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Risk Profiles in Individual Software Development and Packaged Software Implementation Projects:
A Delphi Study at a German-Based Financial Services Company

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ABSTRACT

The aim of this paper is to compare risk profiles of individual software development (ISD) and packaged software implementation (PSI) projects. While researchers have investigated risks in either PSI projects or ISD projects, an integrated perspective on how the risk profiles of these two types of information system (IS) projects differ is missing. To explore these differences, this work conducted a Delphi study at a German-based financial services company. The results suggest that: First, ISD projects seem to be more heterogeneous and face a larger variety of risks than the more straightforward PSI projects. Second, ISD projects seem to be particularly prone to risks related to sponsorship, requirements, and project organization. Third, PSI projects tend to be predominantly subject to risks related to technology, project planning, and project completion. Finally, in contrast to available lists of risks in IS projects and irrespective of the project type, the paper found a surprisingly high prominence of technology and testing-related risks.

Keywords: Delphi Study, Individual Software Development, Packaged Software Implementation, Project Risk, Risk Identification, Risk Profile

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1. INTRODUCTION

Although the discipline of information systems (IS) project management has matured considerably over the last decades, a lot of IS projects still face time, quality and budget issues. Failure rates of IS projects range from 23% to 68% – even in the optimistic case of 23% a high number for a professional discipline (Sauer et al., 2007; The Standish Group International, 2010). As successful IS project managers tend to be good at managing risks (Boehm, 1991) project risk management has increasingly gained importance among practitioners and academics (Bannerman, 2008).

Project risk management typically comprises the two phases of risk analysis (the identification, the assessment and the prioritization of possible events that pose a threat to project success) and risk control (the planning of responses, risk resolution and continuous monitoring) (Charette, 1996; Heemstra et al., 1996). Studies on project risk management in the IS discipline tend to focus on the first phase, and, in particular, on risk identification. In this regard, researchers have devised various generic lists of risks or checklists (Alter et al., 1978; Barki et al., 1993; Boehm, 1991; McFarlan, 1981; Moynihan, 1997; Zmud, 1980) to guide IS project managers in identifying and analyzing potential threats to IS project success. More recently, researchers have started to acknowledge that there is no one-size-fits-all risk profile for IS projects. Existence and importance of risks seem to vary depending on contextual, project-related, or individual characteristics. In this regard, researchers have analyzed how the cultural and socioeconomic (Mursu et al., 2003; Schmidt et al., 2001) context, a project's outsourcing location (Nakatsu et al., 2009), an individual's role in a project (Keil et al., 2002; Liu et al., 2010), and how his or her experience (Du et al., 2007; Warkentin et al., 2009) influence the existence and importance of IS project risks. Existing studies tend to either subsume various project activities under the general category of IS projects or exclusively focus on either individual software development (ISD) projects or packaged software implementation (PSI) projects. An integrated perspective on how risk profiles of these two types of information system (IS) projects differ is missing.

We argue that besides the mentioned contextual, project-related and individual characteristics, a main factor affecting a project's risk profile is the type of project that is being analyzed. The development of individual software differs considerably from the implementation of packaged software in terms of the project lifecycle and the intensity of the relationship between client and vendors (Lucas et al., 1988; Markus et al., 2000). With regard to the project lifecycle, individually developed software is typically designed to fit a company's extant business processes, which puts considerable emphasis on requirements analysis. The implementation of packaged software, in contrast, oftentimes comes with major business process changes as tailoring the software package to extant processes is difficult and only possible to some

extent. With regard to the client-vendor relationship, individual software development projects are frequently limited to the short- or medium-term. On the contrary, the implementation of packaged software oftentimes means long-term relationships between clients and vendors in order to maintain and update the software.

While extant research on risks sets the basis for understanding success and failure in IS projects, a consideration of risk profiles contingent on the project type may allow for a more effective management of risks. Hence, our research question is: *What differences exist between individual software development and packaged software implementation projects with regard to their risk profiles?*

In order to answer this question, we conducted a Delphi study at a German-based financial services company. The focus on a single research site enables us to control for organizational characteristics (Hofstede, 1980) and to achieve more open discussions on the sensitive topic of project risk and failure. Our experts included twelve IS project managers representing two types of IS projects: 1) individual software development (ISD) projects, in which new software is developed from scratch, and 2) packaged software implementation (PSI) projects, which integrate off-the-shelf software packages such as data base management systems into the existing IS landscape.

Our results suggest that: (1) ISD projects seem to be more heterogeneous and face a larger variety of risks than the more straightforward PSI projects. (2) ISD projects seem to be particularly prone to risks related to sponsorship, requirements, and project organization. (3) PSI projects tend to be predominantly subject to risks related to technology, project planning, and project completion. Finally, (4) in contrast to available lists of risks in IS projects and irrespective of the project type, we find a surprisingly high prominence of technology- and testing-related risks.

The remainder of the paper is structured as follows: In section 2, we review the related literature on IS project risks with a focus on risk identification and risk analysis. Section 3 outlines our research approach. In section 4, we present the results and compare them to previous findings. Finally, we conclude by pointing out the limitations as well as the implications of our study.

2. RELATED LITERATURE

A considerable body of research on IS project risks has focused on the identification of risks as a necessary condition for successful project risk management (Clarke et al., 2012). While there are various tools to improve risk identification such as brainstorming, scenarios, or failure trees, lists of risks or checklists are arguably the most frequently used among practitioners and researchers (Li, 2011). Checklists typically contain a list of key risks and descriptions of these risks and thus provide a starting point for risk identification and analysis. Though there is an ongoing debate about the advantages and disadvantages of checklists (Budzier, 2011; Drummond,

2011; Li, 2011; Lyytinen, 2011), empirical evidence suggests that checklists indeed can help risk managers to identify project risks more effectively (Keil et al., 2008).

Based on early checklists that identify and describe risks in IS projects (Alter et al., 1978; Barki et al., 1993; Boehm, 1991; McFarlan, 1981; Moynihan, 1997; Zmud, 1980), more recent research has acknowledged that there is no one-size-fits-all checklist. Rather, project risks seem to vary in existence and importance depending on certain characteristics related, e.g., to the project's context, the project, the individuals involved in risk management, or the risk itself.

For instance, the cultural background has been shown to affect the relative importance of project risks (Sam et al., 2012; Schmidt et al., 2001): While cultures with a collectivist philosophy such as Hong Kong seem to emphasize risks for which there is collective responsibility, individualistic cultures such as Finland or the United States tend to focus on risks attributable to single individuals (Schmidt et al., 2001). In addition to cultural influences also the socioeconomic background is of importance when prioritizing risks. Extending the work by Schmidt et al. (2001), Mursu et al. (2003) investigate how Nigerian project managers identify and rank risks in software development projects. The findings suggest that the socio-economic background and the constraints it implies in terms of reliable energy and telecommunication infrastructure and educational standards strongly affect a software development project's risk profile (Mursu et al., 2003): Nigerian project managers ranked the risks "energy supply" and "unreliable communication network" among the most important risks in software development projects. In contrast, these risks are not mentioned at all by project managers in industrialized countries (Schmidt et al., 2001).

Besides the cultural and socioeconomic background, characteristics of the project exert influence on the risk profile of software development projects, as for example illustrated in a study by Nakatsu et al. (2009) on offshore and domestic outsourcing projects. Not surprisingly, the offshore context resulted in specific risks such language barriers, cultural differences, or political instabilities which were not deemed relevant in the domestic context (Nakatsu et al., 2009).

The role of individuals is also known to affect the risk profile of IS projects. While senior executives tend to focus on more strategic risks related to politics, organization structure, and culture, project managers put emphasis on tactical risks related, e.g., to user involvement, or requirements engineering (Liu et al., 2010). Users seem to prioritize risks related to the project manager and his or her abilities (Keil et al., 2002). Another important individual characteristic concerns the risk managers' level of experience. Warkentin et al. (2009) suggest that more experienced project managers and system engineers see organizational risks as the ultimate source of other risks. In contrast, less experienced project managers and system engineers seem to focus on operational risks such as a project's technical feasibility (Warkentin et al.,

2009). The results of an experimental study by Du et al. (2007) add that project managers with more experience tend to perceive higher levels of risks than project managers with less experience.

Finally, characteristics of a risk itself have been suggested to influence its perceived importance. Keil et al. (1998) provide a framework for categorizing risks into four quadrants, based on their importance and the level of control as perceived by the project manager. The results illustrate that these two dimensions are not independent of each other. The level of control actually seems to negatively affect the importance a project manager attributes to a risk, i.e., the lower the level of direct control, the higher a risk's perceived importance tends to be (Keil et al., 1998). Table 1 gives an overview studies that investigate these variations in risk profiles.

By devising specific checklists for ISD (e.g., Barki et al., 1993; Boehm, 1991; Moynihan, 1997; Reed, 2012) and PSI projects (e.g., Chen et al., 2009; Finney et al., 2007; Sumner, 2000) researchers also acknowledge that the project type is an important characteristic affecting a project's risk profile. For instance, based on known risks in ISD projects, Sumner (2000) investigates risks specific to PSI projects by the example of enterprise resource planning (ERP) projects. Her analysis of seven large ERP implementations yields several ERP specific risks that relate the enterprise-wide design of business processes, the integration of external expertise, the customization and the integration with legacy systems. Research on software economics also supports the notion of project type specific risks: Appari et al. (2010) explore a pricing method for software development risks based on two

Table 1. Overview on studies on variations in risk profiles

Study	Characteristic influencing project risk profile	Research approach	# Risks identified
Schmidt et al. (2001)[x]	Cultural background	Delphi study	53
Mursu et al. (2003)	Socioeconomic background	Delphi study	51
Nakatsu et al. (2009)	Outsourcing location	Delphi study	25 / 20*
Liu et al. (2010)	Role	Delphi study	57
Keil et al. (2002)	Role	Delphi study	-┼
Warkentin et al. (2009)	Experience	Case study	7╪
Du et al. (2007)	Experience	Experimental study	-
Keil et al. (1998)	Perceived control	Delphi study	53

x: The results are based on the Delphi study conducted by Keil et al. (1998).
*: Nakatsu et al. (2009) identified 25 risks for offshore and 20 for domestic outsourcing projects.
┼: Keil et al. (2002) used the 53 risks identified in Schmidt et al. (2001) as a starting point for risk selection.
╪: Warkentin et al. (2009) identified no risks but seven themes, which include combinations of several risks.

parameters: a risk premium and a project's sensitivity to the risk. Their results suggest that different project types may have different sensitivities to project risks: The authors found that system software projects tend to react twice as sensitive to technology platform risks as support software projects, implying that the priority of risks varies depending on the project type. While studies which investigate risks of either ISD or PSI projects provide valuable insights for risk managers of these projects, comparing their findings and drawing inferences as to how different projects vary in terms of their risk priorities is almost impossible due to the varying study contexts. An integrated perspective on how the risk profiles of ISD and PSI projects differ is missing. By analyzing these differences in one common context, we aim to fill this gap and contribute to the IS discipline's understanding of project risks.

3. RESEARCH APPROACH

In order to answer our research question we conducted a ranking type Delphi study at a German financial services company. The Delphi approach is a common approach for this kind of research (see Table 1) and aims at achieving consensus among experts regarding complex problems through iterative feedback loops (Linstone et al., 1976). We conducted the Delphi study between October 2010 and April 2011 within the IS unit of a German, DAX-30-listed financial services company (for reasons of anonymity called OMEGA). We chose a one-company setting for two reasons: First, it helps control for any organizational or industry characteristics (Hofstede, 1980). Second, as information about project risks and failure is potentially confidential, limiting the study to in-house experts from one research site ensures more open discussions and feedback from the participants (Linstone et al., 1976). OMEGA's IS unit provides development, implementation, operations and maintenance services to OMEGA internal clients. We distinguished two types of IS projects: First, ISD projects, in which new software is developed according to OMEGA's specific requirements. Second, PSI projects, where off-the-shelf software packages such as data base management systems are integrated in OMEGA's existing IS landscape.

3.1. Composition of the Panels

We recruited a total of 12 project managers from OMEGA. We followed a systematic selection approach as recommended by Linstone et al. (1976). To account for role-based (Keil et al., 2002; Liu et al., 2010) and cultural (Schmidt et al., 2001) biases, we limited our study participants to German project managers. In addition, we preferred participants with a visible interest in the research topic in order to achieve meaningful results and keep the drop-out rate as low as possible. Furthermore, the study participants' projects should cover various project contexts within their panel to gain a picture as holistic as possible. We emailed invitations to participate in the study including procedural details

to project managers from ten different departments within OMEGA's IS unit. Based on the positive responses two panels were composed, each consisting of six project managers whose last or ongoing project belonged to the panel's project type. Table 2 shows descriptive statistics for the two panels.

3.2. Data Collection and Analysis

To investigate the relative importance of project risks we followed the Delphi approach as described by Schmidt (1997): Data collection was not exclusively done via electronic mail but also via semi-structured interviews. Through the interviews we could develop an in-depth understanding of the identified risks and the reasoning behind the participants' individual rankings (see Table 5 for interview questions). Furthermore, the interviews turned out to be helpful in keeping the project managers motivated throughout the study. In total, the study took seven months. It involved three sequential phases as depicted in Figure 1.

In phase one, we conducted semi-structured interviews with each project manager. The semi-structured interviews aimed at identifying as many risks as possible. The discussions during the interviews resulted in a total of 641 risks. Besides, the discussions were useful for developing the understanding necessary for the subsequent consolidation: we removed exact duplicates from the list, yielding 100 unique risks. We grouped similar risks following the categorization proposed by Wallace et al. (2004) and Schmidt et al. (2001).

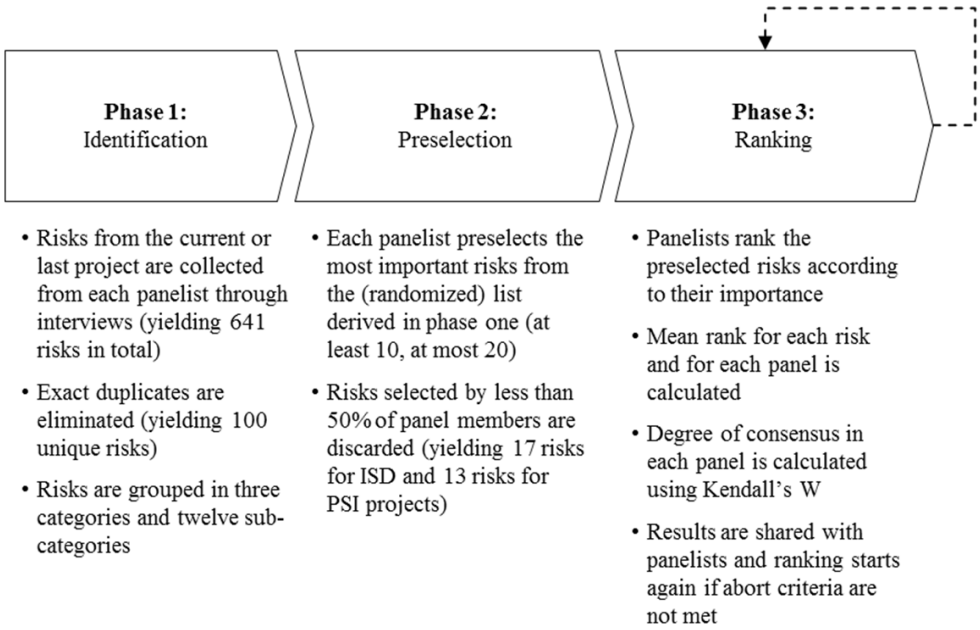
In phase two, we divided the project managers into the two panels. In order to allow for a meaningful assessment of the risks, we asked the project managers to select between 10 and 20 risks from a randomized list of the 100 unique risks derived in phase 1. Risks which were selected by at least half of the project managers in one panel were kept for phase three. Phase two yielded 17 risks for ISD projects and 13 risks for PSI projects.

In phase three, we presented each project manager with an ordered list of risks for the respective panel. In order to provide the project managers with feedback from the second phase (Keil et al., 2002), the list of panel-specific risks was ordered by the relative number of mentions descending. We emphasized that a high number of mentions is not

Table 2. Descriptive statistics for the two panels

	ISD project panel				PSI project panel			
	Ø	SD	Min	Max	Ø	SD	Min	Max
IS experience [in years]	17,3	8,1	10	25	23,5	7,5	14	35
PM experience [in years]	13,3	7,2	7	22	14,3	4,3	10	30
Project effort [in man-months]	491	320	53	1033	46	49	6	150
Project duration [in months]	13,6	4, 8	9	24	15,8	9,5	8	36
SD: Standard deviation.								

Figure 1. Delphi methodology as proposed by Schmidt (1997)



necessarily an indicator of the importance of the risks. Similar to phase one, the first round of the ranking was done via interviews. This approach helped us capture the reasons for ranking risks high or low. In the interviews we asked the project manager to sort the risks by descending importance and to explain the final ranking to us. The subsequent ranking rounds were carried out via email. After each round we calculated the degree of consensus within the panels using Kendall's coefficient of concordance (W). In addition, we provided the panelists with the mean rank of each risk and also the reasons for the rankings as stated by the project managers during the interviews.

We stopped the ranking in both panels after the second round as the participants made clear that their individual rankings won't change. The panel of ISD project managers reached a low to moderate agreement (W = 0.43); the panel of PSI project managers reached a strong agreement (W = 0.68) (Schmidt, 1997). Although both panels did not reach the predefined threshold of 0.7, we can have a fair degree of confidence in our results (Schmidt, 1997).

4. RESULTS AND DISCUSSION

In the following section, we present and discuss the results of our study in three subsections: First, we analyze the results of the identification phase. Second, we take a detailed look at the risks selected for each panel for ranking. Third, we analyze the final rankings agreed upon by the panels.

4.1. Phase 1: Risk Identification

In phase one a comprehensive list of risks in ISD and PSI projects at OMEGA was developed. The list comprises 100 risks and is organized in three categories and twelve sub-categories based on Wallace et al. (2004) and Schmidt et al. (2001). Due to space limitations, we do not present it here. However, the list is available from the authors upon request. Consistent with the findings of Keil et al. (2008), checklists seem to support individuals in risk identification: OMEGA project managers who used checklists were able to identify on average 23.3 different risks. In contrast, their colleagues, who did not use checklists, could only name 15.1 different risks on average.

As the main goal of our study was to explore differences in risk profiles across ISD and PSI projects, we will refrain from a detailed one-on-one comparison of the risks identified in this study with the risks identified in related studies. Overall, a considerable number of risks in our study can be matched to the risks identified in our reference studies by Schmidt et al. (2001) and Liu et al. (2010). However, two major differences to these studies are apparent: First, the project managers at OMEGA identified considerably more (almost twice as many) risks than participants in Schmidt et al. (2001) and Liu et al. (2010). On the one hand, this may be due to the fact that our list is more granular, i.e., that several of the risks identified in our study are reflected in only one risk in Schmidt et al. (2001) and Liu et al. (2010). On the other hand, this may be due to the second major difference, namely the surprisingly high number of risks related to the technology and testing sub-categories. Although these sub-categories are mentioned in Schmidt et al. (2001) and Liu et al. (2010), the number of risks belonging to these sub-categories is substantially lower than in our study. We assume that the prominence of risks related to technology and testing in our study may result from the general trend of information systems becoming ever more complex, which is especially true in the financial services industry with its large and interlinked systems. Furthermore, as project management practices in companies become more and more mature, the focus of project managers may have shifted away from risks related to project management towards risks related to technology and testing issues.

Overall, project managers of ISD projects identified substantially more risks (79 risks) than project managers of PSI projects (51 risks), suggesting that development projects are subject to a greater variety of risks than implementation projects. Figure 2 depicts the share of risks identified in each sub-category relative to the total number of risks identified in the ISD and the PSI project panel, respectively. Sub-categories with a considerable share of identified risks, e.g. the technology sub-category, can be said to contain a larger bandwidth of risks than categories with a smaller share.

In contrast to our expectation, the risk profiles of ISD and PSI projects look quite similar suggesting that the common context in which the projects take place also determines the variety

of risks the projects are subject to. Both panels identify many risks in the technology, team, corporate environment and project planning sub-categories. While the prominence of team, corporate environment and planning related risks is also found in related work, the high share of technology related risks is rather surprising. In addition, project managers from both panels identify few risks in the sub-categories sponsorship and project completion, probably due to mature project management practices which reduce the breadth of possible for risks in these sub-categories.

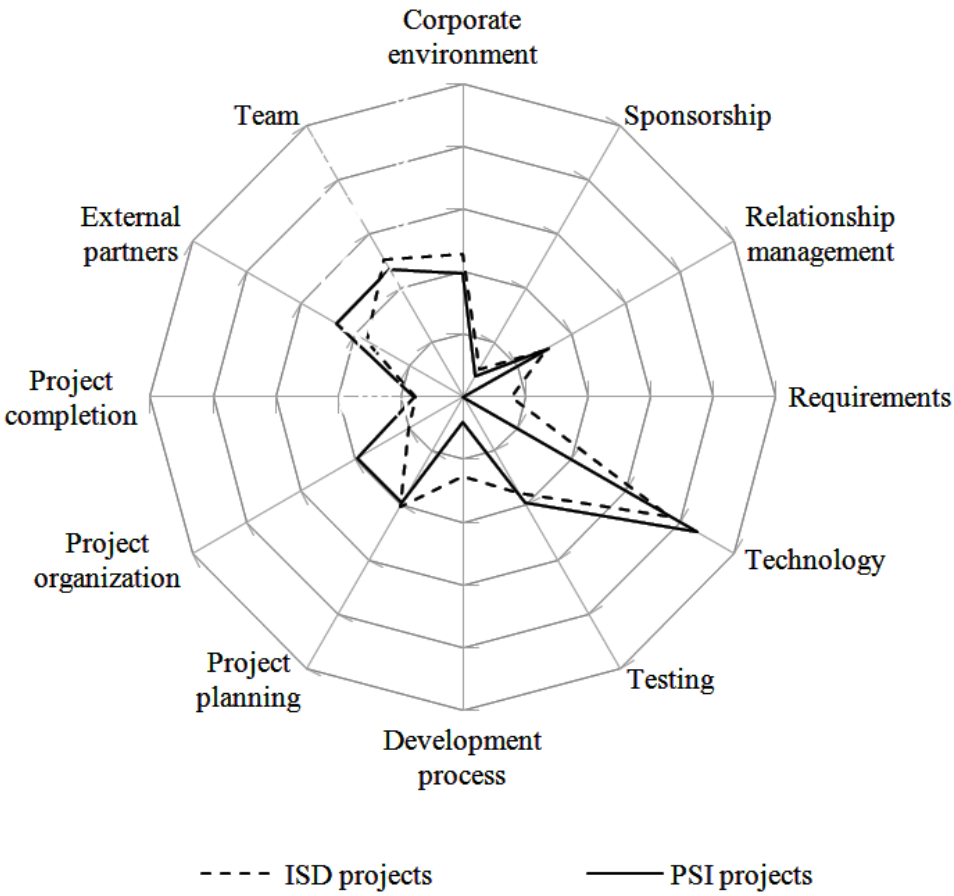
Major differences between ISD and PSI projects become visible in the subcategories requirements, development process, project organization, and external partners. Not surprisingly, ISD projects are subject to a broader variety of risks related to requirements, above all unclear or unstable requirements. This aptly reflects the creation of new software from scratch, where the focus lies on understanding what the client exactly wants and building the software accordingly. Naturally, there are also fewer limits to the clients' ideas in ISD projects than in PSI projects which may result in frequent requirement changes. In a similar vein, also the development process tends to bear considerably more risks such as an inefficient change management or excessive administrative requirements in ISD projects. On the other hand, PSI projects seem to face more risks related to the project organization and external partners. Risks related to the project organization include for example no risk management or a lack of communication guidelines. As these risks have no obvious link to the specific project type, we argue that they might originate from the fact that PSI projects are substantially smaller than ISD projects and, thus, less attention is paid to organizational issues which again increases the spectrum of risks in this sub-category. Finally, external partners tend to pose more risks to PSI projects as these projects are typically conducted with the help of specialized consultants over which OMEGA has little or no control.

4.2. Phase 2: Risk Selection

In the second phase of our Delphi study, the project managers were asked to select between ten and twenty risks they deemed most critical for project success from the complete randomized list developed in phase 1. Again project managers of ISD projects selected more risks (17) than project managers of PSI projects (13) corroborating the notion that ISD projects tend to be subject to a greater variety of risks.

Table 3 shows the number of selected and identified risks in ISD and PSI projects by risk sub-category. Risks in the sub-categories corporate environment, relationship management, requirements, technology, testing, project planning, and team were selected for ranking in both, ISD and PSI projects. Risks in the sub-category external partners were ignored by both panels, indicating that these risks are not deemed critical for project success by ISD and PSI project managers. Besides these commonalities, also several differences between ISD and PSI projects are recognizable: In contrast to project managers of PSI

Figure 2. Share of risks identified in each sub-category in ISD and PSI projects



projects, project managers of ISD projects selected risks in the sub-categories sponsorship, development process, and project organization for ranking. Conversely, project managers of ISD projects did not select risks in the sub-category project completion. The focus on the development process by the ISD project managers and on project completion by the PSI project managers, respectively, aptly reflects the inherently different project activities of developing and implementing software.

While the results of phase 1 indicate slightly different bandwidths of risks in ISD and PSI projects, the results of phase 2 highlight that the risk profiles of ISD and PSI projects seem to vary above all with regard to the importance of risk sub-categories and the risks themselves. Out of the 17 risks identified by the ISD project managers, twelve risks are important for ISD project managers only. Five risks were also selected for ranking by the PSI project managers. Conversely, the PSI project managers selected eight

Table 3. Number of identified and selected risks in ISD and PSI projects by risk sub-category

Risk sub-category	ISD projects		PSI projects	
	# of risks identified in p1	# of risks selected in p2	# of risks identified in p1	# of risks selected in p2
Corporate environment	9	2	5	2
Sponsorship	2	1	1	-
Relationship management	6	3	4	1
Requirements	3	1	-	2
Technology	15	3	11	2
Testing	7	1	5	1
Development process	5	2	1	-
Project planning	8	1	5	1
Project organization	4	1	5	-
Project completion	3	-	2	2
External partners	7	-	6	-
Team	10	2	6	2
Total	**79**	**17**	**51**	**13**

risks for ranking that the ISD project managers considered unimportant. In the following, we discuss these differences in more detail.

4.3. Phase 3: Risk Ranking

The third phase of our study aimed at ranking the risks selected in phase 2. Project managers in both panels were asked to rank order the risks by declining importance. To achieve panel consensus, the results of the first round of ranking were fed back to the panelists and a second round was conducted. The ranking stopped after this second round as it became clear that the consensus within both panels would not improve further. Interestingly, the degree of consensus within the two panels is quite different: Whereas the panel of ISD project managers only reached weak consensus (W = 0.43), the panel of PSI project managers reached a moderate to strong consensus (W = 0.68). The difficulty of reaching a stronger consensus in the ISD panel may be explained by the fact that ISD projects tend to be more heterogeneous with regard to their risks than PSI projects, which again substantiates the findings of phase 1. The final risk rankings for ISD and PSI projects and a mapping to Schmidt et al. (2001) are shown in Table 4.

Looking at Figure 3, some commonalities between ISD and PSI rankings stand out. In both panels the risk sub-categories corporate environment, testing, and team rank relatively high, whereas the sub-categories relationship management, external partners and development process rank relatively low. Regarding the corporate environment,

Table 4. Risk ranking for ISD and PSI projects at omega

Risk		Sub-category	Rank ISD projects	Rank PSI projects	Rank Schmidt et al. (2001)
A	Dependencies on other projects	Project organization	1		(17) [USA]
B	Unavailability of testing infrastructure	Testing	2	4	
C	Unclear requirements	Requirements	3		2
D	Unrealistic external deadlines	Corporate environment	3		7 [FIN]
E	Complex interfaces	Technology	5	2	
F	Lack of skilled resources	Team	6	1	5
G	Inter-divisional decisions	Relationship management	7		11
H	Unrealistic sponsor expectations	Sponsorship	8		(9)
I	Low project priority	Corporate environment	9	3	(1)
J	Unclear roles and responsibilities	Team	10		15 [USA]
K	End user resistance	Relationship management	11		4 [HKG]
L	Parallel release development	Development process	12		
M	Poor coordination between sub projects	Development process	13		(5) [FIN]
N	Missing stakeholders	Relationship management	14	11	(4)
O	Heterogeneous system architectures	Technology	15		
P	No integration of experienced team members	Planning	16		(5) [FIN]
Q	New technology	Technology	17		8
R	Unstable requirements	Requirements		6	6
S	High technical complexity	Technology		5	(16) [FIN]
T	Optimistic project planning	Planning		7	(5) [FIN]
U	No implementation strategy	Project completion		8	(5) [FIN]
V	Budget cuts	Corporate environment		9	(1)
W	Unrealistic project scope	Requirements		10	(18) [FIN]
X	No fall-back scenarios	Project completion		11	(5) [FIN]
Y	Dependency on third parties	Team		11	(5)
Round brackets indicate related risks rather than one-to-one mappings. Square brackets indicate the respective panel ranking.					

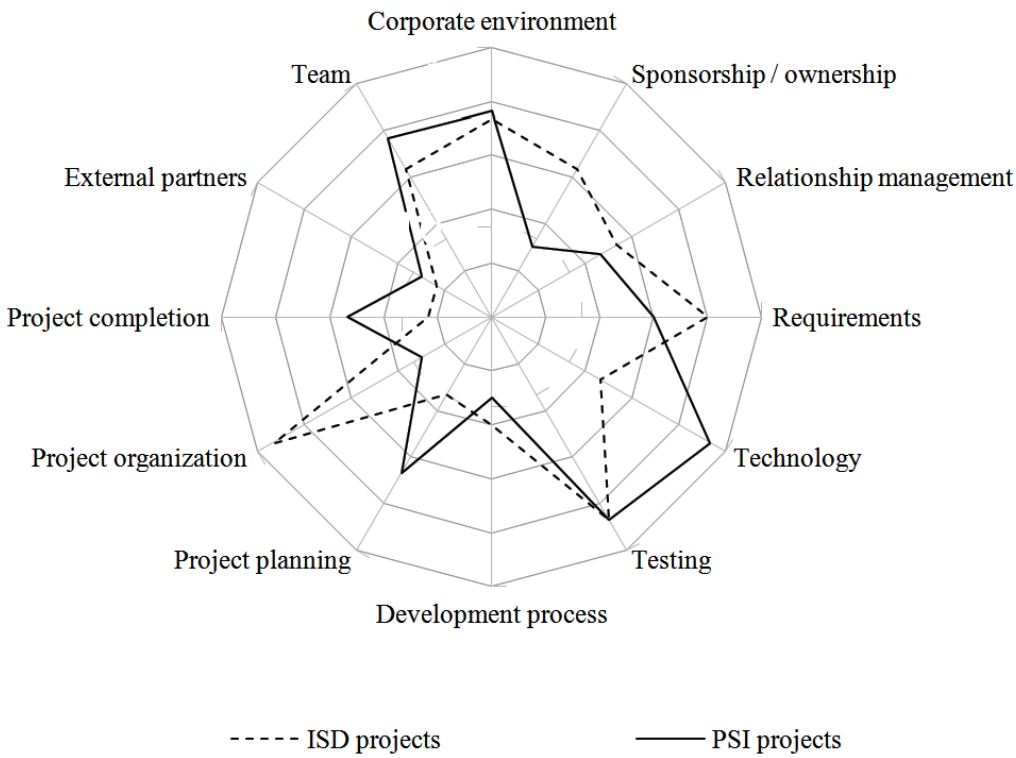
low project prioritization seems to be an issue for both, ISD and PSI projects, albeit being slightly more important for PSI projects. In PSI projects a low project prioritization tends to translate into budget cuts whereas this seems not to be the case for ISD projects. ISD projects in addition face unrealistic external deadlines, which possibly reflect the higher urgency and strategic importance of ISD

projects. In the testing sub-category, the unavailability of the testing infrastructure ranks high in both panels. Although of slightly higher importance in ISD projects, the prominence of testing in PSI projects is rather surprising. We argue that this may be due to increasingly interlinked information systems, which make integration and system tests a critical issue for PSI projects as well. Another risk sub-category ranked high by project managers in both panels is the team sub-category. Irrespective of the specific project type, adequately skilled resources are scarce. This is particularly exacerbated in PSI projects, where a lack of skilled resources was ranked the most important risk, probably being a consequence of the low project priority and the conditional access to the company's resource pool by these projects. Risks related to the relationship management, the external partners, and the development process sub-categories rank comparatively low in both panels. Whereas risks related to relationship management appear in both rankings, risks related to external partners were not ranked in either panel, making external partners the least important sub-category for ISD and PSI projects. As indicated by the results of phase 1, especially PSI project managers seem to recognize external partners as a potential source for risks though. Risks related to the development process were ranked by ISD project managers only, see above. However, as indicated by their low rank, these risks seem not to be the most critical ones for project success.

Regarding the differences between the two rankings, the most important risks for ISD projects reside in the project organization, the requirements, and the sponsorship sub-categories. ISD project managers rank risks related to these sub-categories substantially higher than PSI project managers. The project organization sub-category is the most important sub-category with dependencies on other projects posing the most important risk in the ISD panel. The fact that ISD projects at OMEGA tend to be part of large development programs with many sub-projects seem to be the reason for this. Furthermore, risks in other sub-categories appear to be related to the considerable size of these development programs, such as inter-divisional decisions, a poor coordination between sub-projects, and the development of parallel releases. Additionally, although requirements play an important role in PSI projects as well, they are particularly important for ISD projects. As described above, ISD projects, in which new software is developed from scratch, leave more room for the client's ideas than PSI projects, in which the functionalities are clearly defined upfront by the respective software package. Accordingly, the risks of unclear requirements and unrealistic sponsor expectations are among the top ten risks in ISD projects, whereas these risks are not ranked in the PSI panel. However, PSI projects are apparently more vulnerable to unstable requirements and an unrealistic project scope, which is understandable given the tight budgets of PSI projects. Unrealistic sponsor expectations in ISD projects may also be driven by the frequent use of new, state-of-the-art technology in these projects which sometimes is not

mature enough to deliver on its promises. Where these promises cannot be kept, user resistance tends to be high as well. In contrast to ISD projects, which seem particularly exposed to risks in the project organization, the requirements, and the sponsorship sub-categories, the most important risks in PSI projects seem to be related to the technology, the project planning, and the project completion sub-categories. First, with regard to technology, complex interfaces and high technical complexity in general were ranked high by PSI project managers. Again we argue, that today's interlinked IS landscapes in the financial services industry pose new challenges with regard to the integration of packaged software adding substantial complexity to these projects, and also making integration testing an important issue. Second, project planning seems to be more important for PSI projects. Due to their comparatively small size and the use of "ready-to-use" packaged software, project planners tend to underestimate the effort necessary for successfully implementing these projects: The risk of planning the project too optimistically ranks seventh among PSI project managers while it was not ranked by ISD project managers. This issue is also reflected in two planning related risks in the project completion sub-category:

Figure 3. Relative importance of risk sub-categories in ISD and PSI projects



While not an issue for ISD projects, the risks of having no implementation strategy and no fall-back scenarios ranked eighth and tenth in the PSI panel. The risk of no fall-back scenarios may relate to the high costs of switching to another software package once it has been found out that the chosen software package cannot deliver the required functionality.

5. CONCLUSION AND IMPLICATIONS

In addition to national culture, hierarchical roles, and personal experience, the project type also seems to exert considerable influence on a project's risk profile. We explore this proposition using a Delphi study approach with two different panels representing individual software development (ISD) projects and packaged software implementation (PSI) projects.

Our results suggest that ISD projects tend to be more heterogeneous and face a greater variety of risks than the more straightforward PSI projects as indicated by the greater number of risks identified/selected by ISD project managers in phase 1/phase 2 or the greater difficulty of reaching a consensus among ISD project managers in phase 3 of our study (see Tables 6 and 7). Additionally, both, ISD and PSI projects rank risks related to the corporate environment, the testing and the team sub-category high. ISD projects in particular seem to be prone to risks related to sponsorship, requirements, and project organization. Furthermore, ISD projects face more risks related to the development process than PSI projects reflecting the different nature of software development, e.g., a focus on requirements and the way the software is created, when compared to software implementation. In contrast, PSI projects tend to be subject to risks related to technology, project planning, and project completion. These particularities in the risk profile may be due to the fact that PSI projects are often underestimated with regard to technological risks and risks related to project planning because of the use of presumably mature packaged software and their more manageable size, respectively. Irrespective of the project's type, we find a surprisingly high prominence of technology- and testing-related risks compared to other studies. We see two explanations for this: Either, we can observe a general trend towards more complex information systems, which should be especially true in the financial services industry. Or, the prominence of testing and technology related risks partly reflects a cultural particularity by German engineers, who tend to focus more on technical issues than for example their American or Chinese colleagues.

The following limitations have to be kept in mind: First and foremost, the one company setting of our study potentially limits the generalizability of our results. The characteristics of the chosen industry and company may bias the identified risk profiles: For instance, technology- and testing-related risks may be more accentuated in the financial services industry than in other industries in which information systems do not play such a crucial role. Also, company

specifics, such as the resource pool of OMEGA's internal IS unit may bias the risk profiles of both project types. As mentioned above, however, focusing on one research site also enabled us to hold these factors constant across our two panels. We found no indication that company specifics affected either ISD or PSI projects alone, giving us confidence that the observed differences between ISD and PSI projects may be generalizable to other organizational settings. Furthermore, limiting the study participants to in-house experts from a single company helped obtain more open feedback when discussing confidential topics with the study participants, enhancing our confidence in the validity of our results. A second limitation is our selection of project managers: We preferred project managers with a visible interest in the research topic in order to ensure a high response rate. However, this focus potentially disguises risks that individuals with different roles or less interested project managers are faced with (Warkentin et al., 2009). Accordingly, our findings should be treated with caution when studying different settings. Third, our risk profiles depend on our subjective definition and categorization of risks. Although we tried to minimize this bias by cross-checking the definition of risks and their categorization by all four authors of this study, subjectivity cannot be ruled out completely.

Despite these limitations, we are confident that our study contributes by shedding a first light on differences in the risk profiles of ISD and PSI projects. Practitioners should keep in mind that the importance of similar risks may vary in ISD and PSI projects. Future research should address the limitations mentioned above. In particular, the study should be replicated in different industry and organizational settings. Further promising avenues for future research include the development of project risk profiles and matching project risk management approaches. Also, investigating dependencies between several risks in specific project risk profiles seems to bear great potential in order to be able to tackle problems in IS projects at their root cause.

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APPENDIX

Table 5. Interview guideline

General part
• Which part of the organization do you belong to? • What is your current role? • Which kind of projects have you been managing? • How much experience do you have with IS projects • How much experience do you have in managing projects?
Specific part
• Which risks were identified in your last / current project during the project? • Why were these risks identified? Which consequences did these risks have / were thought to have? • Which risks were prevalent in other projects that were of the same project type (either ISD or PSI) as your last / current one? • With which risks have you been confronted in other IS projects that were of the same project type (either ISD or PSI) as your last / current one? Relating to the: o …project environment: corporate environment, sponsorship, relationship mgmt. o …technical aspects: requirements, technology, testing o …project management: development process, project planning, project organization, project completion, third parties, team)

Table 6. Top 10 Risks for ISD projects

Risk	Sub-category	Rank
Dependencies on other projects	Project organization	1
Unavailability of testing infrastructure	Testing	2
Unclear requirements	Requirements	3
Unrealistic external deadlines	External influences	3
Complex interfaces	Technology	5
Lack of skilled resources	Team	6
Inter-divisional decisions	Relationship management	7
Unrealistic sponsor expectations	Sponsorship / ownership	8
Low project priority	External influences	9
Unclear roles and responsibilities	Team	10

Table 7. Top 10 Risks for PSI projects

Risk	Sub-category	Rank
Lack of skilled resources	Team	1
Complex interfaces	Technology	2
Low project priority	External influences	3
Unavailability of testing infrastructure	Testing	4
High technical complexity	Technology	5
Unstable requirements	Requirements	6
Optimistic project planning	Planning	7
No implementation strategy	Project completion	8
Budget cuts	External influences	9
Unrealistic project scope	Requirements	10