g. by utilizing managers, reducing anonymity, extending guard-ship, strengthening formal surveillance?	☐	☐	☐	☐	☐
75	... to REDUCE REWARDS FOR INFORMATION THEFT/DISCLOSURE by e.g. identifying/concealing/removing potential information TARGETS and denying potential benefits for it	☐	☐	☐	☐	☐
76	... to REDUCE PROVOCATIONS e.g. frustration and stress, avoid disputes, reduce emotional arousal, discourage imitations	☐	☐	☐	☐	☐
77	... to REMOVE EXCUSES e.g. by clear rules, alerting conscience, assisting compliance, controlling interfering variables	☐	☐	☐	☐	☐

	The Trans-APAC-Scooter team consists of employees of different ages, as does the Latt-Bikes team. In comparison to Trans-APAC-Scooter, Latt-Bikes gives more weight to risk assessments made by older employees. You are the Risk Manager and should rate the statements in regards to the risk assessment:					
78	Groups made up of members with different ages have, when compared to each other, less variance than groups made up of members with similar ages, when compared to each other	☐	☐	☐	☐	☐

79	Groups made up of members with different ages make less accurate decisions	☐	☐	☐	☐	☐
80	With groups made up of members with different ages there is the danger of having unnecessary, controversial discussions	☐	☐	☐	☐	☐
81	Groups made up of members with different ages discuss their decisions more than groups made up of members with similar ages	☐	☐	☐	☐	☐
82	In groups made up of members with similar ages, authority and influence will be used more so than in groups made up of different ages	☐	☐	☐	☐	☐
83	Groups made up of members with different ages concentrate more on the company goals, a group made up of members with similar ages concentrate more on their own goals	☐	☐	☐	☐	☐
84	Less time is required to make a decision when a group is made up of members with similar ages	☐	☐	☐	☐	☐
85	Groups made up of members with different ages spend more time searching for information than is the case with groups made up of members with similar ages	☐	☐	☐	☐	☐
86	When groups made up of members with different ages make decisions, information is more thoroughly analyzed than by groups made up of members with similar ages	☐	☐	☐	☐	☐
87	In groups made up of members with similar ages, irrelevant information has a greater influence than in groups made up of members with different ages	☐	☐	☐	☐	☐
88	With higher budget impact, groups should not be made up of members with different ages	☐	☐	☐	☐	☐
89	With higher strategic impact, groups should be made up of members with different ages	☐	☐	☐	☐	☐
90	With greater personnel impact, groups should not be made up of members with different ages	☐	☐	☐	☐	☐

	Do you think, by also implementing and following a formal "Controls Framework" in the new Joint Venture from the beginning on (as it was done in Trans-APAC-Scooter) would help the new JOINT VENTURE...					
91	... to be seen from the inside and outside as a company with more COMPETENCE, EXPERTNESS and DYNAMISM?	☐	☐	☐	☐	☐
92	... to improve the GOODWILL, BENEVOLENCE and RESPONISVENESS on customer/stakeholder side?	☐	☐	☐	☐	☐
93	... to be seen as more CREDABIL, MORAL, INTEGER and RELIABLE from the inside and outside?	☐	☐	☐	☐	☐
94	... to be seen as more ATTRACTIVE, PREDICTABE, CAREFUL, OPEN from the inside and outside?	☐	☐	☐	☐	☐
95	... to increase EARNINGS (indirect/in general)? = "information" also as "Good Sold"	☐	☐	☐	☐	☐
96	... to increase PROFITABILITY (indirect/in general) = better protect "information" as INTELECTUAL PROPERTY?	☐	☐	☐	☐	☐
97	... to improve EMPLOYEES' INDIVIDUAL/PERSONAL EFFICIENCY in information handling? = MORE EFFICIENT COMMUNICATION?	☐	☐	☐	☐	☐
98	... to improve TEMPORAL EFFICIENCY (speed up) in information processes? = improve ACCURACY/INTEGRITIY of INORMATION?	☐	☐	☐	☐	☐
99	... to improve flexibility in organizational processes according COMMUNICATION and GROWTH? = improve level of READYNESS for usage of MULTIPLE ADDITIONAL "information"-sources	☐	☐	☐	☐	☐
100	... to improve SOCIO-ECONOMIC EFFICIENCY = "need to know"-principal in information selection and information aggregation	☐	☐	☐	☐	☐
101	... to IMPROVE INFORMATION CONTROL ACCESS, (intrusion detection, supervisioning)	☐	☐	☐	☐	☐
102	... to DECREASE RISKS e.g. by utilizing managers, reducing anonymity, extending guard-ship, strengthening formal surveillance?	☐	☐	☐	☐	☐

103	… to REDUCE REWARDS FOR INFORMATION THEFT/DISCLOSURE by e.g. identifying/concealing/removing potential information TARGETS and denying potential benefits for it	☐	☐	☐	☐	☐
104	… to REDUCE PROVOCATIONS e.g. frustration and stress, avoid disputes, reduce emotional arousal, discourage imitations	☐	☐	☐	☐	☐
105	… to REMOVE EXCUSES e.g. by clear rules, alerting conscience, assisting compliance, controlling interfering variables	☐	☐	☐	☐	☐

	When forming working groups, Latt-Bikes try to include different personality types. Trans-APAC-Scooter does not believe this is necessary. You are the Risk Manager and should rate the statements in regards to the risk assessment:					
106	Groups made up of members with different personality types have, when compared to each other, less variance than groups made up of members with similar personality types, when compared to each other	☐	☐	☐	☐	☐
107	Groups made up of members with different personality types make less accurate decisions	☐	☐	☐	☐	☐
108	With groups made up of members with different personality types there is the danger of having unnecessary, controversial discussions	☐	☐	☐	☐	☐
109	Groups made up of members with different personality types discuss their decisions more than groups made up of members with similar personality types	☐	☐	☐	☐	☐
110	In groups made up of members with similar personality types, authority and influence will be used more so than in groups made up of different personality types	☐	☐	☐	☐	☐
111	Groups made up of members with different personality types concentrate more on the company goals, a group made up of members with similar personality types concentrate more on their own goals	☐	☐	☐	☐	☐
112	Less time is required to make a decision when a group is made up of members with similar personality types	☐	☐	☐	☐	☐
113	Groups made up of members with different personality types spend more time searching for information than is the case with groups made up of members with similar personality types	☐	☐	☐	☐	☐
114	When groups made up of members with different personality types make decisions, information is more thoroughly analyzed than by groups made up of members with similar personality types	☐	☐	☐	☐	☐
115	In groups made up of members with similar personality types, irrelevant information has a greater influence than in groups made up of members with different personality types	☐	☐	☐	☐	☐
116	With higher budget impact, groups should not be made up of different personality types	☐	☐	☐	☐	☐
117	With higher strategic impact, groups should be made up of different personality types	☐	☐	☐	☐	☐
118	With greater personnel impact, groups should not be made up of different personality types	☐	☐	☐	☐	☐

Relationship between relevant survey questions and the variables of the model:

Latent Exogenous Variable	Latent Endogenous Variable	Measurement indicator on latent endogenous variables	Question Nr.
X1	Y1	Y1,1	16
		Y1,2	17
		Y1,3	18
	Y2	Y2,1	23,24,25
		Y2,2	22
		Y2,3	19,20,21
	Y3	Y3,1	26,27,28
		Y3,2	29,30,31
		Y3,3	32,33,34
X2	Y1	Y1,1	106
		Y1,2	107
		Y1,3	108
	Y2	Y2,1	113,114,115
		Y2,2	112
		Y2,3	109,110,111
	Y3	Y3,1	116
		Y3,2	117
		Y3,3	118
X3	Y1	Y1,1	50
		Y1,2	51
		Y1,3	52
	Y2	Y2,1	57,58,59
		Y2,2	56
		Y2,3	53,54,55
	Y3	Y3,1	60
		Y3,2	61
		Y3,3	62
X4	Y1	Y1,1	78
		Y1,2	79

Latent Exogenous Variable	Latent Endogenous Variable	Measurement indicator on latent endogenous variables	Question Nr.
		Y1,3	80
	Y2	Y2,1	85,86,87
		Y2,2	84
		Y2,3	81,82,83
	Y3	Y3,1	88
		Y3,2	89
		Y3,3	90