CRANFIELD UNIVERSITY

MUHAMMAD AKRAM AFZAL

RISKS IN NEW PRODUCT DEVELOPMENT (NPD) PROJECTS

SCHOOL OF MANAGEMENT
PhD DISSERTATION

Academic Year: 2016 - 2017

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Abstract

New product development (NPD) is vulnerable to a wide variety of risks arising from within the firm or from the external environment. Existing categorizations of NPD project risks are partial or ill-defined and consequently there is no clear consensus among researchers and practitioners about what constitute NPD project risks.

To address this gap, this thesis deploys a systematic literature methodology to inductively develop a comprehensive risk taxonomy from a review of 124 empirical studies. This taxonomy is then empirically validated through a survey capturing data from 263 NPD projects conducted by UK firms. The thesis further investigated the moderating effect of NPD project type (incremental or radical), firm size (SMEs and large firms) and industry sectors on the proposed risk taxonomy. Variation in the perceptions of NPD risk by different members of the team was explored as well.

The findings revealed that the principal risk factors affecting NPD projects are technological rapidity risk, supply chain risk, lack of funding and resource risk. The risk profile of radical NPD projects differed to that of incremental projects. SMEs were more vulnerable to NPD project risks than large firms. Most risks influenced NPD projects equally across industrial sectors. Members of NPD project teams from different backgrounds or with different roles perceived risks differently.

The proposed taxonomy and its subsequent empirical validation provides a comprehensive and robust taxonomy for identifying and managing risks associated with different types of NPD project conducted by firms of varying sizes from different industrial sectors.

Keywords: Risk; NPD; Taxonomy; Systematic Literature Review

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1 Introduction

1.1 General introduction to risk

The word risk is ambiguous as both its origin and meaning are debatable. Some researchers link its origin to the Italian word "risicare" which means to dare (Khan and Burnes, 2007; Shashank and Thomas, 2009). Others associate it with the Arabic word "Risq" which means a blessing from God (Shashank and Thomas, 2009). The concept of risk was initially used in the 17th century by French mathematicians Pascal and Fermat in gambling and later in the insurance sector in early 19th century (Shashank and Thomas, 2009). Since 1950 its applications have been found in wider domains such as human behaviour and psychology, supply chain management, project management and new product development (NPD) (Choi et al., 2008; Mu et al., 2009; PMI, 2008).

A review of general risk literature suggests very few clear and concise definitions of risk (see Table 1-1 for a summary of definitions of risks from general risk literature). Besides the stated risk definitions from researchers, various government organizations and professional associations also introduced different definitions of risk e.g. US Department of defense (DOD) and Project Management Institute (PMI). One possible explanation for the difficulty in defining risk is because there is considerable debate about different concepts of risk. The three most important debates relate to positive and negative aspects of risk definitions, to the distinction between risk and uncertainty and to the subjective and objective nature of the risk (Khan and Burnes, 2007; Shashank and Thomas, 2009).

1.1.1 Is risk a threat or an opportunity (positive and negative aspects)

There is considerable disagreement about the positive and negative aspect of risk. For example, some argue that risk is not solely a downside possibility of some event but can reflect positive performance as well (Arrow, 1970). This stance is mainly adopted by decision theorists (Kahneman and Tversky, 1979). They argue that decision-making is risky because the possibility of different outcomes (could be positive or negative) has different probabilities. They consider risk to be an uncontrollable phenomenon that can result not only in negative outcomes but also could lead to positive performance as well (Miller, 1991).

Table 1-1: Selected definitions of risk from general risk literature

#	Reference	Risk definitions
1	Chiles and Mackin, (1996)	Possibility of loss
2	Yates and Stone, (1992)	The risk is an inherently subjective construct deals with the possibility of loss
3	Kaplan and Garrick, (1981)	Risk is a triplet which is mathematically written as (Si, Li, Xi), where s= scenario(what can happen); L= likelihood of scenario; X= consequences
4	Moore, (1983)	When terms like high risk or low risk are used, the meaning commonly depends on the starting asset base and the consequences that the occurrence of risk would have for the asset base of the individual or organization concerned
5	Royal Society, (1992)	A combination of probability, or frequency, of occurrence of defined hazard and its magnitude
6	Miller, (1991)	Variance in outcome and performance that cannot be predicted prior to outcome
7	Mitchell, (1999)	Expectation of loss which is determined subjectively
8	Markowitz, (1952)	In financial setting, "Yield" and "Risk" frequently used as variance of return
9	Rowe, (1980)	Potential for negative outcome
10	Simon et al. (1997)	Likelihood of uncertain event that would have an adverse effect on project's success
11	US Department of Defence DOD, (2006)	Measure of future uncertainties in achieving program performance goals and objectives within defined cost, schedule and performance constraints
12	Project Management Institute PMI, (2008)	Uncertain event or condition that if it occurs has effect on at least one project objective

In contrast, business and managerial literature emphasize only the negative aspect of risk and the deterioration of the project's performance (Lowrance, 1980; Rowe, 1980; Simon et al., 1997). Such perception is obvious as it is the negative side of the risk which worries management (Khan and Burnes, 2007). Following the same direction, this paper also advocates the negative aspect of risk due to two reasons. First, negative view of risk truly reflects the business reality and emphasizes the need for proper risk management. Second, this research falls under the realms of business, and managerial research and majority of researchers in these realms favour the downside/negative aspect of risk only (For example as illustrated later in Table 1-2).

1.1.2 Risk and uncertainty

Another important debate talks about whether risk and uncertainty are the same. The word uncertainty and risk are sometimes used interchangeably in the literature (Shashank and Thomas, 2009).

Table 1-2: Selected definitions of risks from NPD literature

No.	**Reference**	**Definition**
1	Browning et al. (2002)	"uncertainty that a product design will satisfy technical requirements and the consequences thereof" (p.445).
2	International Council on Systems Engineering (INCOSE) Haskin, (2010)	"events that if they occur can influence the ability of project team to achieve project objectives and jeopardize the successful completeness of the projects" (Haskin, 2010, p.218)
3	Keizer et al., (2002; 2005) and Keizer and Halman, (2007; 2009)	The risk is a "triplet" which is the integration of outcome uncertainty, the level of control and perceived impact on the desired product performance.
4	Meyer et al. (2001)	"uncertain factors, positive or negative that can significantly affect achievable performance" (p.61)
5	Mu et al. (2009)	Risk refers to any possibility that a new product development fails due to technological, organizational and market uncertainty.
6	Raz et al. (2002)	"The undesired event that may cause delays, excessive spending, unsatisfactory project results, safety or environmental hazards and even total failure of the product".(p.)
7	Unger and Eppinger, (2009)	"exposure to danger or loss"(p.21)

Although both risk and uncertainty closely tie with each other, some researchers believe that they are not the same (Khan and Burnes, 2007). For example, they argue that uncertainty can be a driver for both risk and opportunity. Uncertainty may lead to risky situations which compromise performance or lead to some opportunity that influences the performance positively. Further, they suggest that risk is measurable by a probability function whereas uncertainty cannot (Shashank and Thomas, 2009). In contrast, other researchers regard both risk and uncertainty as the same (Yates and Stones, 1992). For example, researchers believe that the outcome of a risk has to be uncertain and that if the risk is measurable or quantifiable, then the event is no longer considered risky (Yates and Stones, 1992). Still, others argue that risk is the function of uncertainty and loss i.e. risk is always uncertain and brings loss (Kaplan and Garrick, 1981). In conclusion, the debate on risk and uncertainty is an important one, where different viewpoints clearly exist. This paper takes the view that while uncertainty may not be measurable; the risk is both measurable and manageable.

1.1.3 Is risk an objective or subjective phenomenon?

Another key debate in the general risk literature concerns the subjective or objective nature of risk. Few consider the risk to be context dependent (Mitchell, 1999; Moore, 1983; Yates and Stone, 1992) and argue that risk has different meanings to different people in different contexts. In contrast, the findings of the Royal Society, (1992) illustrate that the majority of engineers and scientists perceive risk as an objective phenomenon i.e. quantifiable and manageable. Overall, literature is fragmented on the nature of risk from technico - scientific view (viewing risks objectively) to social constructionist view (viewing risks subjectively) (Mitchell, 1999). From the above discussion, one can say that the debate of subjective and objective nature of risk may have significant implications on how new product development (NPD) project management perceives different NPD projects risks?

In summary, the study and applications of risk have a long antecedence. In term of organizations, it tends to be associated with avoiding loss rather than seeking advantage. Further, the literature on risk and its management is well developed (Khan and Burnes, 2007); there is much disagreement as to whether it is a subjective or objective process or a combination of both. The next section will address risk in relation to the NPD. This is an area where the issue of risk has only relatively recently been addressed (last 15 years) and where the understanding of various risk types associated with NPD project appears to be underdeveloped (Khan and Burnes, 2007).

1.2 Risk in NPD projects

1.2.1 Defining NPD

NPD is defined as the "set of activities beginning with the perception of the market opportunity and ending in the production, sale, and delivery of a product" (Ulrich and Eppinger, 2012, p.2). It involves a full spectrum of activities including marketing, design, manufacturing, project management and supply chain management (Browning et al., 2002). The literature also defines the NPD process as a "sequence of steps or activities which an enterprise employs to conceive, design, and commercialize a product" (Ulrich and Eppinger, 2012, p.14). While there is no clear distinction between the terms NPD and NPD process, researchers often tend to associate the term "NPD process" with certain frameworks and procedures which firms employ to develop products e.g. the traditional Waterfall and Spiral development (Bassler et al., 2011). To avoid any confusion of different terms such as NPD, NPD processes or frameworks, this research uses the term "NPD project" to refer to the execution of NPD efforts in an organized manner beginning with concept planning to production and sale of a product. The term NPD project is used in many studies and particularly mentioned in empirical studies as a unit of analysis (Kim and Vonortas, 2014; Mu et al., 2009; Oehmen et al., 2014).

1.2.2 Defining risk in NPD project

The NPD literature suggests various definitions of risks (Table 1-2). For example, Meyer et al. (2001) define NPD project risk as “uncertain factors, positive or negative that can significantly affect achievable performance" (p.61). Browning et al. (2002) adopt a narrow scope in defining NPD project risk as “the uncertainty that a product design will satisfy technical requirements and the consequences thereof” (p.445). Mu et al. (2009) relate risk to technology, market and organizational aspects of a firm and define it as" any possibility that a new product development fails due to technological, organizational and market uncertainties" (p. 170).

In addition to these, various definitions from general risk literature are applicable to NPD projects and have been used by researchers. For example, ISO 31000 standards on risk management (ISO, 2009) is a generic framework proposed by experts. It defines risk as the effect of uncertainty on objectives. Due to its generic nature, it is independent of any specific application and is applicable at both the functional and strategic levels of a firm. The process steps of ISO 31000 have been empirically investigated in US defense and aviation sectors (Oehmen et al., 2014; Oehmen et al., 2010). Similarly, the Project Management Institute (PMI) outlines risk as an “uncertain event or condition that, if it occurs, has an effect on at least one project objective” (PMI, 2008, p.275). The focus of PMI is mainly on project management risks such as cost and schedule. However, it also considers external and technical related risks. The applications of PMI have also been used in the NPD literature particularly in software development projects (Raz et al., 2002; Wallace et al., 2004). In the context of the defence related products and systems, the US Department of Defence (DOD) published established and standard risk management framework (DOD, 2006). According to this framework, the risk refers to uncertainties in achieving performance within cost, schedule and performance constraints. In its scope, DOD risk management framework considers the risks associated with requirement stability, technical baseline planning, execution of process, environmental influences and project management related implications.

1.2.3 The recognition of general risk debates by NPD risk theory

The debates from general risk literature (section 1.1) may also have considerable implications on NPD project risks. The first debate talks about the positive and negative aspects of risk. Although, authors such as Meyer et al. (2001) conceptualize the risk construct both from positive and negative aspect: for example authors defined risk as " uncertain factors, positive or negative that can significantly affect achievable performance" (p.61), others defined the risk construct mainly from the perspective only. For example, Browning et al. (2002) defined risk as "uncertainty that a product design will satisfy technical requirements and the consequences thereof" (p.445). Similarly, Mu et al. (2009) defined the risk from technical, marketing and organizational perspectives as to "any possibility that a new product development fails due to technological, organizational and market uncertainty". Also,
Raz et al. (2002) defined the risk from negative perspective only as "the undesired event that may cause delays, excessive spending, unsatisfactory project results, safety or environmental hazards and even total failure of the product" (p.101). Furthermore, no attempt has been made which could explore the implication of positive and negative side of risk construct in NPD theory. In conclusion, this area is largely under-explored in NPD literature.

The NPD literature does not also recognize the debate of difference between risk and uncertainty, and often both terms risk and uncertainty have been used interchangeably by the researchers. For example, Browning et al. 2002 and Meyer et al. (2001) have used the word "uncertainty" in their risk conceptualization. Such a debate need to be investigated both conceptually and empirically in order to gain an in-depth insight of construct. i. e.
Finally, the NPD literature does not seem to distinguish between subjective and objective nature of risk. This was evident from the definition of the risk from researchers such as Kiezer and Halman, (2009) who used the word perception or perceived in their definition of risk. Words such as "perception" or "perceived" might indicate the subjective nature of risk definition (Keizer et al., 2002; Keizer et al., 2007; Keizer and Halman, 2009). Perceived risk is a manager's subjective assessment regarding the probability of loss due to a decision or an action (Lee and Johnson, 2010. Thus, risk may not arise when a firm does not perceive so. Within NPD literature, the majority of researchers adopt a more objective stance in defining risk i.e. they relate the notion of probability with definition (Han and Huang, 2007; Huang and Han, 2008; Wallace et al., 2004).

From the above, once can conclude that the common debates in the general risk literature are still not recognized to a great extent in the NPD theory and researchers do not pay attention in distinguishing the key constructs. These debates provide interesting research opportunity as it is imperative to understand what are the different implication of such a difference and to what extent it can influence the research of risk in NPD context.

1.3 Research background and rationale

NPD is a key aspect of innovation and is one of the most important strategic and operational tools an organization can use to sustain growth and profitability (Kok and Lightart, 2014). Firms increasingly develop new products to respond to environmental change, develop competitive advantages, and increase their chances of survival (Kok and Lightart, 2014). Environmental changes require firms to develop not just incremental products, but also radical and really new products that they can commercialize (Kok and Lightart, 2014; O'Connor et al., 2008). Radical NPD requires new knowledge based on new competencies and practices, whereas incremental NPD builds on existing competencies and practices (Christensen, 1997; O'Connor et al., 2008).

There are several significant incentives for firms to continuously introduce new products (increment or radical) to the markets. First, the financial payoff from successful new product introductions can help many firms overcome the slowing growth and profitability of existing products that are approaching the maturity stages of their life cycles (Ahmad et al., 2013). For example, according to a study by the Marketing Science Institute (USA), 25% of successful firms' current sales were derived from new products introduced in the last three years (Dahan and Hauser, 2002). Second, the image and reputation of the firm and its brands are heavily influenced by the number of successful products in its portfolio (Dahan and Hauser, 2002). For example, Nike has enhanced its overall brand reputation, well beyond athletic footwear by introducing golf equipment and supplies, swimwear, soccer equipment and apparel (Dahan and Hauser, 2002). Third, NPD can be a potential source of significant economies of scale for the firm (Beverland et al., 2016). New products may be able to use many of the same raw material inputs as the firm's existing products and may be able to be sold by the firm's existing sales force resulting in substantially lower unit costs (and in turn higher margins) for the firm.

A critical factor for successful NPD projects is the incorporation of the optimal set of specifications (reflecting the correct customers' needs and demands) into the final product (Ulrich and Eppinger, 2012). The formulation of an optimal set of product specifications, however, is increasingly complex as it requires assimilation of knowledge and skills both from inside and outside the organization (Ahmadi and Wang, 1999). The complexities associated with the NPD process stemming from both inside and outside the firms make the NPD process a risky endeavour (Oehmen et al., 2010a). Yet, many firms assume that their entire portfolio of NPD projects will succeed and do not identify and analyse any of the associated risks (Raz et al., 2002). This attitude by firms often leads to the failure of their respective NPD projects. There is considerable evidence that NPD projects suffer from risks and are prone to serious cost and schedule overrun, and poor technical performance of the product. Four case studies reported in the literature are following.

- The world's largest smartphone manufacturer Samsung launched its most advanced new product (Galaxy Note 7). Within a month of its release, Samsung announced the massive recall of the entire product (approximately 2.5 million units) after various reports (around 96 cases) of product explosions. Later on, the company had to cease production and shipment of the Galaxy Note 7 entirely. The initial reports both by the firm and investigative authorities indicated an error in the design of the product. Sudden pressure increases on plates within the battery cells brought negative and positive poles into contact, triggering excessive heat and therefore causing the battery to explode. According to the reports, the company estimated the initial recall alone resulted in losses of more than $10 billion. Among other cited reasons, it was reported that the firm might have accelerated the product development process by compromising the quality assurance process and pushing suppliers to meet tighter deadlines while competing with Apple (its rival). This was evident from the firm's press release which stated that the firm would "focus on enhancing product safety for consumers by making significant changes in quality assurance processes." (Tuttle, 2016)
- According to the research conducted by McKinsey and the BT center for major program management at the University of Oxford (2012), 66% of 5400 software development projects had a cost overrun totaling $66 billion. One-third of the projects

faced schedule delays, and 20% of them failed to develop the product according to the specifications (Kayser, 2016).

- The world's largest airplane manufacturer Boeing faced major delays and cost overrun initially and later had to ground their innovative product 787 Dreamliner. According to various research findings such as by Tang et al, (2009) and Denning, (2013), the underlying reasons for these issues were the firm's failure in managing supplier, operational, human resource and technological risks.
- The UK leading clothing retailer Marks and Spencer faced increasing difficulties and haphazard procurements several years ago and the company failed to maintain its profitability and customers retention. Key factors cited by researchers were poor management of suppliers and technology related risks (Khan et al., 2008).

These illustrative case studies indicate that unsuccessful NPD projects are not uncommon and occur regularly. This was evident from statistics published by an insurance monitoring agency which stated that the last two years (2015 and 2016) were associated with one of the largest and most publicized product recalls in history ever (Steve, 2016). The failure of NPD project does not only have financial consequences, but it could severely damage the company's market position as well as its survival (Wallace et al., 2004). Consequently, a primary area of concern among academics and practitioners is how to minimize these NPD project failures given the high ratio of NPD project failures and their associated costs (Raz et al., 2002; Wallace et al. 2004).

According to the literature, risk management is one of the mechanisms that can minimize the NPD failures (Mu et al., 2009; Oehmen et al., 2014). During an NPD project, risk management identifies, evaluates and controls the risk factors associated with NPD project both to avoid and to mitigate their potential negative effects on the NPD project (Meyer et al. 2001). According to the various empirical studies in the NPD context, risk management does not only target specific risk factors and mitigates them but significantly contributes to the probability of project success (Kim and Vonortas, 2014; Mu et al. 2009). Furthermore, it is widely believed that many NPD project failures could have been avoided if proper risk identification and resolution had been undertaken (Han and Huang, 2007). Advocates of risk management are also of the view that the main reason behind the failure of NPD projects was the faulty perceptions of NPD project risks by the management (Wallace et al., 2004). With an inaccurate and an incomplete view of NPD project risks, it is highly likely that management efforts will be misdirected and they will make risky decisions (Wallace et al., 2004). Therefore, formal risk identification and evaluation can help management make more informed decisions and improve project performance (Wallace et al., 2004). Risk identification and assessment involve identifying and prioritizing those risk factors that are likely to impact NPD projects negatively (Khan et al., 2008). It is obvious that risk mitigation or risk control cannot be done until risks are identified and assessed properly. Therefore, risk identification is significantly important during NPD projects (Wallace et al., 2004).

A review of NPD literature suggests that there is no clear consensus among researchers and practitioners about what constitute an NPD project risk and how best it can be conceptualized. There were several articles in the NPD literature that address risks associated with NPD projects. Some of the articles from academic literature emphasize the role of risk in NPD projects e.g. Keizer and Halman, (2009); Loch et al. (2008), Wallace et al., (2004), Thamhain and Skelton, (2007) and the Sicotte and Bourgault, (2008). Some explicitly identified risk factors, such as Tang et al. (2009) and Denning, (2013), who both identified sources of delays and failures of Boeing 787 Dreamliner NPD project. The majority of other articles, however, do not directly address the topic of risk and do not provide extensive references regarding possible NPD project risk factors. Instead, these articles deal only with the discussion and analysis of the risk management strategies that can be used to address different NPD project risks (Mu et al., 2009; Kim and Vonortas, 2014). Other studies have analyzed the relationship of risks with different contingency factors such as risks associated due to the board of directors (Wu and Wu, 2014), risk and performance (Jun, 2011; Mu et al., 2009) and risks in SMEs (Millward and Lewis, 2005; Owens, 2007). A summary of these risk factors can be seen in Table 1-3. It is evident from the table that there has been little agreement regarding the dimensions or components of NPD project risk in most cases. Among these few risks where there is consensus, technological, marketing and organizational risks are prominent (Keizer et al., 2002; Mu et al., 2009; Smith, 1999). A possible explanation of their frequent appearance in the NPD literature is the fact that technology, market, and organizations are the three most essential components of any NPD process (Mu et al., 2009) and due to which firms pay more attention in diagnosing the risks pertinent to these components. However, the success of an NPD project is not only determined by managing these risks; there are several other internal and external risk factors which can be influential on the NPD process as well (Keizer et al., 2002; Kim and Vonortas, 2014). Unfortunately, these risk factors are not widely acknowledged in the literature e.g. operations risk, finance risk, environmental risk. Furthermore, most of the researchers provided lists of risk factors either based on their personal experiences with NPD projects (Meyer et al. 2001; Tang et al. 2009 and Denning, 2013) or their proposed risk factors are not supported by the literature thereby limiting its applicability to a wide variety of NPD projects. For example, Keizer and Halman, (2009)'s list of risk factors is entirely based on case studies in FMCG company. Moreover, these authors made no attempt to reconcile their findings with the NPD literature. Furthermore, the age of the studies (e.g. studies by Wallace et al., 2004; Schmidt et al., 2001) on which the list of risk factors was based is another significant issue). Due to the dynamism of the organizational environment, the organizational setting is constantly changing, and there may be corresponding changes in the risk factors that should be included in a risk. Finally, the existing risk classifications do not provide any rigorous and structured conceptualization of NPD project risks, i.e. these risk definitions are lacking a clear definition and conceptualization. It is unclear what the components/sub-dimensions of these risks are, and what their mutual interactions with each other might be. As a result, the literature does not offer a comprehensive framework of these risks.

Table 1-3: Risk classifications

Authors	Risk Types
Abetti and Stuart, (1988)	Market, functional and technology risks
Hottenstein and Dean Jr, (1992)	Market, strategy, technology and organization
Halman and Keizer, (1994)	Technological, organizational and commercial risks
Coppendale, (1995)	External risk, project management risk, marketing risk, commercial risk, manufacturing risk, technical risk
Hise and Groth, (1995)	Market risks, competition, technology, political and social risks.
Polk et al., (1996)	Technological risk
Lynn and Akgun, (1998)	Technical and market uncertainty
Smith, (1999)	Technical risk and market risks
Meyer et al., (2001)	Project uncertainties variation, foreseen uncertainty, unforeseen uncertainty, chaos
Browning et al., (2002)	Technical performance risk
MacCormack and Verganti, (2003)	Platform uncertainty and market uncertainty
Millward and Lewis, (2005)	Lack of design capability in top management, ignorance of strategic decisions, failure in understanding importance of design
Ogawa and Piller,(2006)	Market risks
Katsanis and Pitta, (2006)	Market risks and technology risks
Goodman et al. (2007)	Technology risks, platform integration risk and increased business risk, triplet constraints i.e. schedule, scope and requirements
Thamhain, and Skelton, (2007)	Changing project requirement, changing market or customer needs, technical difficulties, technology changes, lost or changing team members, changing organizational priorities, conflict, changing management commitment, environmental quality problem, new regulatory requirement, changing contractor relations, intellectual property disputes, changing social economics conditions
Huang and Han, (2008)	User risk, requirement risk, project complexity risk, planning and control risk, team risk and organizational environmental risks.
Sicotte and Bourgault, (2008)	Fuzziness, market uncertainty, technical uncertainty, complexity
Segismundo and Miguel, (2008)	Technical risks
Szwejczewski et al., (2008)	Commercial risks and technical risks
Tang et al., (2009)	Technology risk, supply risk, process risk, management risk, labor risk, demand risk
Unger and Eppinger, (2009)	Technical, market, schedule and finance risks
Mu et al., (2009)	Technological risk, organizational risk, marketing risk
Lin and Zhou, (2010)	Internal risks (research and development (R&D) risk, production risk, planning risk
Lee and Johnson, (2010)	Performance risks, relational risks and knowledge appropriate risks
Denning, (2013)	The coordination risk, the innovation risk, the outsourcing risk, risk of tiered outsourcing, risk of partially implementing Toyota NPD model, the offshoring risk, risk of communication by computer, the labor relations risk, project management skills risk, risk of disengaged C-suite
Köhler and Som, (2014)	Environment, health & safety and sustainability (EHS/s) related risks
Kim and Vonortas, (2014)	Technology, market, finance, and operational risk
Stevens, (2014)	Uncertainty, equivocality, and complexity
Ilevbare et al., (2014)	Environmental uncertainty and risk, decision uncertainty

1.4 Positioning of study, research objectives, and research questions

Lacking a framework of NPD project risk is a major omission in the literature because, without a clear overview of risks, management may fail to devise an effective risk management strategy (Wallace et al., 2004). Thus, there is a need for an overarching taxonomy of NPD project risks. Based on this, the objectives of this dissertation will be then:

I. Deploying a systematic literature review methodology to identify relevant studies
II. Developing inductively from these studies, a taxonomy of main risk types, each with a number of sub-categories, providing definitions and supporting evidence for each
III. Empirically validating the proposed taxonomy of risks

The first two objectives are answered through an extensive literature review from where a taxonomy of main risk types is inductively developed. The last research objective refers to the empirical validation of proposed taxonomy which is further translated into following precise research questions.

Research question 1: What risks do managers of NPD projects perceive?

Research question 1 is divided into two sub-questions in terms of probability and impact of risk. An explanation for translating the question in the form of both probability and impact is to gain a clear understanding of the risk construct. According to the risk literature, there are several attributes of risk (which describe and explain risk). These include the probability, impact, variability, controllability and urgency. Readers are referred to Hopkinson et al. (2008) for detailed discussion. Probability refers to the likelihood that a risk will occur and impact is the potential consequences should a risk occur. Variability refers to the uncertainty of outcome. However, not all these attributes of risks are necessarily relevant for risk prioritization in all particular situation or context (Hopkinson et al., 2008). For the purpose of this research, I am considering the two most common attributes which are the probability of occurrence of risk and the potential negative impact of risk. This is for two reasons. First, the term risk is often defined and conceptualized in terms of probability and impact (Table 1-1). Second, key risk management frameworks such as Software Risk Evaluation (SRE), Software Engineering Risk Management (SERM) and US Department of Defence (DOD) risk management frameworks have assessed the construct of risk by calculating its probability and impact. It is, therefore, important to explore the phenomenon of risk in accordance with these two attributes (Hopkinson et al., 2008). Therefore, both of these attributes need to be reflected in the proposed research question. Based on this, research question can be broken down into two sub-research questions.

Research question 1.1: What is the probability of occurrence of different risks in NPD projects?

Research question 1.2: What is the impact of these risks on NPD projects?

Further to the initial objectives and research question 1, another follow-up research question would be to study the interaction of the NPD project risks with different contingency factors. This is imperative as NPD projects differ from each other in several characteristics such as size, duration, and product type (Raz et al., 2002). Researchers have therefore suggested that NPD practices should depend on the project's characteristics (Griffin, 1997). The same applies to NPD project risks. One cannot expect that a single universal list of risk factors would be applicable to all types of NPD projects. Just as there are different types of projects, one should expect to see different types of risks (Raz et al., 2002). For example, risks associated with radical NPD projects may differ from those risks associated with incremental NPD projects because radical and incremental products have different characteristics (O' Connor and Rice, 2013). The previous research which has compiled risk factors (Jiang and Klein 1999; 2000; Jiang et al., 2001; Keizer et al., 2002; Kim and Vonortas, 2014) did not examine the relationship between NPD project risks and project characteristics. This is a major gap in the literature as understanding the NPD project risks, and the trends or patterns they are likely to follow in different contexts allows management to find out when and how certain risk types emerge (Wallace et al., 2004). Based on this, I decided to analyze the relationship between risks and different contingency factors. Therefore the next two research objectives are:

IV. to discuss the relationship between risks and different contingency factors

V. to empirically identify how do perceptions of risks change according to different contingency factors (NPD project type, firm size, and industry sector)

The objective (IV) is answered through an extensive literature review from where a discussion will be provided which will explain the interaction between the proposed risk types and different contingency factors. The research objective (V) refers to the empirical identification of how do perceptions of risks change according to these different contingency factors. A precise research question based on these two research objectives will be as follow:

Research question 2: How do perceptions of risks change according to different contingency factors that may influence NPD project?

By answering this question, this work aims to empirically determine if the probability of occurrence and impact of different NPD project risks differ significantly according to different contingency factors.

It is a commonly argued in the literature that firms in general, do conduct risk management procedure but they do not follow any systematic procedure i.e. risk management is often conducted at ad-hoc basis by team members and mostly by a single person (Szwejczewski et al., 2005). Moreover, because, in many cases, respondents represent certain functions e.g. project management, engineering or manufacturing, marketing or could be a representative of top management, so their perceptions might represent the perspective of their functions. Schmidt et al. (2001) suggest the need for further research in this important area because ‘it is quite possible that different stakeholders will have divergent opinions regarding what the risk factors are, as well as their relative importance,' (p. 29). Surprisingly, despite this earlier call, there is little-published research which could compare different perspectives on NPD project risks. For example, there are few studies particularly in the software development context which have compared and contrasted the perceptions among software developer and software users of products (Keil et al., 2002) or conducted a cross-country comparisons of NPD project managers’ perceptions of software product (Liu et al., 2010). Because the existing research is lacking an insight about the difference of the perception of NPD project risk by different stakeholders (team members in this case), I decided to explore the phenomenon further by setting the objective as:

VI. to investigate the perceptions of different members of NPD projects team with different backgrounds and managerial roles involve in NPD project

The research objective (VI) refers to the empirical examination of how do perceptions of risks change based on the different background and managerial role. A precise research question based on the research objective will be as follow:

Table 1-4: Summary of objectives and their relations with research questions

Research objectives	Literature review-theory	Empirical study-practice
Deploying a systematic literature review methodology to identify relevant studies	**Chapter 2**	
Developing inductively from these studies, a taxonomy of main risk types, each with a number of sub-categories, providing definitions and supporting evidence for each;	**Chapter 2** What literature tells about risks associated with NPD projects	
Empirically validating the proposed taxonomy of risks		**Chapter 3, Chapter 4 and Chapter 5** What risks do managers of NPD projects perceive? -What is the probability of occurrence of different risks in NPD projects? - What is the impact of these risks on NPD projects?
To discuss the relationship between risks and different contingency factors	**Chapter 2** What literature tells about any reported differences in the profile of risks between industry sectors, firm size and project types.	
Empirically identifying how perceptions of risks change according to these different contingency factors		**Chapter 4 & Chapter 6** How do perceptions of risks change according to different contingency factors that may influence NPD project?
To investigate the perceptions of different members of NPD projects team with different backgrounds and managerial roles involve in NPD project	**Chapter 2**	**Chapter 4 and Chapter 7** How do perceptions of NPD projects' risks vary among the team members with different backgrounds and managerial roles involve in NPD project?

Research question 3: How do perceptions of NPD projects' risks vary among the team members with different backgrounds and managerial roles involve in NPD project?

Table 1-4 summarizes the list of research objectives and their relationship with research questions. This study is positioned mainly at the individual business level where the NPD process is conducted. However, because firms distribute their NPD activities globally and involve several other firms in their NPD processes, this study also looks into those risk factors that arise due to business–to–business (B2B) relationship e.g. supply chain risks.

1.5 Phenomenon of interest and unit of analysis

The phenomenon of interest for this work is a risk in NPD projects. The definitions of risk indicate that uncertainty may arise from different sources of risk and the subsequent impact of these risks on NPD objectives. Here my focus is only in identifying different sources of risk, rather than on their outcomes. Based on this, I adopt Meyer et al. (2001)'s definition of NPD risk, "an uncertain negative factor that can significantly affect achievable [NPD] performance" (Meyer et al., 2001; p.61).

The unit of analysis for this work is an NPD project which refers to the execution of NPD efforts in an organized manner beginning from concept planning to production and sale of a product. The term NPD project is used in many empirical studies as a unit of analysis, for example, Kim and Vonortas, (2014), Mu et al. (2009), Oehmen et al. (2014).

1.6 A note on success factors in NPD project and their potential implications on risk based research

The general management literature defines success factors as "those limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organization (Rochart, 1979, p.16). Through these factors, key areas that are essential for management success of particular task are made explicit (Boynton and Zmud, 1984). Success factors may also be used as guidelines or philosophies which govern management behavior. In the context of the NPD project, these success factors may drive or govern the NPD process (ISO, 2009). They may also improve the effectiveness of process by drawing the attention of management to key activities and tasks. Furthermore, besides driving the NPD process, I posit that they also establish the values and philosophy of the process.

There are few studies in the NPD literature which compiled both theoretically and empirically the list of critical success factors (Ernst, 2002; Lester, 1998; Gemundon, 2015). In contrast, more work has been conducted in identifying and compiling the failure factors for NPD projects in different context (O' Conner et al 2013; Mu et al, 2009; Keizer et al. 2009). Because they are more studies on the failure factors, I argue that these studies (failure factors) are likely to provide more insight on the risks associated to NPD projects than studies about success factors.

Furthermore, the unit of analysis for this research was “risk in a NPD project”. And this unit of analysis was used a key inclusion criteria for the selection of studies. Based on this, all those studies where unit of analysis was not NPD project risk were discarded.
Finally, this thesis, while deriving the proposed risk taxonomy, analyzed and included those risk factors into considerations where there was enough empirical support regarding their potential negative impact on NPD project was paramount and established conceptually and empirically. This was not however, the case with success factors. These success factors are mainly tested in term of their positive effect on NPD performance. No attempt has been made which would examine the negative impact of possible reverse of success factors on NPD performance. Based on the above, I argue that studies on success factors would not fit with the scope of this research.

1.7 Other possible categorization of NPD project risks (revealed vs. deterrent risk factors)

An interesting aspect of looking into risks in NPD project is to classify them into some sort of meaningful categories. Researchers often bring into attention different underlying factors and use these factors to classify risks into different categories. For example, one possible way of looking into risk factors is to classify them into endogenous and exogenous risk factors ((Trkman and McCormack, 2009). Endogenous risk, for example, refers to risk arise within the firm due to internal operational failures e.g. lacking technological capabilities and lack of resources etc. Exogenous risk, in contrast, refers to risk types which come from external environment and are usually non-controllable in nature. Examples are technological rapidity risk, macro-economic risk and changing customer demands etc. The distinction between both types of risks allows the firm to adopt different risk mitigation strategies.

Another interesting classification is proposed by D’Este et al., (2011) where researchers classify NPD project risks into revealed and deterrent risk factors. Revealed risks or barriers refer to the firm’s awareness of the difficulties involved as a result of engagement in NPD project activities. Firms in this case, try to invest in the project and may or may not fail to develop new product. In contrast, deterrent risk factors refer to a barrier that is seen by firms as being impossible to tackle and firm, as a result deterred to engage in NPD venture. Such a distinction is crucial due to the fact that it allows the management to design appropriate risk mitigation strategies. Both types of risks are likely to have different affects and likelihood of occurrences. For example, as evident from the definitions, some risk factors might deter some firms from any sort of NPD project engagement at all. And, other risk types may prevent a firm to achieve the success of NPD project or bring loads of difficulties. The proposed taxonomy, in this thesis, is a comprehensive and exhaustive risk classification and therefore addresses the risk related to revealed and deterred barriers. For example, deterrent risks are high innovation cost, availability of finance, technological rapidity etc. Revealed risk factors are operations risk and demand uncertainty etc.

1.8 Conceptual framework

The proposed taxonomy highlights six main categories of risk each with components and sub-categories (See chapter 2 for the detailed inductive process). This differs significantly from other taxonomies of risk (e.g. Hottenstein and Dean Jr., 1992; Keizer et al., 2002; Keizer and Halman, 2009; Mu et al., 2009), which identified fewer categories of risk (typically three or four) and do not provide sub-categories. The components and sub-categories of each risk type allow greater in-depth analysis of risk sources affecting NPD projects. The conceptual taxonomy linking the six risk types with the NPD project along with the potential impact of contingency factors is represented in Figure 1.1.

1.9 Research methodology and design

There is little prior work on empirically identifying NPD project risks and validating their relationship with different contingency factors such as incremental and radical NPD types, SMEs and large firms and different industry types. This research aims to fill the gap by addressing the two research questions by testing theory in the NPD context. Therefore, this research has used a cross-sectional design where data is collected from UK firms conducting NPD projects via self-administered survey by adopting a deductive research strategy (Cresswell, 2008). The empirical validation of the research objectives in UK context would increase the understanding of risk(s) associated with NPD projects in UK firms, and

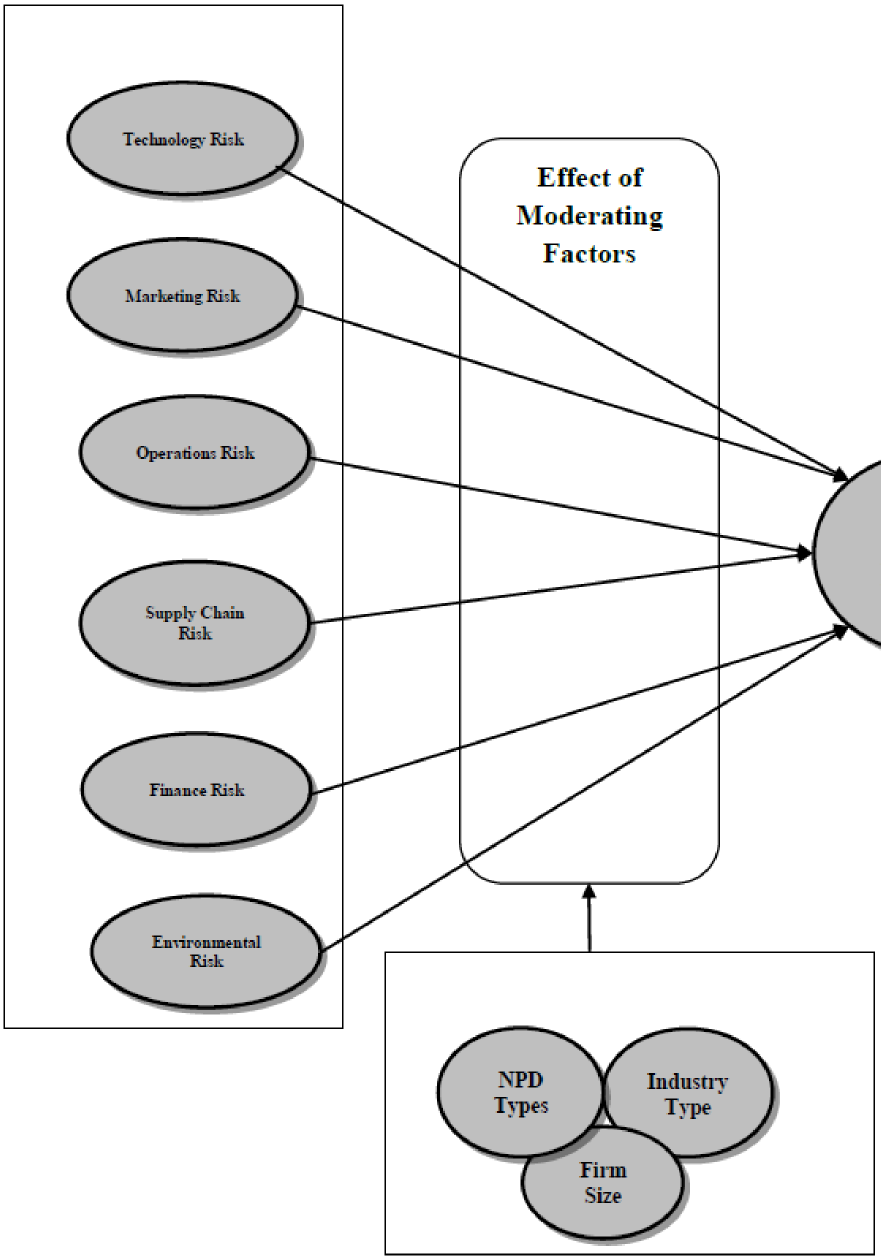

Figure 1-1: Proposed risk classification

thereby suggest ways in which risk can be better managed. A total of 263 responses are collected from the targeted population. The resulting data is analysed using analysis of variance, independent–sample t–tests, Chi-square test and binary logistic regression to test hypotheses.

1.10 Summary of research findings

The finding of research question 1 shows that the attributes of NPD project risks (likelihood of occurrence and impact) differ significantly for different risks. According to the results, technological rapidity risk, supply chain risk, lack of funding, and resource risk are the principal factors affecting NPD projects. While the likelihood of occurrence of strategic management risk, control risk, planning risk, marketing rapidity risk, marketing capability risk and human resource risks was high, they pose a low degree of impact on NPD project. Competition risk, in contrast, was perceived to have a high degree of impact with a low probability of occurrence. Finally, technological capability risk and four components of environmental risk (political risk, macroeconomic risk, social risk and natural risk) did not appear to have any profound effect on NPD project both in terms of probability and potential negative impact. The findings of this research confirm the literature for the severity and negative impact of NPD project risks. However, it is this study which provides a more objective analysis and prioritizes the list of risk factors in a meaningful way.

Research question 2 analyzes the moderating role of different contingency factors which have been rarely explored in the innovation literature. Particularly, there is limited empirical research which explores the interaction of NPD project risks with incremental and radical NPD projects. According to the findings, technological rapidity risk and competition risk are particularly associated with incremental NPD projects. In contrast, radical NPD projects are more vulnerable to technological capability risk, customer perceived risk, human resource risk, strategic management risk and social risk. These findings will enable the researchers and practitioners to pay more attention to specific risk types depending upon the type of project they are undertaking.

The second aspect of research question 2 dealt with NPD project risks and their interaction with different firm sizes. This research suggests that SMEs in general, are more vulnerable to NPD project risks than their counterpart large size firms. While SMEs are frequently exposed to technological capability risk, marketing capability risk, human resource risk, lack of resources, control risk, lack of funding risk and financial unpredictability risk, large size firms have frequently experienced strategic management, supply chain risk and political risk. Based on the findings of this study, practitioners can pay more attention to these particulars risks affecting firms of their particular size.

The third aspect of research question 2 dealt with NPD project risks and their emergence in different industry sectors. According to the findings, most of the risks are associated with NPD project across industrial sectors. However, several sectors were particularly influenced by certain risks. For example, the FMCG sector was particularly associated with competition risk and marketing rapidity risk. The sector (software development and information system) was particularly influenced by marketing capability risk and competition risk. Similarly, the electronic and computer firms are mostly vulnerable from environmental risk particularly macroeconomic risk and natural risk.

Research question 3 examines the perceptions of different team members about NPD project risks. According to the findings, respondents from technological functions emphasize on technological rapidity risk, marketing rapidity risk, lack of funding and supply chain risks. All other respondents, in contrast, assigned more importance to technological capability, marketing capability, competition, and planning risk. The comparison of the perceptions of top management and middle level or low-level management reveals several interesting results. Top management assigns more importance to the risks which are environmental in nature and fall outside the realm of firm i.e. technological rapidity risk and macroeconomic risks. In contrast, middle level or low-level management perceives operational level risk as most important such as technological and marketing capability risks, resource risk, planning, and control risks.

1.11 Summary of contributions

The main contributions of this empirical research to theory and practice are as follows. For the academics, this study provides an empirical investigation into the NPD project risk construct. Although this topic has received some attention in the innovation literature (as illustrated later), there remains a need for a classification of the NPD project risk construct that is grounded in both practice and theory. The resulting risk classification highlights the most prevalent risks to the successful development and can be used for further research into the area of NPD project risk. The existence of a validated and reliable measure of NPD project risk will enable numerous researchers to approach the study of risk from the same perspective. The resulting measure can guide future research efforts, such as enabling the identification of the risk management techniques that are most appropriate for a project's particular set of risk factors.

For the practitioners, the results of this study will provide a better understanding of the NPD project risk construct. This study will enable project managers to become aware of possible risks to the successful completion of their development projects. The development of risk taxonomy will also provide managers with a means for including regular risk assessments throughout a development project. Such a comprehensive taxonomy would enable NPD project teams to become aware of the risky aspects of a project so they could implement the appropriate controls. This study identifies the most prevalent risks to NPD development projects, thereby allowing project managers to identify project risk factors so that they may take the necessary steps to control them.

1.12 Thesis structure

The remaining thesis is structured as follows. Chapter 2 provides a systematic review that illustrates the induction process adopted to come up with the taxonomy of risks in NPD projects. It further provides the discussion that forms the basis of the hypotheses developed for this empirical study. Chapter 3 talks about the methodology employed for this research and present a detailed account of the research. Chapter 4 entails the descriptive analyses of the data. Chapter 5 provides an insight into the empirical finding regarding the research question 1. Chapter 6 presents the results of research question 2. Chapter 7 presents the results of research question 3. Chapter 8 provides a discussion on the empirical findings of this work. Chapter 9 incorporates the conclusion of this work including the contributions to theory and practice, research limitations, and further research agenda. Detailed results of the statistical analysis are presented at the end of the thesis in the appendices.

2 Literature Review and Hypotheses Development

2.1 Introduction

Chapter 2 first presents the methodology employed to systematically review the extant literature on risks in NPD projects. Next, the findings of this systematic literature review (SLR) are presented regarding the NPD project risks. Finally, the findings of the systematic reviews are discussed in relation to various contingency factors and hypotheses are developed.

2.2 Methodology of SLR

Based on the structure presented by Transparent, replicable and explicit methods were used to plan, search, screen and extract information according to a systematic literature review methodology described by Tranfield et al. (2003). The following steps were taken.

2.2.1 Planning the review

The literature on NPD provides an extensive discussion of risk management in new product development (Oehmen et al., 2014). An important aspect of risk management is the identification of risks related to NPD projects. In this regard, the existing literature offers a number of risk classifications. However, as illustrated later, existing risk classifications mainly focus on the limited set of NPD project risks and do not provide a rigorous and structured conceptualization of these risks. As a result, the literature does not offer a comprehensive framework of these risks. Considering this deficiency in the literature, I decided to explore the literature further in this aspect and chose the review question as "***what risks are associated with NPD project?***" A consultation panel that provide expert guidance in the field were selected which comprised of experts from systematic review, database searching, risk management and new product development both within and outside the Cranfield School of Management (Table 2-1)

Table 2-1: Consultation Panel

Name	Organization	Expertise
Dr. Colin Pilbeam	Cranfield School of Management	Literature review process\ subject supervisor
Professor Keith Goffin	Cranfield School of Management	Subject expert (New product development)
Dr John Towriss	Cranfield School of Management	Expert in quantitative methodology
Professor Mohammed Bendaya	American University of Sharjah, UAE	Subject expert: New product development, Risk management
Heather Woodfield	King Norton's Library, Cranfield University	Information specialist

2.2.2 Searching

Relevant studies from diverse disciplines were located by identifying keywords which represent the main constructs of the review question (Table 2-2). It is worth mentioning here that, a pilot phase was undertaken where all possible synonymous and relevant keywords related to construct "risk" were used. Among these keywords were challenges, problems, hurdles, issue, vulnerabilities and hazards obstacles. However, the use of these keywords revealed huge amount of irrelevant articles. Based on the results, all these keywords were discarded from the search strings and only those keywords were used which were deemed necessary. The left over keywords were then used in search strings (Table 2-2) and applied to major databases including ABI/Inform Global, EBSCO, Scopus and Web of Science. Additionally, references in influential studies (Keizer et al. 2002; Mu et al. 2009) were reviewed to locate relevant articles not appearing in these databases.

Table 2-2: Keywords used to identify relevant studies

Construct 1: Risk	**Construct 2: New Product**	**Construct 3: Development**
Risk*	Product*	Development
Threat*	New Product*	Introduction
Turbulence*	Project*	Design
Barrier*	System*	Innovation
Uncertaint*	Technology	
Failure*		

2.2.3 Screening

Relevant papers (representing risks to NPD only) were then selected by applying explicit inclusion and exclusion criteria (Table 2-3) to first screen title and abstract, and then full papers. The resulting 260 articles were evaluated against two quality appraisal criteria (in terms of theory robustness and research design) as adopted by Pittaway et al. (2004). In order to evaluate the robustness of theory, each of 260 articles was given a score from (0-3) as per the following dimensions:

1) Each article was given (0) if it did not provide any information about existing literature and debates, for examples Katsanis and Pitta, (2006) and Coppendale, (1995);
2) Each article was given (1) if it only provided poor awareness of existing literature and debates e.g. basic understanding of the issue around the topic being discussed (Dey et al., 2007); and
3) Each article was given (3) if it provided deep and broad knowledge of relevant literature. In particular, it referred to existing management and organizational theories (e.g. Nidumolu, 1995; Zsidisin and Smith, 2005; Mu et al., 2009).

Similar dimensions were used to evaluate the quality of research design in empirical studies. These were:

Table 2-3: Inclusion and exclusion criteria

Inclusion criteria	**Rationale**
Publication in peer-reviewed journals only	Quality of evidence base
Publications since 1970	Beginning in 1970 the field produced significant numbers of papers only after 2000
Risks in NPD projects as the main theme	The review focused on the risk associated with NPD. Exceptionally, three studies on risk management investigated NPD project risk types, and they are included (Charoo and Ali, 2013; Conrow and Shishido, 1997; Mu et al., 2009)
All types of papers	The review sought reported risks discussed in conceptual papers, empirical papers and literature reviews
Innovative firms only	The study focused on firms using their facilities for NPD projects
NPD projects as the unit of analysis	This review included only studies where the unit of analysis was an NPD project

Exclusion criteria	Rationale
Risk management but not risk	The focus of the review was a risk. So studies focused on risk management in NPD projects were excluded.
Unit of analysis other than NPD project such as success factors etc	Some studies focused on risks associated with NPD but at the supply chain or portfolio levels.
English language only	Language competence of the author
Domain of literature	Natural Sciences, Computer Sciences, and Engineering Sciences were all excluded
Conference papers	Greater quality assurance through peer review

1) Each article was given (0) if methodology and data collection methods was not described (Dey et al., 2007);
2) Each article was given (1) if it described methodology and data collection but these were flawed. i.e. missing key information regarding instruments, measures, or data sample (Han and Huang, 2007; Na et al., 2004; 2007; Sicotte and Bourgault, 2008);

   Summing the scores from the two dimensions gives a maximum possible score of 6. The minimum acceptance score was set to be 4. Total, 124 articles were included (Figure 2-1).

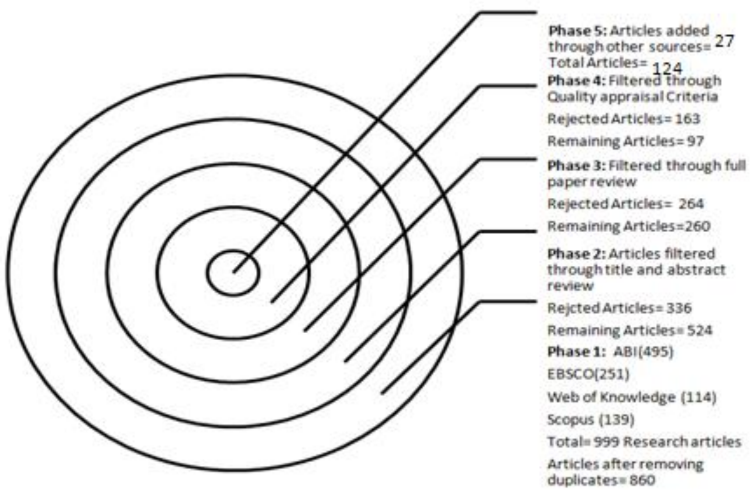

Figure 2-1: Selection process

2.2.4 Extracting and synthesizing

According to the literature, perceived risk is more than a uni-dimensional construct (Stone and Gronhaug, 1993). Specifically, in the field of NPD, it involves various facets that affect the NPD projects a firm is conducting. It is, therefore, crucial to conceptualize the risk constructs in the NPD domain and identify components relating to them. Churchill (1979) suggests that the first step in developing instruments with desirable psychometric properties is to specify the domain of the construct. The specification of the construct domain makes it clear what is included in the construct definition and what is not. In line with the above-recommended procedure, I began the journey by examining the existing literature as mentioned by Churchill (1979) that the "researcher should consult the literature when conceptualizing constructs and specify domains" (p. 67). During the review, my aim was to identify those characteristics of NPD projects that either researchers or practitioners have found to increase the riskiness of an NPD effort. For this purpose, I reviewed both academic and practitioner literature to ensure that no risk factors were overlooked and to identify as many risk factors as possible.

I identified several articles within NPD literature that address the problems associated with NPD projects. Some of the articles from academic literature emphasize the role of risk in NPD projects such as the Keizer and Halman, (2009); Loch et al. (2008); Sicotte and Bourgault, (2008); Thamhain and Skelton, (2007); Wallace et al., (2004). Similarly, Tang et al. (2009) and Denning, (2013) identified risk factors that caused delays and failures of Boeing 787 Dreamliner NPD project. The majority of other articles, however, do not directly address the topic of risk and thus do not provide extensive references regarding possible NPD project risk factors. Instead, these articles deal only with the discussion and analysis of the risk management strategies that can be used to address different NPD project risks (Mu et al., 2009; Kim and Vonortas, 2014). Other studies have analyzed the relationship of risks with different contingency factors such as risks associated due to the board of directors (Wu and Wu, 2014), risk and performance (Jun et al., 2011; Mu et al., 2009) and risks in SMEs (Owens, 2007; Millward and Lewis, 2005). A summary of risk factors was already illustrated in Table 1-3. It is further evident from the table that with few exceptions, there has been no agreement regarding the dimensions or components of NPD project risk in most cases.

Among these few risks where there was consensus, technological, marketing and organizational risks were prominent (e.g. Keizer et al., 2002; Mu et al., 2009; Smith, 1999). A possible explanation of their frequent appearance in the NPD literature is the fact that technology, market, and organizations are the three most essential components of any NPD process (Mu et al., 2009) and due to which firms pay more attention in diagnosing the risks pertinent to these components. However, the success of an NPD project, is not only determined by managing these risks, but also by managing other internal and external risk factors which can be influential on the NPD process (Keizer et al., 2002; Kim and Vonortas, 2014). And therefore, these factors need to be included in the list of risk factors.

I further noticed that most of the researchers provided lists of risk factors either based on their personal experiences with NPD projects (e.g. Denning, 2013; Meyer et al. 2001; Tang et al. 2009) or their proposed risk factors were not consolidated with the academic literature thereby limiting their applicability to a wide variety of NPD projects. For example, Keizer and Halman, (2009) list of risk factors was entirely based on case studies in a FMCG company. Moreover, the authors make no attempt to reconcile their findings with the NPD literature. Further to this, the age of the studies on which the list of risk factors was based was another issue. Due to dynamic environmental turbulence, the organizational setting is constantly changing, and there may be corresponding changes in the risk factors that should be included in NPD (Schmidt et al., 2001). Finally, the existing risk classifications do not provide any rigorous and structured conceptualization of NPD project risks i.e. these risk definitions were lacking a clear definition and conceptualization which leads towards a clear understanding of risk components/sub-dimensions and their mutual interactions with each other.

The Development of Proposed Risk Taxonomy

In order to come up with comprehensive risk taxonomy, I followed Armstrong *et al*. (2012), Pittaway and Cope (2007) and Pittaway *et al*. (2004) approach (emergent coding scheme).

Step 1

Following this approach, the relevant content (which is in this case risk types) of the 123 articles were imported into NVIVO where each article was coded using emergent coding. This approach allowed the key risk types to be emerged from the 123 articles and helped me to identify which papers would contribute to which risk types (as illustrated in Appendix 1-column 1). This step resulted in 30 pages of listed potential project risks (305 risk factors).

Step 2

The next step was to group similar risk types together in order to get a clearer conceptualization of the general types of NPD project risk factors and in order to consolidate these risk factors in to a parsimonious and unified classification. This was achieved through careful analysis of the definitions and conceptualization of extracted risk factors. What is especially noteworthy here is that I found considerable synergy between the risk factors with different labels. I noted that, even though, two risk factors are labelled differently, but the substance of these two risks was identical. In other words, same risk factors were merely been re-labelled under new titles. I sorted out commonly cited risk factors in an iterative and interpretive manner. The list of risk factors and categories were combined and modified in the light of commonly cited risk in an intuitive manner in order to come up with underlying risk factors. Several iterations were performed in order to develop these underlying risk factors in which the risk factors were as distinct as possible. This procedure resulted in the identification of 18 underlying risk factors. These risk factors are: technological rapidity and the firm’s technological capability, market rapidity, customer perceived risk, marketing capability and competition. resources, human resources, planning, control and strategic management, supply chain management risk, financial unpredictability, lack of funding risk, political risk, macro-economic risk, social risk and natural risks.

Step 3

Each of the extracted risk factors (from step 1) was then classified and labelled according to the one of underlying risk factors (see column 4 in Appendix 1). This is a common approach which has been used by several researchers in software development sector (Moore and Benbasat, 1991; Smith, 1996).

Step 4

The next step was to accumulate these 18 risk factors into more abstract risk classification. This was achieved by first analyzing the process nature of NPD project risk. NPD is a process in which ideas or technologies are materialized, managed, and finally moved to market. Technology, operations, and marketing are the three most indispensable NPD process components. Success of product innovation is determined by both external influences and internal circumstances in which these factors interact. Technology is the carrier of new ideas, organization is the delivery process for the ideas, and market is where the technology meets the customers. Consistent with previous studies (e.g., Doering and Parayre, 2000; Keizer et al., 2002), I tried to accumulate the extracted 18 risk factors into these broader 3 categories of risk i.e. technological risk, market risk and operations risk. A problem here, however was that these three factors could not capture all extracted NPD related risks. Kim and Vonortas, (2014) and Keizer et al. (2002) argued that too often risk analysis in NPD was limited to technological, organizational and marketing risk factors. And, that the success of product innovation should be determined by the combination of both external influences and internal circumstances. These authors then suggested that NPD project risks factors should be assessed from technology, marketing, operations and finance risks. I therefore, used the notion of finance risk as main dimensions of risk factor which classify financial unpredictability and lack of funding in it.

An important underlying risk factor revealed in the analysis was supply chain risk. I considered it as a separate risk factor in the proposed taxonomy in order to emphasize on its importance in term of potential negative impact on NPD project. Particularly, in the last decade, a high complex and uncertain business environment characterized by increased competition, globalization, catastrophic events such as natural disasters e.g. Tsunami in 2004, Hurricane Katrina in 2005 and an economic recession emerged (Khan et al., 2008; Manuj and Mentzer, 2008). To remain competitive, firms started re-structuring their businesses to operate on a global basis to take advantage of external expertise, skills, goods and capital (Manuj and Mentzer, 2009). Consequently, supply chain management have become a key competency, essential for the survival of firms. For example, large savings in NPD projects can be generated by ensuring supplier integration (Zsidisin and Smith, 2005). Further, by using suppliers, third party logistic' resources and skills, firms can achieve efficiency in their NPD project, and are able to reduce both operational cost and product development lead-times and gain access to supplier technological capabilities (Zsidisin and Smith, 2005). However, the complexities in modern supply chains and reliance on the competitive advantage of the supply chain as a whole may lead to an increased exposure to supply chain risk (Manuj and Mentzer, 2008; Shelanski and Klein, 1995). For example, in December 2001, Land Rover had to face a nine month disruption in completing a NPD project related to key model Discovery due to bankruptcy of a Chassis supplier (UPF-Thompson) (Sheffi and Rice, 2005). The example shows that new risks emerge from the dependency and integration of firms in the supply chain. Despite such importance, in the context of NPD project, the risk has been previously considered in isolation and was not listed in mainstream NPD project risk classifications. Therefore, in this research, I argued that as supply chain becomes integral to NPD projects, it contributes significant risks to the NPD efforts and an additional theorization of supply chain risk factors is key to achieving an understanding of NPD project risks.

Among the underlying factors extracted in step 2, I located several factors associated to external environment of the firm. For example, political risk factor, macro-economic and social risk etc. The role of the environment has received a lot of attention in both strategic management research and in organizational theory. For example, Ritchie and Marshall, (1993) argue that business and organizational risks also emerge from environmental factors. Environmental risk factors are those that affect the overall business context across industries (Ritchie and Marshall, 1993). While the magnitude of this impact across different industry sectors may be different, everyone will be affected to some extent (Kouvelis et al., 2006). The review of NPD literature suggests that environmental risk or its associated factors have not been addressed to great extent and was also not the part of existing risk classifications. These factors were mainly addressed as isolated risk factors. Therefore, based on the fact that risks associated with environmental factors may pose a significant threat to NPD projects; I argued that an additional theorization of environmental risk factors is key to achieving an understanding of NPD project risks.

Thus, in addition to four main types of risks (technology, marketing, operation and finance); I classified 18 underlying risk factors further into supply chain and environmental risks factors. The six main risk factors and associated 18 underlying risk factors are presented in figure 2-2.

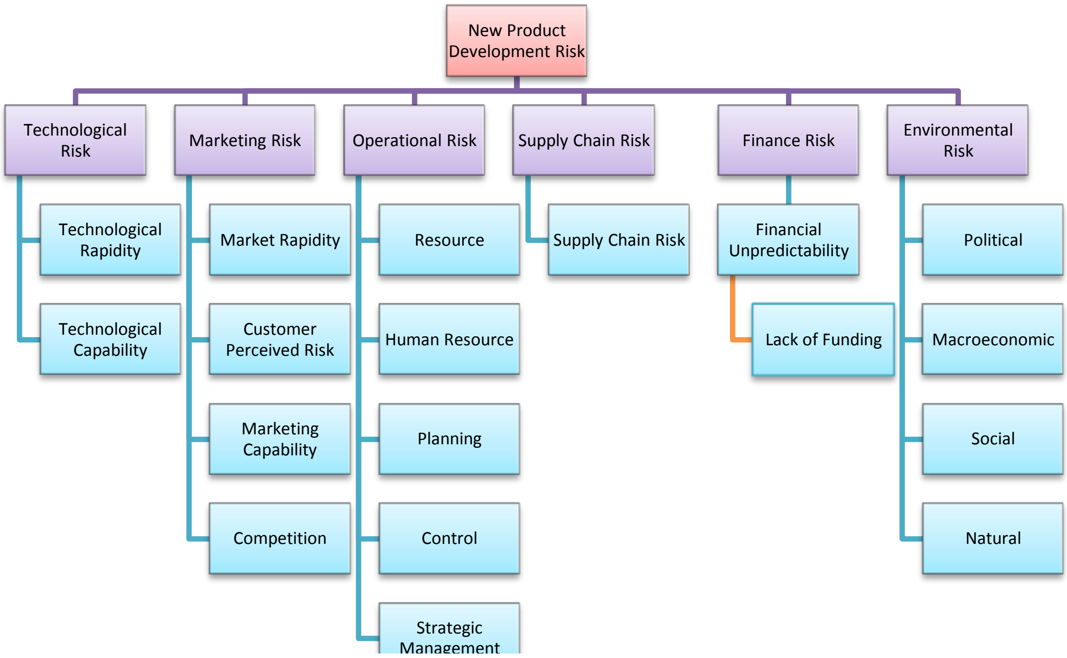

Figure 2-2 Proposed risk taxonomy

2.3 Findings

2.3.1 Technological risk

The technological risk is frequently mentioned in the literature as one factor that can negatively influence NPD projects. It refers to the firm's inability to understand fully or partially the technological environment and its different aspects (Mu et al., 2009). A recent empirical study conducted in the manufacturing sector revealed that technological problems not only escalate into larger issues, affecting the NPD project portfolio but also are difficult to manage (Martinsuo et al., 2014). For example, one NPD project manager expressed it as

"If for some reason the product design has to be changed (due to poorly designed initially) or product performance (technical performance) is not what we imagine it should be, it can jeopardize the whole product offering or parts of it. These risks are really difficult to manage" (Martinsuo et al., 2014; p. 739)

The origin of technological risk can either be within the company or from outside in the wider environment (Mu et al., 2009). The most notable internal source of technological risk is a lack of technological or research & development (R&D) capabilities (Kim and Vonortas, 2014; Khan et al., 2008; Mu et al., 2009). Externally, the technological environment in which a firm competes drives the technological risk, e.g. technology obsolescence. In line with the conceptualization of Kim and Vonortas, (2014) and Mu et al.

(2009), the two important elements which constitute technological risk are technological rapidity and the firm's technological capability.

2.3.2 Technological rapidity

Technological rapidity refers to the extent to which technology changes over time or becomes obsolete during the NPD project (Buganza et al., 2009). This is the exogenous aspect of technological risk. A firm is vulnerable to technological rapidity at any time during the NPD project, e.g. during the project execution phase or even after launching the product (Stockstrom and Herstatt, 2008). In addition to the product itself or a component of it, the NPD process can be vulnerable to technological rapidity risk too (Jerrard et al., 2008; Stevens, 2014).

Due to technological rapidity, firms become indecisive in determining what technology to adopt or invest in (Ilevbare et al., 2014). Firms also become concern whether a particular technology will work (Wu and Wu, 2014) and if it works, then how long for (Mu et al., 2009) and to what extent unexpected or novel problems may occur during the adoption of the technology (Nidumolu, 1995). For instance, in a case study of a company that developed industrial printing technologies in the USA, a brand new electronics marker for printing was vulnerable to technical risk due to the novelty and NPD team was unsure if the new design would work (Unger and Eppinger, 2011).

Technological rapidity also causes delays in NPD projects. For example, according to multiple case studies conducted in 12 manufacturing-based small to medium-sized enterprises (SMEs) in the North of England, fifty-eight percent of the respondents claimed that upon the availability of newer technology, a desire to inlcude the latest technology into the product delay the product's development. Such behaviour can also contribute to serious delays due to the lack of freezing product specification (Owens, 2007). A list of the studies which have highlighted the risk of technological rapidity in their research is provided in Table 2-4.

2.3.3 Technological capability

Technological capability reflects the firm's ability to launch a new product successfully (Browning et al., 2002; Kayis et al., 2007). Unlike technological rapidity, it is an endogenous aspect of technological risk. Firms either do not possess the technological orientation at all or insufficiently to be able to handle new technology challenges (Tang et al., 2009; Wu and Wu, 2014). A particular situation demonstrating a firm's technological incapability is a lack of the required technological experience to understand and handle the new technology (Jun et al., 2011). Firms may lack the complex knowledge and information required to understand the technological environment (Kim and Vonortas, 2014). Firms may also lack technological resources to design and develop products, for example, design tools, process flow tools and equipment (Goodman et al., 2007) and established procedures (Nidumolu, 1995). Further, firms may be unable to handle product design changes (Zsidisin and Smith, 2005). An example of poor technological capability came from the findings of multiple case studies conducted in two cutting edge technology development projects with inherited complexities in South Korea. In a project which aimed to develop endoscopic microcapsule and micro bio-medical diagnostic systems, out of 20 scientists, only 2/3 had extensive knowledge of the technologies under consideration. This lack of necessary expertise directly resulted in planning deficiencies that complicated the actual development process (Yong-Li et al., 2007).

Table 2-4: Summary of technology risk and its components (References and their counts)

Technological rapidity: Barki et al., 2001; Bstieler, 2005; Bstieler and Gross 2003; Buganza et al., 2009; Floricel and Ibanescu, 2008; Han and Huang,2007; Hise and Groth, 1995; Huang and Han, 2008; Hottenstein and Dean Jr, 1992; Ilevbare et al., 2014; Jiang et al., 2001; Jiang and Klein, 1999; 2000; Kim and Vonortas, 2014; Larson and Kusiak, 1996; Lee and Johnson, 2010; Martinsue et al., 2014; Meldrum and Millman, 1991; Mu et al., 2009; Nidumolu, 1995; O'Connor et al., 2008; O'Connor and Rice, 2013; Owens, 2007; Park, 2010; Schmidt et al., 2001; Segismundo and Miguel, 2008; Souder and Beethay, 1993; Stevens, 2014; Stockstrom and Herstatt, 2008; Thamhain and Skelton, 2007;Thangamani, 2016; Wang and Yang, 2012; Wu and Wu, 2014; Yeo and Rin, 2009	34
Technological capability: Barki et al., 2001; Brun et al., 2009; Browning et al., 2002; Buganza et al., 2009; Bstieler and Gross 2003; Chi et al., 2012; Conrow and Shishido, 1997; Coppendale, 1995; Davis, 2002; Dey et al., 2007; Freel, 2000; Gon and Choi, 2012; Goodman et al.,2007; Gosnik, 2011; Halman and Keizer, 1994; Hise and Groth, 1995; Hottenstein and Dean Jr, 1992; Jerrard et al., 2008; Jiang and Klein, 1999; Jiang and Klein, 2000; Jiang et al., 2001; Jun et al., 2001; Kayis et al., 2007; Keil et al., 1998 ; Keizer et al., 2002; Keizer et al., 2005; Keizer and Halman, 2007; Keizer and Halman, 2009; Khan et al., 2008 ; Kim and Vonortas, 2014; Kim and Wilemon, 2009; Larson and Kusiak, 1996; Lin and Zhou, 2010; Li et al., 2008; MacCormack and Verganti, 2003; Meldrum and Millman, 1991; Miller and Waller, 2003; Miorando et al., 2014; Mu et al., 2009; Nidumolu, 1995; O'Connor and Rice, 2013; Owens, 2007; Park, 2010 ; Raharjo et al., 2008; Schmidt et al., 2001; Segismundo and Miguel, 2008; Shaw et al., 2005; Smith, 1999; Song et al., 2013; Stockstrom and Herstatt, 2008; Tang et al., 2009; Thamhain and Skelton, 2007; Thangamani, (2016); Unger and Eppinger, 2009; Unger and Eppinger, 2011; Van thuyet et al 2007; Wang et al., 2010; Wang and Yang, 2012; Wu and Wu, 2014; Wu et al., 2010; Yeo and Ren, 2009; Yong li 2007; Zhang and Doll, 2011; Zsidisin and Smith, 2005	64

Another situation demonstrating poor technological capability is the inaccuracy in defining product design, and the false assumptions about product requirements (MacCormack and Verganti, 2003). According to an extensive case study of NPD projects in a large manufacturing company in Sweden, false assumptions concerning the technical functionality and decisions made during the pre-development work and the first phase of the industrialization project caused the design engineers to go back and redo some of the activities executed in pre-development. Consequently, the company suffered significant delays and inefficiency in product development efforts (Munthe et al., 2014).

Further, firms fail to pay attention to details of product specifications during the design phase which eventually results in poor quality products (Owens, 2007; Unger and Eppinger, 2009). This was evident from case studies of United Technology Corporation, a large manufacturing company which stated that the risk which concerned management most was technical risk (Unger and Eppinger, 2009). A list of the studies which have highlighted the risk of technological capability in their research is provided in Table 2-4.

2.3.4 Marketing risk

Marketing risk reflects ambiguities about customer requirements that can be satisfied by a particular product (Steven,2014; Mu et al., 2009). It also refers to uncertainties about competitor's actions and behaviours (Kim and Vonartas, 2014). Various empirical studies show the severity of marketing risks in NPD projects. For example, in the UK manufacturing sector, a product manager in a high tech electronic components manufacturing company shared his view about marketing risk as

"You can get technical risk under control if you invest time and money to deal with, but the market you can never be certain of" (Szwejczewski et al., 2005; p. 1592).

Marketing risk is mainly due to external factors such as changing requirements or competition and is therefore considered to be less controllable and predictable (Kima nd Vonortas, 2014;Mu et al., 2009). However, some marketing risk can originate from within the firm, e.g. a firm' s poor marketing capability (Unger and Eppinger, 2009). Therefore, in accordance with the existing literature, the sources of marketing risk can best be described in terms of four main aspects: market rapidity, customer perceived risk, marketing capability and competition.

2.3.4.1 Market rapidity

Market rapidity refers to the extent to which customer requirements change over time (Buganza et al., 2009). It is an exogenous aspect of marketing risk. A firm is vulnerable to market rapidity at any time during the NPD project (Kayis et al., 2007), e.g. the sudden emergence of new customer requirements during the project execution phase (Dey et al., 2007; Thamhain and Skelton, 2007). The significance of market rapidity is evident from the empirical data collected from 35 projects of 17 multinational companies belonging to the Fortune 1000 category in USA which revealed that 76% of respondents cited market rapidity as one of the major risk factors for NPD projects (Thamhain, 2013).

Due to market rapidity, firms face difficulties in integrating overall customer requirements (Nidumolu, 1995; 1996). For example, Kim and Wilemon, (2009) interviewed 32 project team members about their experiences with NPD related issues in 8 American technological companies. One project team member considering marketing rapidity noted that as *"changing marketing requirements is number one. And we were not able to solve that specific complexity. We just had to live with it. Marketing requirements always change so we have to adapt to them. So we end up having to meet the new marketing requirements"* (Kim and Wilemon, 2009; p.553).

A list of the studies which have highlighted the risk of marketing rapidity in their research is provided in Table 2-5.

2.3.4.2 Customer perceived risk

This reflects customer reactions such as fear, doubt and uncertainty concerning the intended objectives of the product (Khan et al., 2008). More explicitly, it refers to customers doubts about whether the new product will meet their satisfaction or whether there may be a safety issue with the use of the product. The sources of customer perceived risk appeared to be both exogenous and endogenous.

The exogenous factor can be, for example, high levels of customer satisfaction with existing products (Huang and Han, 2008) creating a reluctance to show any commitment to the new product. Further, a new product may require education/ expertise or abnormal changes in consumer habits (Song et al., 2013; Hise and Groth, 1995), which decrease probable customer satisfaction and increase customer perceived risk. Consequently, customers become hesitant to accept the product. This was evident from the example of BlackBerry which launched the Playbook with new hardware and new operating system. However, due to high price tag and availability of rival products such as Nokia Lumia, it failed to receive a warm reception by customers which led to massive price cuts and a huge loss for BlackBerry (Martin, 2013).

Endogenous factors can be related to the poor performance of the firm which results in adverse publicity of the product. Customers then change their commitment towards the product (Tang et al., 2009). Other internal factors which increase customer perceived risks are the fall of the product quality level below general accepted values, failure of the product to satisfy customer needs or customers experiencing problems while using the products (Mu et al., 2009; Raharjo et al., 2008). For example, after facing various issues that resulted in a series of delays, some customers lost their confidence in Boeing's aircraft development capability. Customers were also concerned about the fact that the first 787s were overweight by about 8%, or 2.2 metric tons, which could lead to a 15% reduction in range. As a result, some customers cancelled their orders for the Dreamliner 787 and a few migrated towards leasing contracts instead of purchasing the airplane outright (Tang et al., 2009). A list of the studies which have highlighted the customer perceived risk in their research is provided in Table 2-5.

2.3.4.3 Marketing capability

Failing to anticipate the exact customer requirements (Ogawa and Piller, 2006), to identify target customers (Ilevbare et al., 2014), to understand their demands for different product types (Zhang and Doll, 2001) and failing to aggregate this demand with the appropriate product characteristics to be incorporated in the product describes poor marketing capability of a firm (Davis, 2002; Zhang and Doll, 2001). Unlike other sources of marketing risk, it is an endogenous aspect. Particular situations demonstrating poor marketing capability of a firm are the lack of marketing expertise (Nidumolu, 1995; 1996), ineffectiveness of the team members in judging the customer requirements (Smith, 1999) which can be due to the diverging interpretations about market by different team members (Steven, 2014) and the inefficiency of marketing advertisement (Keizer and Halman, 2009). Improper marketing is also cited as the major source of NPD project failure (Hartley, 2006). For example, according to multiple case studies conducted in 12 manufacturing-based small to medium-sized enterprises (SMEs) NPD projects in the North of England, seventy-one percent of the respondents highlighted that the NPD process was delayed due to poor understanding of customer requirements by firms (Owens, 2007). A list of the studies which have highlighted the risk of marketing capability in their research is provided in Table 2-5.

2.3.4.4 Competition

Marketing risk due to competition reflects a firm’s inability to understand the current or future changes in the competitive market (Kim and Vonartas, 2014) and the potential for harm due to competitor actions (Souder and Bethay, 1993). More explicitly, it is associated

Table 2-5: Summary of marketing risk

Market rapidity : Bstieler, 2005; Bstieler and Gross 2003; Buganza et al., 2009; Chi et al., 2012; Conrow and Shishido, 1997; Dey et al., 2007; Gon and Choi, 2012; Han and Huang, 2007; Hise and Groth, 1995 ; Hottenstein and Dean Jr, 1992; Huang and Han, 2008; Ilevbare, 2014; Jerrard et al., 2008; Kayis et al., 2007; Kim and Vonartas, 2014; Kim and Wilemon, 2009; MacCormack and Verganti, 2003;Martinsue et al., 014; Miorando et al., 2014; Mu et al., 2009; Nidumolu, 1995; Nidumolu, 1996; Owens, 2007; Park, 2010; Schmidt et al., 2001; Souder and Bethay, 1993; Thamhain and Skelton, 2007; Wang and Yang, 2012	28
Customer perceived risk: Dey et al., 2007; Han and Huang, 2007; Hise and Groth, 1995; Huang and Han, 2008; Jerrad et al., 2008; Jiang and Klein, 1999; Jiang and Klein, 2000; Jiang et al., 2001; Jun et al., 2011; Keil, 1998; Keizer et al., 2002; Keizer et al., 2005; Keizer and Halman, 2007; Keizer and Halman, 2009; Khan et al., 2008; Larson and Kusiak, 1996; MacCormack and Verganti, 2003; Mu et al., 2009; Raharjo et al., 2008; Song et al., 2013; Steven, 2014; Tang et al., 2009	23
Market unpredictability: Brun et al., 2009; Bstieler and Gross, 2003; Buganza et al., 2009; Chi et al., 2012; Coppendale, 1995; Davis, 2002; Goodman et al.,2007; Han and Huang, 2007; Hise and Groth, 1995; Huang and Han, 2008; Huchzermeier and Loch, 2001; Ilevbare et al., 2014; Keil, 1998; Keizer et al., 2002; Keizer et al., 2005; Keizer and Halman, 2007; Keizer and Halman, 2009; Khan et al., 2008; Kim and Vonortas, 2014; Kim and Wilemon, 2009; Larson and Kusiak, 1996; Martinsuo et al., 2014; Miller and Waller, 2003; Mu et al., 2009; Nidumolu, 1995; Nidumolu, 1996; O'Connor and Rice, 2013; Ogawa and Piller, 2006; Schmidt et al., 2001; Shaw et al., 2005; Smith, 1999; Song et al., 2013; Souder and Bethay, 1993; Steven, 2014; Thangamani, (2016); Unger and Eppinger, 2009; Unger and Eppinger, 2011; Wang and Yang, 2012; Yeo and Rin, 2009; Zhang and Doll, 2011	40
Competition: Brun et al., 2009; Bstieler and Gross, 2003; Chi et al., 2012; Coppendale, 1995; Floricel and Ibanescu, 2008; Goodman et al., 2007; Hise and Groth, 1995; Hottenstein and Dean Jr, 1992; Jerrard et al., 2008; Keizer et al., 2002; Keizer and Halman, 2005; Keizer and Halman, 2007; Keizer and Halman, 2009; Kim and Vonartas, 2014; Khan et al., 2008; Martinsue, 2014; Miller and Waller, 2003; Mu et al., 2009; O'Connor et al., 2008; Park, 2010; Shaw et al., 2005; Souder and Bethay, 1993; Thangamani, (2016); Unger and Eppinger, 2009; Wu et al., 2010; Zhang and Doll, 2011	26

with firms failing to know about their existing competitors, the types of products these competitors are offering, and the competitive advantages they might have, the competitive strategies and tactics they are using, the potential future competitors and if the firm's product is well positioned relative to this competition (Floricel and Ibanescu, 2008). A firm is prone to high marketing risk when it is surrounded by established and dominant competitors who lead the market in the particular product or technology (Hise and Groth, 1995).

Firms may potentially face sudden technology or product obsolescence when customer requirements change due to the influence of competitor pressure (Schmidt et al., 2001). Another possible threat is the risk of the product being stolen or copied and then sold cheaply in the market by competitors (Khan et al., 2008). In summary, firms may face a reduction in market share or profitability due to competitor risk (Coppendale, 1995). For example, it was reported that the largest aircraft engine manufacturer Rolls-Royce was priced out of the aviation industry by its competitors (Zsidisin and Smith, 2005). A list of the studies which have highlighted the risk of competition in their research is provided in Table 2-5.

2.3.5 Operations risk

Operations risk is a broad term capturing the uncertainties or disruptions materializing from the internal operations of a firm (Christopher and Peck, 2004; Kim and Vonortas, 2014). Important elements which constitute internal operations are people, processes, and physical assets (e.g. property, plant and equipment) (Chin et al., 2009; Yong-li et al., 2007). An empirical investigation of 12 top USA firms such as DuPont, General Electric, General Motors, IBM and Texas Instruments suggested that all 12 organizations had to contend with internal operational risks on a large scale (O'Conner and Rice, 2013). Unlike technological and marketing risk, its origin mainly resides within the firm and all factors contributing to operational risks are endogenous in nature.

Consistent with previous literature, operation risk in this research was described in terms of resources, human resources, planning, control and strategic management (Christopher and Peck, 2004; Kim and Vonortas, 2014; Manuj and Mentzer, 2008).

2.3.5.1 Resources

Resources can be people, equipment, facilities, funding or anything which is required to run NPD related tasks. Thus, unavailability of any of these critical resources creates disruption for NPD projects (Gon and Choi, 2012). However, resource risk in this review is limited to physical assets and facilities only. Other elements such as people and funding are discussed separately in the coming sections. This is because many authors (such as Keizer et al., 2002 and Kim and Vonortas, 2014) classified human resource and funding related risks separately to emphasize their importance.

Particular situations demonstrating the resource risk are a lack of proper infrastructure for carrying out NPD operations (Owens, 2007), lack of resources to perform NPD activities e.g. equipment and facilities (Larson and Kusiak, 1996) and lack of materials (Gon and Choi, 2012). Resource related risks can also be due to sudden accidents such as shortage of material due to disruption in material supply or due to the defective shipment of material by suppliers (Gon and Choi, 2012) and sudden equipment failure (Van thuyet et al., 2007).

Lack of critical resources may have a detrimental effect on NPD projects. An example is the findings of empirical research conducted in 12 manufacturing SMEs suggest that the lack of resources is an important reason for a project delay (Owens, 2007). A list of the studies which have highlighted the risk of resources in their research is provided in Table 2-6.

2.3.5.2 Human resources

Human resource issues are related to the management and administration of people working for a firm. In relation to an NPD project, its purpose is to ensure that the firm carrying out NPD operations has adequate team members with requisite skills (Keizer and Halman, 2009). It is regarded as a key source of operational risk (Kim and Vonartas, 2014). A large empirical dataset, which covered more than 35 projects in 17 US Fortune-1000 multinational companies, revealed that 38% of the projects described human resource risk as a major risk factor with potentially significant negative implications to NPD project performance (Thamhain, 2013).

Human resource risk emerges from inadequate training of employees (Kim and Vonartas, 2014). Firms may also fail to attract and retain the right caliber people (Khan et al., 2008) who possess NPD project related competencies and skills. Different case studies conducted in software and aviation sectors suggest that firms have faced significant failures in their respective projects due to the unavailability of the right caliber people, for example firms were lacking members with general management and project management skills (Gon and Choi, 2012; Gosnik, 2011 and Barki et al., 2001) or supply chain management skills (Denning, 2013). Further, a lack of continuous training and re-skilling of existing employees contributes to human resource risk. This was also evident from the case study conducted in Marks and Spencer, a leading UK retail firm (Khan et al., 2008).

Poor management of employee relations is another contributing factor. For example, failure of firms to manage conflicts between employees (Wallace et al., 2004), to balance excessive workload (Wang et al., 2010), to manage contractual disputes with employees (Yeo and Ren, 2009) and to provide employees with a safe work environment (Miller and Waller, 2003) all lead to an increase in operational risk in NPD projects.

In a particular instance on September 2007, over 73,000 General Motors workers went on strike against the company which resulted in the shutdown of 59 plants and facilities for an indefinite period. This had severe consequences on the NPD operations in terms of project delays. Major issues were workers reservations over contractual agreements including wages, benefits, job security and investments in US facilities (Freeman and Ahrens, 2007).

Additionally, firms may also fail to integrate internal and external expertise and manage conflicts that may arise (Schmidt et al., 2001). Finally, a sudden loss of key NPD project team member adds another uncertainty (O'Connor and Rice, 2013). For example, a case study conducted in the town and country planning office in Barbados suggested that employee turnover during the development of a software project development had a tremendous negative impact on the productivity of the project as it was extremely difficult to get competent, experienced technical persons within a short period and moreover, it took time for new employees to adjust to a new environment (Dey et al., 2007). A list of the studies which have highlighted the risk of human resources in their research is provided in Table 2-6.

2.3.5.3 Planning

In relation to NPD projects, the function of planning is to make decisions about the scope and objectives of the NPD project, setting boundaries of operations including development methods and determining the roles and responsibilities of NPD project team members. Any uncertainty related to these aspects leads towards planning risk. For example, Conrow and Shishido, (1997), and Schmidt et al. (2001) observed that ill- defined, immature, unrealistic and poorly defined project objectives and scope caused significant disruptions to NPD projects. Furthermore, firms come up with unrealistic timelines and schedules (Goi and Choi, 2012) and inadequate prioritization of key project objectives e.g. time, cost and quality level (Millward and Lewis, 2005). In the context of software development projects, Barki et al. (2001) reported poorly defined roles and responsibilities of project team members and the boundaries of operations as major threats for the software projects. Schmidt et al. (2001) collected software project managers experiences through Delphi surveys in Hong Kong, USA, and Finland. These survey results suggested that unclear/misunderstood scope/objectives, the improper definition of roles and responsibilities, artificial deadlines and bad estimation were among the top rated risk factors for NPD projects.

Table 2-6: Summary of operational risk and its components (References and their counts)

Resource risk: Barki et al., 2001; Brun et al., 2009; Coppendale 1995; Gon and Choi, 2012; Gosnik, 2011; Jerrard et al., 2008; Kayis et al., 2007; Larson and Kusiak, 1996; Meldrum and Millman, 1991; Owens, 2007; O'Connor and Rice, 2013; Ropponen and Lyytinen, 2000; Van thuyet et al., 2007; Wang et al., 2010	15
Human resources risk: Barki et al., 2001; Conrow and Shishido, 1997; Coppendale, 1995; Denning, 2013; Dey et al., 2007; Freel, 2000 Gon and Choi, 2012; Gosnik, 2011; Han and Huang, 2007; Huang and Han, 2008; Ilevbare, 2014; Jerrard et al., 2008; Jun et al., 2011; Keil et al., 1998; Khan et al., 2008; Kim and Vonartas, 2014; Martinsuo et al., 2014; Miller and Waller, 2003; Miorando et al., 2014; O'Connor and Rice, 2013; Park, 2010; Ropponen and Lyytinen, 2000; Schmidt et al., 2001; Stevens, 2014; Tang et al., 2009; Thamhain and Skelton, 2007; Van thuyet et al 2007; Wang et al., 2010; Wallace et al., 2004; Wu et al., 2010; Yeo and Rin, 2009;	32
Planning risk: Barki et al., 2001; Browning and Eppinger, 2002; Brun et al., 2009; Chi et al., 2012; Freel, 2000; Gon and Choi, 2012; Goodman et al., 2007; Gosnik, 2011;Halman and Keizer, 1994; Han and Huang, 2007; Huang and Han, 2008; Huchzermeier and Loch, 2001; Jiang and Klein, 1999; Jiang and Klein, 2000; Jiang et al., 2001; Kayis et al., 2007; Keizer et al., 2002; Keizer et al., 2005; Keizer and Halman, 2007; Keizer and Halman, 2009; Khan et al., 2008; Larson and Kusiak, 1996; Lin and Zhou, 2010; Martinsuo et al., 2014; Meldrum and Millman, 1991; Millward and Lewis, 2005; Miorando et al., 2014; Ropponen and Lyytinen, 2000; Schmidt et al., 2001; Song et al., 2013; Steven, 2014; Van thuyet et al 2007; Wallace et al., 2004; Wu et al., 2010; Yeo and Rin, 2009; Yong Li et al., 2007; Zsidisin and Smith, 2005	40
Control risk: Barki et al., 2001; Conrow and Shishido, 1997; Denning, 2013; Dey et al., 2007; Gon and Choi, 2012; Gosnik, 2011; Halman and Keizer, 1994; Han and Huang, 2007; Huang and Han, 2008; Huchzermeier and Loch, 2001; Ilevbare, 2014; Jerrard et al., 2008; Jiang and Klein, 1999; Jiang and Klein, 2000; Jiang et al., 2001; Kayis et al., 2007; Keil et al., 1998; Keizer et al., 2002; Keizer et al., 2005; Keizer and Halman, 2007; Keizer and Halman, 2009; Khajawai et al., 2015; Khan et al., 2008; Kim and Wilemon, 2009; Miller and Waller, 2003; Miorando et al., 2014; Owens, 2007; Park, 2010; Ropponen and Lyytinen, 2000; Schmidt et al., 2001; Shaw et al., 2005; Stevens, 2014; Tang et al., 2009; Thamhain and Skelton, 2007; Van thuyet et al 2007; Wallace et al., 2004; Wang and Yang, 2012; Wang et al., 2010; Wu et al., 2010; Yeo and Rin, 2009; Yong Li et al., 2007; Zsidisin and Smith, 2005	43
Startegic management: Chi et al., 2012; Denning, 2013; Freel, 2000; Gosnik, 2011; Halman and Keizer, 1994; Han and Huang, 2007; Hottenstein and Dean Jr, 1992; Huang and Han, 2008; Jerrard et al., 2008; Keil et al., 1998; Keizer et al., 2002; Keizer et al., 2005; Keizer et al., 2007; Kim and Wilemon, 2009; Lin and Zhou, 2010; Martinsuo et al, 2014; Millward and Lewis, 2005; Miorando et al., 2014; Mu et al., 2009; O'Connor and Rice, 2013; Owens, 2007; Park, 2010; Schmidt et al., 2001; Shaw et al., 2005; Song et al., 2013; Stevens, 2014; Thamhain and Skeleton, 2007; Thangamani, (2016); Van thuyet et al., 2007; Wallace et al., 2004; Wu et al., 2010; Yeo and Rin, 2009; Yong Li et al., 2007;	35

Brun et al. (2009) draw attention to the ambiguity in the appropriate development methodology for a particular product, i.e. which process to use. For example, Boeing adopted synchronized just-in-time delivery processes which caused a massive delay in the first production of the 787 aircraft. Until Boeing received all major sections of the airplane from its tier 1 strategic partners, the firm could not complete the whole airplane (Tang et al., 2009). A list of the studies which have highlighted the risk of planning in their research is provided in Table 2-6.

2.3.5.4 Control

The term control refers to those activities, procedures, and mechanisms that a firm adopts to exert its control over operational processes. Any uncertainty related to these activities leads to control risks. For example, in relation to NPD operations, Goi and Choi, (2012) noted the risk associated with non-existent control over NPD operations. Important dimensions of the management control structure which contribute towards the disruption of NPD projects are communication issues among team members and monitoring performance. For instance, 72% of the project managers in top US multinational firms described communication issues as a major risk factor with potentially significant negative implications (Thamhain, 2013). Kim and Wilemon, (2009) while reporting the findings of interviews with 32 project team members in 8 American based technological companies revealed that 29% of the respondents attributed NPD development delays to control aspects of management practices including not monitoring the project's progress. Further, lack of standard quality assurance procedure was reported to be the main component of control structure (Wang et al., 2010).

Aspects of the control structure that provide support or facilitate the NPD projects also contribute to risk. For example, in the context of software development, Barki et al. (2001) and Schmidt et al. (2001) found that a lack of risk management processes and conflict resolution mechanisms were commonly cited threats for NPD projects. This was supported by Park, (2010) and Yeo and Ren, (2009). Furthermore, a lack of change management processes was also frequently cited as a risk in the empirical studies of Keil et al. (1998) and Schmidt et al. (2001). In the case of severe disruptions, emergency, and sudden plan changes, a contingency process needs to be in placed to keep the project on track. The absence of contingency processes can cause chaos in the firm and consequently disturb NPD operations (Yeo and Ren, 2009). A list of the studies which have highlighted the risk of control in their research is provided in Table 2-6.

2.3.5.5 Strategic management

Strategic management risk refers to the risk factors associated with the internal organizational environment in which an NPD project is conducted (Schmidt et al., 2001; Steven, 2014; Wallace et al., 2004). An important element of strategic management is the alignment of a firm's objectives with the market needs or the surrounding environment. Failure to align itself with environmental change results in severe consequences as all technological and operational capabilities of a firm can become unfocused and misdirected (Owens, 2007; Wang and Yang, 2012). A wrong assessment of environment either results in the inadequate prioritization of NPD projects (Martinsuo et al., 2014; Schmidt et al., 2001) or a complete lack of top management interest in innovation (Chi et al., 2012; Millward and Lewis, 2005). For example, many NPD projects do not represent the market needs or requirements and are just initiated either for the sake of technology (Schmidt et al., 2001) or due to political reasons and not based on business values, sound basis or according to market requirements (Huang and Han, 2008; Han and Huang, 2007). Consequently, NPD projects may fail to gain top management commitment, interest and required resources (Keil et al., 1998). A recent case study conducted in a French multinational company working in semiconductor projects revealed that unbalanced attention to different strategic aspects of NPD projects and wrong assessment were the key issues affecting the firm (Steven, 2014). Another empirical study of small UK firms working as a quality component suppliers, leisure component suppliers and a mechanical engineering company revealed that the company did not put significant emphasis on market research in the early phases of the NPD projects because the managing director thought that he had a good understanding of the needs and aspirations of the end users (Millward and Lewis, 2005). The misalignment of project scope and objectives with market needs resulted in project failure.

The second important aspect of strategic management related to NPD project risk is the organizational structure. Uncertainties related to organizational structure (Song et al., 2013) results in late approval from top management on key decision, lack of involvement of top management in key decisions (Van thuyet et al., 2007), centralization of all decisions by top management(Kutch et al., 2014) and lack of involvement of operational level management e.g. project managers in strategic decision (Schmidt et al., 2001) and poor relationship between top level management and project level management (Yeo and Ren, 2009). Kutch et al. (2014) interviewed project managers from 11 global computer service providers and found that project managers tended to believe that they lacked the power to respond adequately to risks. Other uncertainties creating NPD project risks related to strategic management are sudden changes in top management or in the ownership of business (Gon and Choi, 2012). A new management team may set new business direction that causes a mismatch between corporate needs and project objectives (Schmidt et al., 2001) or the scope of NPD project gets changed (Martinsuo et al., 2014) or management changes its priorities regarding the existing process (Park, 2010). The change in top management creates instability in the organizations, and consequently NPD projects suffer (Schmidt et al., 2001). A list of the studies which have highlighted the risk of strategic management in their research is provided in Table 2-6.

2.3.6 Supply chain risk

Although a typical NPD project is primarily based on specialist functions such as engineering, R&D, and marketing (Ulrich and Eppinger, 2012), a firm has to collaborate with external partners e.g. suppliers, customers, distributors, and logistic providers to ensure that product is developed and delivered to the end customer on time with minimal operational cost and maximum quality level (Khan et al., 2008). A small glitch anywhere in a global supply chain can put a firm at risk. For example, recently, a space exploration firm blamed the failure of an unmanned rocket on a small one inch component strut provided by a supplier and pledged to scrutinize its supply chain and not use the parts from that particular supplier anymore. According to a preliminary analysis by the firm, the struts used in the rocket had failed at a certain temperature during flight (Thielman, 2015).

A review of literature suggests that poor supplier management is a major source of supply chain risks for NPD projects (Zsidisin and Smith, 2005). A key aspect of supplier-related risk is the decision not to involve suppliers in the NPD project. Various studies suggest that firms often made outsourcing decisions without carefully considering short and long term issues (Khan et al., 2008; Tang et al., 2009).

Outsourcing decisions may also increase the fear of firm staff for their job security. Firms may overlook these concerns resulting in a deterioration of the relationship between top management and staff. In the Boeing 787 case, when the firm increased its outsourcing efforts, its workers became concerned about their job security which resulted in a big strike of more than 25,000 employees. The strike cost the firm in cancellations and delay of delivering many Boeing aircrafts (Denning, 2013; Tang et al., 2009).

Another issue pertinent to supplier management in NPD projects is the selection of the right supplier. Firms often do not follow any systematic selection process (Freel, 2000; Van thuyet et al., 2007) or proper selection criteria (Keizer et al., 2002; Park, 2010). For example, according to an internal inquiry report by Apple, the selected suppliers did not fulfil

Apple's expected standards. Suppliers were not only paying salaries under the minimum wage but also had workers under the age of 15. Further, some suppliers during the selection process falsified documents and exploited the auditing process (Foley, 2012).

Contracting adds another layer of uncertainty to supplier management. Firms often do not take contracting with suppliers seriously and may face legal complexities and challenges at later stages (Keizer et al., 2002). This is mainly due to issuing the wrong type of contract, ambiguous clauses, conditions or poor specifications mentioned in the contract (Van thuyet et al., 2007). For example, Boeing used a risk-sharing contract which was intended to reduce the firm's financial risk; however, it did not provide proper incentives for suppliers to complete their tasks early. For instance, some suppliers were incapable of developing their sections according to the planned schedule; therefore, the entire development schedule had to be pushed back. Because of these delays, Boeing incurred millions of dollars in penalties that it had to pay out to its customers (Tang et al., 2009).

Once the supplier is hired and the contract is made, firms often face difficulties in managing the relationships with suppliers. This is probably the most important phase since the success of outsourcing is based on the arrangement put in place in this phase and requires a firm to establish an effective communication and information sharing mechanism. The absence of such mechanisms negatively influences the NPD project (Freel, 2000; Lin and Zhou, 2010; Van thuyet et al., 2007). Other issues pertinent to supplier management are the poor performance of suppliers (Park, 2010) which may result in a trust gap between both parties (Thamhain and Skelton, 2007), problems over intellectual property rights (Freel, 2000) and the lack of a conflict resolution mechanism (Freel, 2000) and contingency planning (Jerrard et al., 2008). A list of the studies which have highlighted the risk of the supply chain in their research is provided in Table 2-7.

Table 2-7: Summary of supply chain risk (References and their counts)

Supply chain related risks: Conrow and Shishido, 1997; Coppendale, 1995; Denning, 2013; Freel, 2000; Jeraard et al., 2009; Kayis et al., 2007; Keizer et al., 2002; Keizer et al., 2005; Keizer and Halman, 2007; Keizer and Halman, 2009; Khan et al., 2008; Lee and Johnson, 2010; Li et al., 2008; Lin and Zhou, 2010; O'Connor and Rice, 2013; Park, 2010; Raharjo et al., 2008; Ropponen and Lyytinen, 2000; Schmidt et al., 2001; Shaw et al. ,2005; Song et al., 2013 ; Tang et al., 2009; Thamhain and Skelton, 2007; Thangamani, 2016; Tse and Tan, 2011; Van thuyet et al., 2007; Yeo and Rin, 2009; Zhang and Doll, 2011; Zhang and Sue, 2015; Zsidisin and Smith, 2005	30

2.3.7 Financial risk

Financial risk refers to uncertainties as to whether adequate financing or budgets are available for NPD projects (Wu and Wu, 2014) and whether the new product can be developed on the allocated budget (Unger and Eppinger, 2009; 2011). An empirical study in innovative firms in the US including DuPont, General Electric, General Motors and IBM revealed that managing financial risk was critical in determining project continuation or termination (O'Connor and Rice, 2013). In the context of NPD projects, firms face financial risks for two main reasons: financial unpredictability and unavailability of adequate finances and budgets.

2.3.7.1 Financial unpredictability

Financial unpredictability is a significant source of financial risks where the firm is unable to predict running development cost (Gon and Choi, 2012; Huchzermeier and Loch, 2001) or estimate profit margins (Keizer and Halman, 2009).

Unpredictability may be associated with the lack of tools and skills required to perform financial analysis (Schmidt et al., 2001; Wang and Yang, 2012). Important situations demonstrating the outcomes of poor financial analysis are failing to estimate NPD project related costs e.g. labour costs, material cost (Ben-asher, 2008; Miorando et al., 2014), inadequate assessment and allocation of budgets for different phases of NPD projects (Schmidt et al., 2001), failing to define appropriate target prices for new products (Jerrard et al., 2008) and failing to determine how much to invest to get a return (Steven, 2014).

Table 2-8: Summary of financial risk and its components (References and their counts)

Financial unpredictability : Adler et al., 2016**;** Ben-asher, 2008; Browning and Eppinger, 2002; Brun et al., 2009; Chi et al., 2012; Conrow and Shishido, 1997; Freel 2000; Gon and Choi, 2012; Halman and Keizer, 1994; Huchzermeier and Loch, 2001; Jerrard et al., 2008; Jiang and Klein, 1999; Jiang and Klein, 2000; Jiang et al., 2001; Kayis et al., 2007; Keizer et al., 2002; Keizer et al., 2005; Keizer and Halman, 2007; Keizer and Halman, 2009; Khan et al., 2008; Loch et al., 2008; Martinsue et al., 2014; Miorando et al., 2014; Newhausler et al., 2016**;** Park, 2010; Schmidt et al., 2001; Steven, 2014; Thangamani, 2016; Van Thuyet et al., 2007; Wang and yang, 2012; Wu et al., 2010; Yeo and Rin, 2009; Yong Li et al., 2007; Zsidisin and Smith, 2005	34
Unavailability of adequate finances and budgets: Brun et al., 2009 ; Chi et al., 2012; Freel 2000; Jerrard et al., 2008; Kayis et al., 2007; Kim and Vonortas, 2014; Miller and Waller, 2003; Miorando et al., 2014; Schmidt et al., 2001; Steven, 2014; Thangamani, 2016; Wang and Yang, 2012; Wu and Wu, 2014; Yeo and Rin, 2009	13

In a study of small firms, the costs associated with NPD projects had not been anticipated adequately by the company resulting in management attention being diverted in pursuit of potential alternative sources of funding. This distracted from the main focus of the project and resulted in the further reduction of resources applied to the project itself (Millward and Lewis, 2005). A list of the studies which have highlighted the risk of financial unpredictability in their research is provided in Table 2-8.

2.3.7.2 Lack of funding/ Unavailability of adequate finances and budgets

Firms often lack adequate finances or budgets to run and complete NPD project (Steven, 2014; Yeo and Ren, 2009). A Norwegian medical device manufacturing company experienced several difficulties to launch new medical devices in the market due to lack of funding (Brun et al., 2009). Firms may also fail to gain external funding from investors or government (Kim and Vonortas, 2014). Lack of cash also results from collection problems from the clients and other stakeholders (Miller and Waller, 2003; Steven, 2014; Wu and Wu, 2014) or unanticipated escalation in the development cost (Conrow and Shishido, 1997; Gon and Choi, 2012). For example, O’Connor and Rice (2013) suggested that external financing made the difference between project continuation and termination for NPD projects in leading US companies. A list of the studies which have highlighted the risk of lack of funding in their research is provided in Table 2-8.

2.3.8 Environmental risk

Environmental risk is associated with the external environment surrounding a firm (Kayis et al., 2007; Souder and Bethay, 1993) and is considered to be less controllable or manageable. For instance, in a case study of Unilever, environmental risks were the most frequent and less controllable risks in NPD projects (Keizer and Halman, 2009). In line with the literature, a typical NPD project is vulnerable to environmental risk from four sources: political factors, macroeconomic factors, social factors and natural factors (Miller, 1991).

2.3.8.1 Political factors

Uncertainties associated with a change in government can affect NPD projects (Miller and Waller, 2003). For example, a new government may unnecessarily interfere with the firm's operations or fail to cooperate with the firm e.g. through long project approval processes or other bureaucratic systems (Van thuyet et al., 2007). Governments can also change policy which impacts NPD projects; changes in environmental regulations (Larson and Kusiak, 1996; Wu and Wu, 2014), changes in labour law (Larson and Kusiak, 1996), changes in copyright or intellectual property rights (Larson and Kusiak, 1996; Wu and Wu, 2014), changes in import/export restrictions, which differ from that of the customer's country (Larson and Kusiak, 1996) and changes in tax policy (Miller and Waller, 2003; Van thuyet et al., 2007) all create risks for NPD projects.

A list of the studies which have highlighted the risk of political factor in their research is provided in Table 2-9.

Table 2-9: Summary of environmental risk and its components (References and their counts)

Political factors : Brun et al. ,2009; Chi et al., 2012; Freel, 2000; Hise and Groth, 1995; Jerrard et al., 2008; Kayis et al., 2007; Keizer et al., 2002; Keizer et al., 2005; Keizer et al., 2007; Keizer and Halman, 2009; Kohler and Som, 2014; Larson and Kusiak, 1996; Lin and Zhou, 2010; Martinsuo et al., 2014; Miller and Waller, 2003; Shaw et al., 2005; Souder and Bethay, 1991; Thamhain and Skelton, 2007; Thangamani, 2016; Van thuyet et al., 2007; Wang and Yang, 2012; Wu et al., 2010; Wu and Wu, 2014; Yeo and Rin, 2009; Yong Li et al., 2007	**25**
Social factors: Hall et al., 2014 ; Hise and Groth, 1995; Jerrard et al., 2008; Keizer et al., 2002; Keizer et al., 2005; Keizer and Halman, 2007; Keizer and Halman, 2009; Martinsuo et al., 2014; Miller and Waller, 2003; Park, 2010; Souder and Bethay, 1991; Van thuyet et al., 2007; Yeo and Rin, 2009	**13**
Macroeconomic factors: Chi et al., 2012; Gon and Choi, 2012; Kayis et al., 2007; Martinsuo et al., 2014; Miller and Waller, 2003; Park, 2010; Souder and Bethay, 1991; Van thuyet et al., 2007; Yao et al., 2013	**10**
Natural factors: Gon and Choi, 2012; Miller and Waller, 2003; Van thuyet et al., 2007	**3**

2.3.8.2 Social factors

Different attitudes, beliefs, and reactions of the general public to the outcome of the NPD project may cause uncertainty (Miller and Waller, 2003). For example negative reactions by key opinion makers or interest groups (Keizer et al., 2002) such as the scientific community may cause uncertainties because they differ either in favouring or in opposing the technology (Hise and Groth, 1995) thus creating confusion about the technology for the general public (Hall et al., 2014).

For instance, Umbro, a UK sports manufacturer, had to withdraw its new trainer called "Zyklon" after receiving complaints from many organizations and individuals because the shoe name was similar to the name of the gas used by the Nazi regime to kill millions of Jews in concentration camps (Petre, 2002). A list of the studies which have highlighted the risk of social factor in their research is provided in Table 2-9.

2.3.8.3 Macroeconomic factors

Macroeconomic factors are related to fluctuations in the level of economic activity, wage rates, and interest rates. Examples found in the NPD literature are changing economic conditions such as the recent global economic recession (Park, 2010), sudden changes in foreign exchange rates (Gon and Choi, 2012), changes in interest rates (Gon and Choi, 2012), or increases in material, labour and resettlement costs (Van thuyet et al., 2007). These all adversely impact NPD projects.

For example, when the Indonesian currency devalued by more than 50% in 1997, many suppliers could not pay for components or parts and were unable which later on resulted in major loss for many customers who had outsourced their manufacturing operations to Indonesia (Tang, 2006). A list of the studies which have highlighted the risk of macroeconomic factor in their research is provided in Table 2-9.

2.3.8.4 Natural factors

Catastrophic events such as disaster, flood, and earthquake may affect NPD projects (Gon and Choi, 2012; Miller and Waller, 2003). For example, when an earthquake hit Taiwan and caused several factories to shut down, many top firms such as Apple and Dell could not receive computer components and hence faced component shortages for its iBook and G4 computers (Tang, 2006). A list of the studies which have highlighted the risk of a natural factor in their research is provided in Table 2-9.

2.3.9 Summary and proposed risk taxonomy

This section has synthesized the findings of studies of NPD risk to create a comprehensive and general taxonomy of NPD risk sources, which differs significantly from other taxonomies by providing sub-categories that are easily observable and readily understood. Existing studies of NPD risk (Ilevbare et al., 2014; Lee and Johnson, 2010) consistently indicate the need to identify additional sources of risk beyond those found in the particular study (Table 2-10). By surveying literature from diverse sources, this taxonomy provides a recognizable and logical categorization of risks that has been used in this paper to differentiate risks

Table 2-10: Summary of risk types

Main risk type	Risk components	Description
Technological risk	Technological rapidity risk	The extent to which the technology changes over time or becomes obsolete during the NPD project
	Technological capability risk	The firm's inability to launch a new product successfully
Marketing risk	Marketing rapidity risk	The extent to which customer requirements change over time
	Customer perceived risk	Customer reactions such as fear, doubt, and uncertainty on the intended objectives of the product
	Marketing capability risk	Failing to anticipate the exact customer requirements, to identify target customers, to understand their demands for different product types and failing to aggregate this demand with the appropriate product characteristics to be incorporated in the product
	Competition risk	Firm's inability to understand the current or future changes in the competitive market
Operations risk	Resource risk	Unavailability of critical resources including facilities, material, and physical assets
	Human resource risk	The poor management and administration of people associated with NPD projects working for the firm.
	Planning risk	Risks related to decisions about scope and objectives of NPD project, setting boundaries of operations including development methods and determining the roles and responsibilities of NPD project team members
	Control risk	Risks related to activities, procedures, and mechanisms a firm adopt to exert its control over the operational processes
	Strategic management risk	The risk or uncertainty surrounding the internal organizational environment including the risk factors associated with organizational politics, organizational support and the stability of the organization environment
Supply chain risk	Supply chain risk	Risks related to supply chain including suppliers related risks
Financial risk	Financial unpredictability risk	Poor financial analysis related to NPD project, poor allocation of budget for different phases of NPD project
	Lack of funding risk	Lack the adequate finances or budgets to run and complete NPD project
Environmental risk	Political risk	Uncertainties associated with a change in the government can affect NPD project
	Macroeconomic risk	Risks related to fluctuations in the level of economic activity, wage rates, and interest rates
	Social risk	Uncertainties due to different attitudes, belief, and reactions of the general public to the outcome of the NPD project may cause uncertainty
	Natural risk	Refers to catastrophic events such as disaster, flood, and earthquake

according to NPD stage and which could now permit industry and sector comparisons. This research will therefore aim to investigate the proposed taxonomy empirically. As mentioned in introduction, this objective can further be translated into precise research questions as follow.

Research Question 1: What risks do managers of NPD projects perceive?

As discussed in introduction, two important attributes of risk are the probability and impact, and it is imperative to explore the phenomenon of risk in accordance with the two attributes (Hopkinson et al., 2008). Therefore, both of these attributes need to be reflected in the proposed research question. Consequently, research question will be re-written in terms of probability and impact as follow:

> ***Research Question 1.1: What is the probability of occurrence of different risks in NPD projects?***
> ***Research Question 1.2: What is the impact of these risks on NPD projects?***

By answering this research question, this work aims to empirically identify the most frequent perceptions of respondents about probability and impact of NPD project risk types.

2.4 The moderating effect of contingency factors

NPD projects differ from each other in several characteristics such as size, duration, and product type (Raz et al., 2002). Researchers have therefore suggested that NPD practices should depend on the project's characteristics (Griffin, 1997). The same applies to NPD project risks. One cannot expect that a single universal list of risk factors would apply to all types of NPD projects. Just as there are different types of projects, one should expect to see different types of risks (Raz et al., 2002). For example, risks associated with radical NPD projects may differ from those risks associated with incremental NPD projects because radical and incremental products have different characteristics (O' Connor and Rice, 2013). The previous research which has compiled risk factors (Kim and Vonortas, 2014; Keizer et al., 2002; Jiang and Klein, 1999; 2000; Jiang et al., 2001) did not examine the relationship between NPD project risks and NPD project characteristics. This is a major gap in the literature as understanding the NPD project risks, and the trends or patterns they are likely to follow in different contexts allows management to find out when and how certain risk types emerge (Wallace et al., 2004). To address the gap, I proposed following research question:

Research Question 2: How do perceptions of risks change according to different contingency factors that may influence NPD projects?

An extensive review of the literature suggests a list of contextual factors which could influence the emergence of risks in NPD projects (see Table 2-11). I chose three contingency factors because they have been proposed in the literature as factors that may have a contingent effect on the severity of a risk and its (risk's) potential impact on a project although there is not as such empirical support to confirm their contingency effect on risks in NPD project: NPD type, firm size, and industry type. In the next section, I will provide a rationale for using these three characteristics and how these might potentially impact NPD project risks.

2.4.1 The moderating role of project types on NPD project risks

The motivation for studying the emergence of risks in different NPD types is imperative because research has shown that the NPD project risk may depend upon on the type of NPD project i.e. incremental or radical innovation (Holahan et al., 2014; Raz et al., 2002). This dependence can be attributed to the difference in the nature of products. To examine differences between the two types of NPD projects, I will first define these categories.

The measures of product innovativeness have been critically discussed in the literature (Garcia and Calantone, 2002). According to the literature, there is a lack of consensus in defining innovativeness (Garcia and Calantone, 2002). A close eye on the definitions of product innovativeness suggests that there seems to be a consensus in defining the two ends of the scale of both incremental and radical quantum. However, there is a debate about the projects that lie in between with regard to their innovativeness. I will, therefore, concentrate on NPD projects that are considered incremental or radical by most of the NPD research (Kleinschmidt and Cooper, 1991). This approach is consistent with existing literature and adopted by several researchers (Keizer and Halman, 2009).

Researchers have adopted a macro-perspective in defining the radical products. For example, these products have been evaluated based on factors such as the familiarity or newness of the innovation to the world (Griffin, 1997). Radical innovation gives rise to new products which are new to the company and the industry.

Table 2-11: List of contingency factors

Firm size	Mu et al., 2009; Stockstrom et al., 2008; Jiang and Klein, 1999, 2000, Jiang et al., 2001; Barki et al., 2001; Polk et al., 1996; Carson, 2012; Schemdit et al., 2001; Bower, 2014; Millward and Lewis, 2005;Owens, 2007
Firm assets	Mu et al., 2009; Song and Montoya-Weiss, 2001
R&D spending	Mu et al., 2009; Wu and Wu, 2014; Song and Montoya-Weiss, 2001, ; Carson, 2012
Firm ownership (government or private owned)	Mu et al., 2009; Wu and Wu, 2014; Van thuyet et al., 2007; Kim and Wilemon, 2009)
Firm's age	Kim and Vonortas, 2014; Bower, 2014
Firm experience in NPD	Bower, 2014
Firm's annual turnover	Stockstrom et al., 2008
Project duration	Huang and Han, 2008 ; Barki et al., 2001; Wallace et al., 2004 ; Heidenreich and Spieth, 2013; Kim andWilemon, 2009
NPD team size	Huang and Han, 2008 ; Jiang and Klein, 1999, 2000, Jiang et al., 2001; Barki et al. 2001
NPD team experience	Huang and Han, 2008 ; Jiang and Klein, 1999, 2000, Jiang et al., 2001; Jun et al. 2011; Van thuyet et al., 2007; Carson, 2012; Schemdit et al., 2001; Li, 2008; Martinsuo et al., 2014; Bower, (2014); Kim andWilemon, 2009; Kim and Vonortas, 2014; Thamhain, 2013
In-house/ Outsourced	Huang and Han, 2008 ; Wallace 2004 ; Freel, 2000;
Project cost	Barki et al., 2001; Thamhain, 2013
Project size	Heidenreich and Spieth, 2013; Zwikael and Ahn, 2001

These NPD projects involve a high level of risk because there is a high degree of uncertainty and complexity in the new product requirements, technology, customers' needs and competitors' actions (Keizer and Halman, 2009; Song and Montoya-Weiss, 2001). Furthermore, the process infrastructure for developing such a product may still be at the development stage or non-existent (Lynn et al., 1996).

In contrast, incremental products have been defined in a micro perspective i.e. researcher often evaluated them from the point of view of the firm or the firm's customers (Garcia and Calantone, 2002). Incremental NPD projects are predictable and linear and are associated with fewer uncertainties which also require less complex collaboration (Keizer et al., 2002). The target market and customer needs are known. Also, the technology required is not usually very different from the existing ones and the production processes used are well-understood and may already exist (O'Connor and Rice, 2013).

The degree of uncertainty and complexities present in the innovation process may moderate the type and influence of risks on NPD projects.Although the support for the claim (difference of risks for both types and that radical NPD are more vulnerable) is widely acknowledged in the literature (Keizer and Halman, 2009; O'Connor and Rice, 2013), there is no empirical study within the context of NPD projects, which could have investigated (or compare and contrast) the risks associated with incremental and radical NPD projects. This is certainly a major omission in the NPD literature. Therefore, this research investigates this phenomenon by positing a general hypothesis.

NPD project risks are more likely to occur in radical NPD projects than in incremental NPD projects.

NPD project risks have a more negative impact on radical NPD projects than on incremental NPD projects.

(As mentioned earlier, I conceptualize the risk in terms of two important attributes the probability and impact and therefore, both of these attributes need to be reflected in the two proposed hypotheses).

2.4.2 The moderating effect of firm size on NPD project risk

The motivation for studying an interaction among firm size and NPD project risks is because the management culture and operational resources in small and medium-sized enterprises (SMEs) are very different to those that exist within large companies (Freel, 2000; Kim and Vonortas, 2014). Therefore, it is important to evaluate or compare the risks of NPD projects in both small and large firm size context (Millward and Lewis, 2005). To examine differences between the two types of firms, I will first define the definitions of different firm sizes.

In accordance with UK government firms' classifications (Levy and Harris, 2013), the full set of enterprise size bands is as follow:

- Less than 10
- Between 10 and 50
- Between 51 and 250
- Between 251 and 1000

- Above 1000

The standard definition of an SME (used by the UK government and the EU) is an enterprise with fewer than 250 employees. Firms with less than 10 employees are referred as micro firms. Firms within 10 and 50 are commonly known as small firms. Firms between 51 and 250 are referred as medium-sized firms. All firms with more than 250 employees are referred as large firms (Levy and Harris, 2013).

Many researchers in the NPD literature have used firm size as a structural category in their researches which is evident from Table 2-11. From these, many studies argued that SMEs face the challenges associated with the resource-constrained environments within which they often operate. It has also been reported that SMEs suffer from NPD failures frequently and often face delays in their projects. A conclusion from these studies is that newer or smaller firms are more vulnerable to various types of risks (Street and Cameron, 2007) and have much more likelihood to quit their NPD projects than larger firms (Kim and Vonortas, 2014; Millward and Lewis, 2005; OECD, 2001). This might be due to their restricted access to resources such as human resource, financial resources and technological and marketing capabilities (Jerrard et al., 2008; Kim and Vonortas, 2014; Kim and Vonortas, 2014; Millward and Lewis, 2005; Owens, 2007).

However, some studies show the opposite. For example, they suggest that given the increasing trend of supplier involvement in NPD project and the continuous attempt to remain competitive in the market, NPD projects can also be highly complex, interactive and tightly coupled systems. Large firms are more often involved in NPD projects that are complex and associated with increasing degrees of outsourcing of value added activities than medium sized or smaller firms e.g. the product portfolio of larger firms is frequently broader and targeted to a broader set of customers. Similarly, in larger firms, more employees are involved in managing NPD projects (Wagner and Neshat, 2012). With more employees, communications between the employees both inside (between different functions and departments) and outside the firm (suppliers, logistic providers) may become extremely difficult than for medium sized or smaller firms (Roebuck et al., 1995). Similarly, exchanging tacit knowledge (critical for identifying potential areas of risks in the NPD projects) becomes more difficult in larger organizations as compared to smaller organizations where informal communication between employees is more likely. This stance is also supported by Normal Accident Theory (NAT) which suggests that organizations may be prone to more accidents under high interactive, complex and tight coupling environment (Wagner and Neshat, 2012). Moreover, large firms conducting NPD projects are more associated with high interactive, complex and tight coupling environment, therefore, these are more vulnerable to NPD project risks than SMEs.

Because of above mentioned inconsistent findings in the literature, a possible conclusion is that there may have been a tendency to over-exaggerate the impact of risk types both in SMEs and large firms (Poolton and Barclay, 1998). This is explained by the literature that researchers may have been too quick to generalize the utility of multi- functional and integrating practices across very diverse environments (McDermott and O'Connor, 2002).

In short, although it seems clear that firm size moderates the influence of risks on NPD projects, clearly there is confusion about which size is more vulnerable. For this reason, this research aims to clarify this and analyses the interaction between different firm sizes and NPD project risks according to the following hypotheses.

The likelihood of occurrence of risks in NPD projects conducted by large size firms is different from those of SMEs.

The potential negative impact of risks in NPD projects conducted by large size firms is different from those of SMEs.

2.4.3 The moderating effect of industry type on NPD project risk

According to the literature, the phenomenon of risk is not restricted to a particular sector (Lee and Johnson, 2010). Different industrial sectors may expose to different risk types. For example, the electronics industry which includes computers, facilities, materials, equipment, telecommunication, automotive and transportation are characterized by rapid technological changes (Mohr et al., 2001). Similarly, the FMCG sector has experienced a growing level of global competition. To remain competitive, firms started restructuring their businesses to operate on a global basis (Manuj and Mentzer, 2008) and integrating suppliers into their NPD projects to reduce operational cost and product development lead-times and gain access to suppliers' technological capabilities (Zsidisin and Smith, 2005). However, this also means that operational risks or supply chain risk will probably be higher in this case than in other sectors. As highlighted by Simms and Trott, (2014), there are notable product failure rates in FMCG sector and reduced chances of product success. Similarly, software product development sector might expose to different risks than other sectors. For example, software products follow the Spiral development process model unlike to other products which mostly follow Stage Gate process or any of its variant, (Mcconnell, 1996; Unger and Eppinger, 2009). The spiral development process is repetitive in nature and allows continuous feedback to be incorporated at different stages of product development which is not the case in Stage gate. Consequently, the differential nature of software products and product development process might mean different patterns of risks associated with it (Wallace et al., 2004). Therefore, I argue that understanding of the emergence of NPD project risks in different industrial contexts seems to be crucial as it allows NPD management to find out what risks are associated with NPD projects in different sectors. For this reason, this research aims to study the interaction between different firm sizes and NPD project risks according to the following hypothesis.

Mean perception of risks in NPD projects differ for respondents from different industry sectors.

2.5 Investigating risk's perception of NPD project team' members

It is a well-established fact that NPD project requires different functions of a firm to coordinate effectively and efficiently to develop a new product (Mu et al., 2009). Moreover, because, many NPD project risks are cross-functional, firms often put in place a cross-functional team for the management of these risks (Mu et al., 2009). In many cases, respondents represent certain functions e.g. project management, engineering or manufacturing, marketing or could be a representative of top management, so their perceptions might represent the perspective of their functions. Schmidt et al. (2001) suggest the need for further research in this important area because "it is quite possible that different stakeholders will have divergent opinions regarding what the risk factors are, as well as their relative importance" (p. 29). Surprisingly, despite this earlier call, there is little-published research which could compare different perspectives on NPD project risks. For example, there are few studies particularly in the software development context which have compared and contrasted the perceptions among software developer and software users of products (Keil et al., 2002) or conducted a cross-country comparisons of NPD project managers' perceptions of software product about software development risks (Liu et al., 2010). Because the existing research is lacking an insight about the difference of the perception of NPD project risk by different stakeholders (team members in this case), I decided to explore the phenomenon further by proposing the following research question:

Research Question 3: How do perceptions of NPD projects' risks vary among the team members with different backgrounds and managerial roles involve in NPD project?

As illustrated later in the descriptive findings, respondents who filled the survey for this research were from a variety of managerial roles and functions. For example, the majority of them representing R&D or technical function such as product design, senior management (CEO, MD, owners, general manager and board of directors), marketing, sales, and finance functions. From these, I particularly interested in investigating the perceptions of respondents from technological functions versus participants from the non-technological functions. The rationale for investigating such a perception is that R&D people often lead NPD project and existing literature argued that R&D people are more likely to identify and diagnose risks associated with technological issues only (Smith, 1999). And, they ignore other important risk factors. To confirm the notion, I will investigate the perception by proposing the following hypothesis

The mean perception of risks in NPD projects of respondents from technological functions differs from those with respondents from other functions

The extant literature also suggests that senior management commitment is a key ingredient to developing successful NPD project (Smith, 1999). Furthermore, Schmidt et al. (2001) found the difference between the perceptions of top management and project managers in the software development context. According to their research, project managers perceive those risks as most essential that were controllable in nature i.e. risks that can be controlled by managers such as technological risk and supplier related risks. On the other hand, top management perceives those risks important which were strategic in nature and were uncontrollable such as catastrophic events, legal risks, and other environmental risks. Because of limited evidence in this particular aspect, comparing and contrasting the perceptions of senior management and middle-level management on risk may yield further insights into it. Therefore, the above discussion informs the development of the following hypothesis.

The mean perception of NPD project risks differs between respondents from top management and those from lower or middle management

The summary of proposed research questions and their hypotheses are presented in Table 2-12.

Table 2-12: Summary of chapter and proposed research question

Research questions	Description
Research Question 1: What risks do managers of NPD projects perceive?	For each of the risk types, respondents will be asked about the probability and impact of risk as follow • What is the probability of occurrence of the NPD project risk in NPD project? • What is the impact of the risks on NPD projects?
How do perceptions of risks change according to different contingency factors that may influence NPD projects?	Three contingency factors were selected for this question: NPD project type, firm size, and industry sector. The respective hypotheses are as follow **NPD project type:** NPD project risks are more likely to occur in radical NPD projects than in incremental NPD projects. NPD project risks have a more negative impact on radical NPD projects than on incremental NPD projects. **Firm size:** The likelihood of occurrence of risks in NPD projects conducted by large size firms is different from those of SMEs. The potential negative impact of risks in NPD projects conducted by large size firms is different from those of SMEs. **Industry sector:** Mean perception of risks in NPD projects differ for respondents from different industry sectors.
How do perceptions of NPD projects' risks vary among the team members with different backgrounds and managerial roles involve in NPD project?	The mean perception will be analyzed as follow 1) Respondents from technological functions versus others 2) Respondents from top management versus middle or low-level management The hypotheses were as follow: The mean perception of risks in NPD projects of respondents from technological functions differs from those with other functions The mean perception of NPD project risks differs between respondents from top management and those from lower or middle management

3 Chapter: Methodology

3.1 Introduction

This chapter presents the research procedures including the sampling frame, data collection, questionnaire design, and analysis plan. The proposed research procedures are employed to investigate the following research questions

1. What risks do managers of NPD projects perceive?
2. How do perceptions of risks change according to different contingency factors that may influence NPD projects?
3. How do perceptions of NPD projects' risks vary among the team members with different backgrounds and managerial roles involved in NPD projects?

The chapter is structured according to Blaikie, (2010)'s suggested research design elements as summarized in Figure 3-1. It is worth mentioning here that the first two elements of the research design (Figure 3-1) have been addressed in chapters 1-2 including i) Business problem and research gaps and ii) research questions. The explanation for the remainder of the elements is presented in the following sections (Section 3.2 to 3.5).

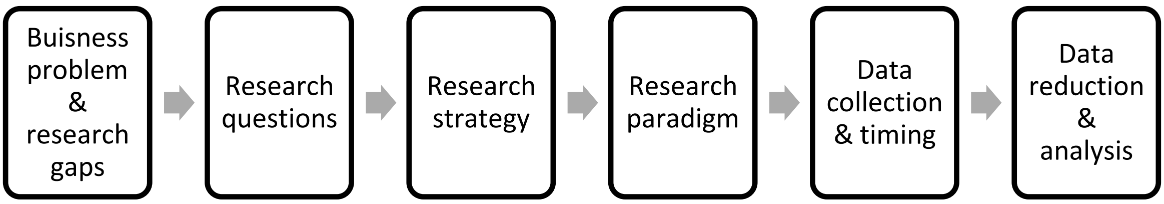

Figure 3-1: Research design process (adopted from Blaikie, 2010)

3.2 Research strategy

A research strategy entails a set of steps through which research objectives and in particular research questions are answered (Denzin and Lincoln, 2011). It provides a starting point for the research. The overall research strategy should seek a methodological fit whereby a link between methodological choices, formulated research question(s) and prior work in the field is established (Van de Ven, 2007). According to Easterby-Smith et al. (2011), methodological fit refers to internal consistency among the four key elements of a research project which include i) prior work, ii) research question, iii) research design and iv) theoretical contribution. In this research, there was little prior work on empirically identifying the NPD project risks and validating their relationship with different contingency factors such as incremental and radical NPD type, SMEs and large firms and different industry types. Furthermore, the literature was lacking research which could compare and contrast perception of different team members about NPD project risks. As illustrated before, these are considered to be major gaps as without such information, management may not be able to devise effective risk management strategy. This research aims to fill the gap by addressing the three research questions by testing theory in a new product development context. Therefore, this research has used a cross-sectional design where data was collected from UK firms conducting NPD projects via self-administered survey by adopting a deductive research strategy (Cresswell, 2008). The deductive strategy facilitates in determining whether existing theoretical framework or generalization could apply to specific stances (Hyde, 2000) which are in this case risks in NPD projects.

The aim of this research is to test the theory i.e. the comprehensive risk classification/taxonomy informed by the literature (as drawn in Figure 1.1). From this, a set of testable hypothesis were developed (chapter 2), and research constructs (e.g. all risk types and their sub-categories) will be operationalized via measurable indicators. The indicators will be then used to develop survey instruments to collect primary data. The data will be analyzed, and results will be used to confirm or refute the proposed risk classification. Figure 3-2 summarizes the process based on the deductive approach applied for this study.

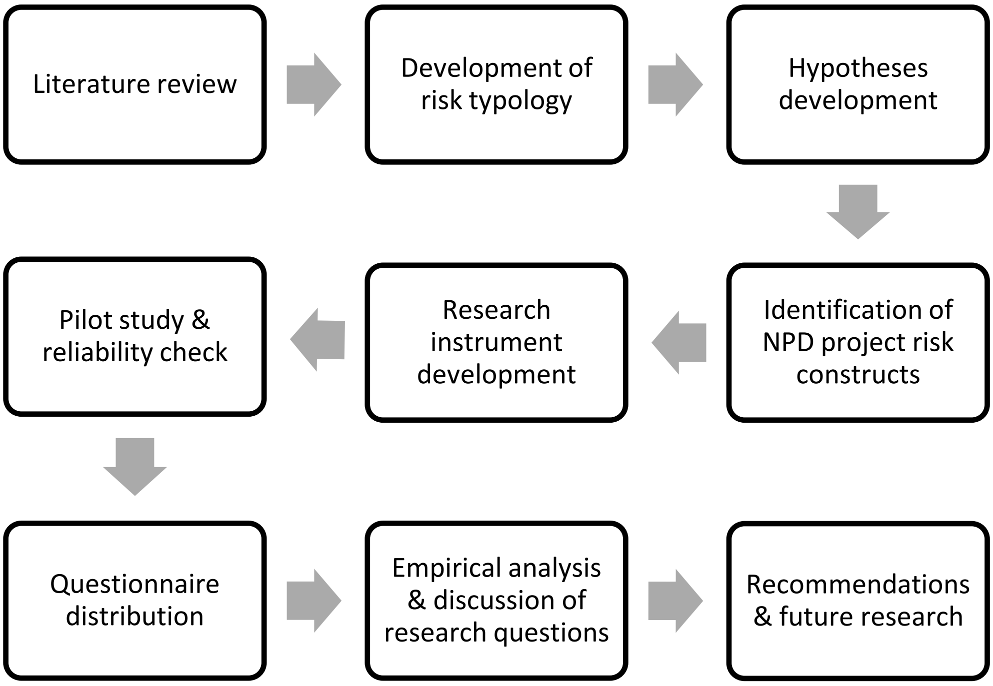

Figure 3-2: Deductive based research process

3.3 Research paradigm

A paradigm represents a set of basic beliefs that lead the researcher during the process of research (Bryman and Bell, 2007). It addresses the clarification of the key aspects of the research including the subjective/objective nature of the knowledge area of the research, positivism versus constructivist orientation of the research paradigm, and the deductive versus inductive approach (Eisenhardt, 1989). The understanding of these concepts enables the researcher to develop methods and instruments, and later formalize research hypotheses (Blaikie, 2010; Easterby-Smith et al., 2011). Earlier research on risk in NPD projects mainly comprised of case research conducted in an attempt to build theory (O'Connor and Rice, 2013; Yin, 2009). There was little work that follows the methodological approach of theory testing when focusing on risk identification in NPD projects (Mu et al., 2009; Wallace et al., 2004). Therefore, this work attempts to address this gap in the literature by adopting a positivist paradigm that tends to be objective with the findings directly based on the data collected.

In line with the positivist paradigm, the quality of the research was measured by reliability, validity and dimensionality tests (Blaikie, 2010). Furthermore, within the positivist paradigm, methodological choices entails developing a research question(s), operationalizing key concepts and formulating hypotheses and collecting data to support or reject hypotheses.

3.4 Data types, forms and analysis

3.4.1 Research context

Research context here refers to the context from which target population was composed. It refers to the country of the target population and industry sectors from where data will be collected. The data is collected from UK firms conducting NPD operations. The reason for limiting the data to UK firms was because, in the very recent years, the UK has a persistent trade deficit reflecting weak supply performance in the traded sectors, particularly in NPD context. This is evident from the UK government report which suggests that UK NPD growth was less than its EU rivals including Germany and France (BIS, 2012). Because the global opportunities are increasing and other developed markets also seem to capture these global opportunities including China and BRICS economies, there is a strong need for UK firms (SMEs or large) to maintain and improve their competitive advantages (BIS, 2012). UK firms are increasingly keen to improve their innovation performance and adopt different mechanisms in overcoming barriers (Owens, 2007). As this research examines, firms are recommended to have in place risk management (RM) process to minimizes the risks associated to NPD projects and improves the firms' performance (Mu et al., 2009). Therefore, UK is an ideal context for this empirical research as empirically validating the research objectives would increase the understanding towards risk(s) associated to NPD projects conducted by UK firms and their consequences/impact during NPD projects and thereby to suggest ways in which risk can be better managed. This would eventually then increase the performance and competitive advantage of UK firms. Additionally, little empirical research has been conducted in understanding how UK firms (conducting NPD operations) perceive, identify and manage NPD project risks (Jerrard et al., 2008;

Owens, 2007). Thus, our research would be an attempt to fill this critical gap in the UK context.

3.4.2 Sampling frame

The sampling frame for this research consists of firms conducting NPD operations in a range of sectors. The reason for including companies operating in a wide range of sectors is because the phenomenon of risk is not restricted to a particular sector (Lee and Johnson, 2010). Further, NPD projects differ in many ways, such as size, duration, product type depending upon different industries. It was ensured that there would be representation from all types of industrial sectors as the different industry may expose to different risk types. For example, I chose to study electronics industries in my sample which include computers, facilities, materials, equipment, telecommunication, automotive and transportation because these industries are characterized by rapid technological changes (Mohr et al., 2001), which provide an excellent research context to examine risk types, particularly for the radical product. Similarly, FMCG sector was chosen on the basis that it is a highly important sector in terms of economic activity in the UK. For example, the UK FMCG industry is responsible for £125 billion of consumer expenditure and contributes over 8% of GDP (FMCG, 2016). New Product Development (NPD) is a significant core activity of FMCG firms. FMCG sector has also experienced a growing level of global competition, combined with the increasing power of supermarkets and their label brands ((Bourlakis and Weightman, 2004). As a result, NPD has become a major activity of both the manufacturer and supermarket brand owners. To remain competitive, firms started restructuring their businesses to operate on a global basis to take advantage of external expertise, skills, goods and capital (Manuj and Mentzer, 2008). For example, firms started integrating suppliers into NPD projects to reduce operational cost and product development lead-times and gain access to suppliers' technological capabilities (Zsidisin and Smith, 2005). However, new risks emerged due to the re-structuring of the business models, dependency and integration of firms on the suppliers (Manuj and Mentzer, 2008; Shelanski and Klein, 1995). On this basis, I argue that FMCG sector is critical to enhance the understanding of NPD project risks and validating the proposed risk taxonomy. Similarly, a large proportion of the samples were from software development sector. The reason for selecting software sector was that unlike to other products which usually follow traditional NPD process e.g. stage gate process, software development follows a unique NPD process such as the spiral model (Unger and Eppinger, 2009). This is also because continuous feedback from stakeholders is required when developing software and spiral NPD process allows this continuous feedback to be incorporated at different stages of product development. The differential nature of software products and product development process might mean different patterns of risks associated with it (Wallace et al., 2004). Therefore, I argue that software sector is also critical to enhance the understanding of NPD project risks and validating the proposed risk taxonomy. From the above, understanding of the emergence of NPD project risks in different industrial contexts seems to be crucial as it allows NPD management to find out how NPD project risk emerge and are perceived in various contexts. Furthermore, validating the proposed risk classification of NPD project risks requires a large number of samples across a broad, representative cross-section of industries and organizations.

The target respondents will be all potential stakeholders responsible for NPD operations in the company. These include senior executives such as vice president, general manager, marketing manager, risk manager, R&D manager, NPD manager and project manager. This sampling criterion is posited to ensure that the respondents had the practical knowledge relevant to the phenomenon of interest (Mu et al., 2009), i.e. risks in NPD projects.

3.4.3 The sample

The importance of sampling in survey research design is imperative because practically, it is almost impossible to collect data from an entire population (also termed as the census) (Saunders et al., 2009). Sampling is of two types: probability or representative sampling and non-probability or judgmental sampling. For this research, probability-based sampling is adopted as it provides an equal opportunity to be selected for all respondents in the sample (Field, 2013). While there are several criteria for determining the sample size based on probability, sample size based on variables and margin errors were used to estimate the sample size for this research (Stevens, 1996).

3.4.3.1 Sample size based on variables

The initial approach to select the appropriate sample size was based on a number of independent variables. There are several opinions found in the literature. For example, Hair et al. (2011), recommends that at least ten responses are required for each independent variable. Stevens (1996), on the other hand, recommends 15 responses per variable. Overall, the sample size was estimated by using the following relationships based on 18 independent variables. Based on Hair et al. (2011)

Sample size (n) = 10 X m (no of independent variables)

= 10 * 18= 180 responses

Based on Stevens, (1996)

Sample size (n) = 15 X m (no of independent variables)

= 15 * 18= 270 responses

Another equation provided by Tabachnick and Fidell (2014) suggests that

Sample size = N > 50 + (8 X m)

Where N= sample size

m= (no of independent variables)

= N > 50 + (8X 18)= N > 194 responses

3.4.4 Sampling frame

Sampling frame refers to the complete list of all the cases from which the sample is drawn. For the purpose of this research, sampling frame comprised UK based firms conducting NPD operations. The list of these companies to be approached was achieved from several sources:

3.4.4.1 FAME

It is a database which contains financial information of over 5.7 million UK and Irish firms provided by Cranfield University. For the purpose of this research, an exhaustive search was performed to obtain the list of UK firms. From this list, firms conducting NPD operations were separated. The contact details of all relevant stakeholders (as mentioned earlier) were obtained. There were about 22,000 eligible firms, and 8000 firms were randomly selected. In February 2016, surveys were mailed to 5000 out of 8000 firms with a cover letter explaining the purpose of the survey. Due to the fact that surveys from prominent organizations can get better response rates (Sekaran, 2003), the cover letter and the questionnaire were endorsed by Cranfield School of Management. Only respondents from 30 firms filled the survey representing a poor response rate of 0.6%. In April 2016, approximately, two months after the first survey, another 1500 respondents (from left over 3000 out of 8000) were sent surveys. To overcome the issue of low response rate, this time respondents were offered to be entered into a prize draw of mini I-pad. This was consistent with the existing literature which has shown that offering respondents incentives for participation increases response rates (Yu and Cooper, 1983). I received 83 completed surveys representing the response rate of 5%. Finally, another set of 1500 survey (left over from 8000) was sent in June 2016. I received another 60 completed responses representing 4 % response rate. In total, I received 173 completed responses through FAME database representing the total response rate of 2%.

3.4.4.2 Linked In

The poor response rate from FAME database made it necessary to look for alternate ways of contacting NPD professionals. Therefore, a three-month premium subscription of Linked In was purchased from March 2016. Linked In claims to be a vital tool for conducting business-related research as researchers and product managers are one of its most frequent users. It also provides the option of searching individual profile and allows searching any particular profile of respondent with keyword, company name, and locations. Therefore, a cover letter along with the survey link was sent to 300 UK NPD professionals (300 was the maximum number permit in this membership). Only 13 professionals responded back in the three month periods and filled the surveys representing 4% response rate.

3.4.4.3 Xing

Xing, a tool very similar to Linked In, was also used to target UK NPD professionals from March 2016 up to 6 months period (because the premium membership for Xing was much cheaper and allowed larger numbers of professionals to be contacted). 400 respondents were chosen based on their profile description and were sent cover letter and survey link. Only five responded back over the period of 6 months representing the response rate of 1.25%.

3.4.4.4 Cranfield Alumni

Cranfield University also provided access to the Cranfield alumni database. The database was thoroughly searched to find out professionals who were involved in NPD processes at that time. Alumni graduated in last 2-3 years (as they were more likely to be approachable) were then randomly selected. 25 Respondents were sent a cover letter with the survey link. Out of these, three members responded back with completed surveys.

3.4.4.5 Academic seminars/ Lunch seminars

Considering the poor response rate from FAME database and social networking websites (194 total responses so far), I decided to adopt direct efforts to persuade and gain compliance of respondents. The first step was to search and look for research seminars organized by universities. In doing so, the focus was to identify seminars on technology management, R&D management and NPD delivered by either faculty members or practitioner from industry. I identified seminars held at different universities and booked my participation. In total, I attended eight seminars conducted at Leeds University Business School, Cranfield University School of Applied Science and Bradford School of Management. At the end of the seminar, I requested each of the speakers (provided that they are involved in NPD project) to fill the survey. The response rate was 100 percent as all speakers filled the survey (Table 3-1).

Table 3-1: List of seminars I attended

Seminar title	University\Organization	Date
Big data science and technology to enable smart business	Bradford University	8 March
Models in engineering design	Bradford University	9 March
Technology and product convergence in health innovation	Leeds University	3rd April
Liquid crystal displays: Spinning a magic roundabout	Leeds University	5 April
Network-based approaches for evaluating ambient assisted living technologies	Leeds University	20 April
The roles of operations strategy in implementing lean	Leeds University	27 April
Make in India	Asian Manufacturing association and Leeds University	29 April
Challenges in aerospace extended enterprise	Cranfield University	15 May

3.4.4.6 UK manufacturing associations

As part of the "direct efforts to persuade and gain compliance of respondents" strategy, I decided to contact different manufacturing associations and sought their help in forwarding the survey to their members NPD firms. This idea was the outcome of the constructive discussion with few manufacturing professionals during one of the seminars I attended. The following key manufacturing and business associations were contacted and sought for help.

I. EEF- The manufacturing organization

EEF (the Engineering Employers' Federation) works with manufacturing, engineering and technology-based businesses in the UK and provides businesses manufacturing related advice, guidance, training and support. With their kind support, I approached 25 respondents who were involved in manufacturing and NPD related activities. Among these, 14 members responded back with completed surveys representing the response rate of 56%.

II. Yorkshire Manufacturing Association (YMA)

YMA works with manufacturing, engineering and technology-based businesses specifically in the Yorkshire region and provides businesses manufacturing related advice, guidance, and support. The secretary of association forwarded my survey to firms registered with YMA. 34 members responded back with completed surveys.

III. Yorkshire Asian Business Association (YABA)

YABA works with all sorts of traded businesses managed by Asians in the Yorkshire region and provides businesses related advice, guidance, and support. One of the representatives of the association forwarded my survey to their member firms which were involved in NPD operations. I received three completed surveys.

IV. Leeds Enterprise Centre (LEC) & Wakefield Enterprise Centre (WEC)

The representative of LEC and WEC agreed to forward the survey to business firms and entrepreneurs associated with their enterprises. However, despite several reminders, no member firm or their associated staff responded.

3.4.4.7 Social Entrepreneurs and owners of small and medium-sized businesses

Continuing with the "direct efforts to persuade and gain compliance of respondents" strategy, I further decided to meet owners of small businesses particularly entrepreneurs. With the help of a researcher who is undertaking a British Academy Fellowship project and collecting and archiving female business owners' oral history accounts in Yorkshire over the last 70 to 80 years, I got the opportunity to meet 11 female entrepreneurs who were involved in NPD activities e.g. Halwani cheese, software apps and fashion design. All meetings were arranged on one to one basis. The respondents were asked to describe their NPD process. Respondents were then also provided an overview of NPD project risks. The surveys were filled both in the form of paper format and online.

3.4.5 Survey questionnaire design

The data collection instrument development process illustrated in Appendix 2 was used to develop instruments that satisfy the requirements of reliability, validity, and unidimensionality. The questionnaire (Appendix 3) was divided into three main sections briefly discussed below:

1) The first section (demographics) captured the background information about the respondents and their firms. This included the information about the budget for both firm and specific NPD projects, firm size, and respondent role during the project. Based on this information, a more detailed analysis of risk types can be made.
2) The second section (project description) was intended to capture the information about a particular NPD project. This was an important section as it addressed an important part of the research question.
3) The third section (risk types) captured the information about different risks associated with a particular NPD project. Respondents were asked to provide their perception about the probability of occurrence and impact for every risk dimensions. They were further asked to provide their judgment about how to manage the risk effectively.

The online survey was then sent to respondents along with the letters to explain the nature of the research.

The following sections will attempt to define the different components of NPD project risks and suggest a measurement scale for each of the risk factors for further empirical validation. It will first specify the domain and dimensionality of the constructs by identifying the NPD project risk factors through the review of the NPD literature. This is particularly important as Churchill, (1979) suggests that the first step in developing instruments is to specify the domain of the construct. This means that researchers should be as exact as possible in defining the conceptual content of the construct under investigation. The specification of the construct domain makes it clear what is included in the construct definition and what is excluded. The detailed procedure for instrument develops is provided in accordance with each component of proposed risk taxonomy. First, the instrument for each of NPD project risks will be developed (section 3.4.5.1 to 3.4.5.6). Next, the instrument for moderating factors i.e. NPD project type, firm size and industry sector will be provided (3.4.5.7 to 3.4.5.10).

3.4.5.1 Technological risk

3.4.5.1.1 Technological rapidity

Technological rapidity refers to the extent to which the technology changes over time or becomes obsolete during the NPD project (Buganza et al., 2009). The extensive literature review suggests that many technological rapidity measurement items have been developed and validated in previous studies. Previously tested and validated instruments allow the researcher to conduct research that is methodologically sound and produces results that easily lend themselves to comparison with other studies. Therefore, it is advisable to re-use the instruments developed and validated in one study rather than "re-inventing the wheel again" (Wallace et al., 2004). The reuse of validated instruments also ensures that researchers are measuring the same constructs in the same way and will strengthen the relationship among studies through the triangulation and confirmation of earlier results (e.g. Cook and Campbell, 1979).

It was also observed that the items developed by existent studies do not vary substantially despite development in different contexts (e.g. software development, FMCG sectors). For example, the initial studies which developed the items for technological rapidity were those of Bucklin and Sengupta, (1992), and Cooper, (1985; 1993). Technological rapidity was measured in terms of stability, predictability, and complexity of technology. Similar items (with minor modification of wordings) were adopted in later empirical studies. For example, Bstieler and Gross, (2003) and Bstieler, (2005) used these items in their empirical studies of 50 high-tech Canadian and Australian companies. Song and Montoya-Weiss, (2001) also used these items to measure technological rapidity in 500 Japanese NPD projects.

Jaworski and Kohli, (1993) developed and validated a similar instrument for technological rapidity in an empirical study of American marketing firms, but with the addition of few more factors to the existing three, namely frequent product modification, emergence of major opportunities for a firm due to rapid technological change and intensity of R&D efforts in the industry. Afterwards, these instruments were adopted by Lee and Johnson, (2010) in high tech USA industrial sector and by Candi et al. (2013) in Dutch innovation projects.

There were some other studies which provided instruments to measure technological rapidity, but these were excluded from the analysis. This was for two reasons. First, many studies reported results based on newly developed measures but failed to describe the instrument development process that was used. It is not enough for instruments to be available for reuse but these instruments must also exhibit high levels of reliability and validity to ensure the integrity of the research. Therefore, unless the development history of an instrument and the context of the studies where it was originally developed or used is known, it is hard to assess the reliability and validity of the instrument, and thus unclear if it is a suitable instrument to be used for another study (Moore and Benbasat, 1991).

Second, many studies which provided the instruments for technological rapidity were based in software development contexts. Examples are empirical studies by Barki et al., (2001), Jiang and Klein, (1999), Jun et al., (2011) and Wallace et al., (2004). In this research, I prioritize the items obtained from empirical studies conducted in multiple sectors or manufacturing sectors over software sectors. This is because software development projects due to their unique characteristics may not be similar to manufacturing products such as mobile, autos and aviation. Further, often the wordings of the items used in software context are modified according to software needs, and it was hard to adapt such items for our research. However, it does not mean that the items proposed in software development studies are not reliable or used at all; whenever I failed to obtain items from empirical studies conducted in multiple sectors or other manufacturing sectors, I adopted them from empirical studies conducted in software sector (as illustrated later).

Therefore, excluding the software context studies, I adopted the instruments provided by Bstieler and Gross, (2003) and Bstieler, (2005), Lee and Johnson, (2010) and Candi et al. (2013) for two reasons. First, the items provided in these studies were multi-scales which ensured a comprehensive coverage of the concepts/aspects mentioned in our definition. Second, these items were developed and validated across industries and are thus considered to be more reliable than items used in the specific sector. The items are summarized below in Table 3-2. (Please note that for the purpose of transparency, the wordings of all the items are kept as quoted by original authors. Due to this, items may not necessarily be consistent with other items in terms of structure and format).

Table 3-2: Items for technological rapidity

Sample items	Scale development
The technology in our industry is changing rapidly.	Adapted from Bstieler and Gross, (2003) and Bstieler, (2005), Lee and Johnson, (2010) and Candi et al. (2013) and anchored on the 6-point Likert scale.
Rapid technological changes in our industry necessitate frequent product modifications.	
It is very difficult to forecast where the technology in this industry will be in the next five years.	
Technological developments in our industry are frequent.	
The technology involved in this project is simple	

3.4.5.1.2 Technological capability

Unlike technological rapidity, few studies provided instruments to measure firm technological capability. Among them, Mu et al., (2009), through an extensive literature review and qualitative fieldwork, developed items that were validated through cross industrial surveys of NPD projects in Chinese manufacturing firms. The items were (i) strong and well-organized product development team and (ii) good understanding of the technology in the industry by the NPD team.

Stockstrom and Herstatt, (2008) used several existing items for measuring technological capability with minor modification and validated them in 475 research and development projects in Japanese electrical and engineering companies. The items were associated with the experience of the firm with the technical components of the new product, the lack of required production lines, and the experience of the firm with production processes and the availability of required competencies and skills to realize the product concept.

When integrated the items mentioned above cover all main aspects of our definition of technological capability. Therefore, for this research, the items are summarized in Table 3-3.

Table 3-3: Items for technological capability

Sample items	Scale development
The product development team is strong and well- organized	Adapted from Mu et al, (2009) and Stockstrom and Herstatt, (2008) anchored on the 6-point Likert scale.
The product development team understand technology of the industry well	
The required production lines and processes exist in our company.	

3.4.5.2 Marketing risk

3.4.5.2.1 Marketing rapidity

Market rapidity refers to the extent to which customer requirements change over time (Buganza et al., 2009). A firm is vulnerable to market rapidity at any time during the NPD project (Kayis et al., 2007), e.g. the sudden emergence of new customer requirements during the project execution phase (Dey et al., 2007; Thamhain and Skelton, 2007).

Many marketing rapidity measurement items have been developed and validated in previous studies. Furthermore, the items developed by these studies do not vary substantially except for minor wording modifications despite development in different contexts (e.g. software development, FMCG sectors).

The earlier studies which had suggested instruments for marketing rapidity were those of Bucklin and Sengupta, (1992), and Cooper~~,~~ (1985; 1993). Marketing rapidity was measured in terms of marketing stability and predictability. These items were then adopted in later empirical studies. For example, Bstieler and Gross, (2003) and Bstieler, (2005) used these items in their empirical studies of 50 high-tech Canadian and Australian companies.

A few other studies such as Nidumolu, (1995) and Polk et al., (1996) also developed and validated measures for marketing rapidity in Canadian, US and German high technology companies, respectively. However, these were subject to several limitations. First, some of these studies lack evidence of the reliability of the measures. Second, these measures were developed or used in a specific sector (software development e.g. Nidumolu, 1995). Third, the measures were narrowly developed i.e. all these studies described marketing rapidity in terms of stability only. Therefore, I excluded these studies from further analysis.

For the purpose of this research, I adopted the instruments provided by Bstieler and Gross, (2003) and Bstieler, (2005) because there was sufficient evidence of the reliability of the items and because the items were validated in various industries. Also, these items were adopted from studies of Bucklin and Sengupta, (1992), and Cooper (1985; 1993). The items are summarized below in Table 3-4.

Table 3-4: Items for marketing rapidity

Sample items	Scale development
The customer requirements in our industry are changing rapidly.	Adapted from Bucklin and Sengupta, (1992), Cooper, (1985; 1993), Bstieler and Gross, (2003) and Bstieler, (2005) and anchored on the 6-point Likert scale.
It is very difficult to forecast what will be the customer requirements in this industry in the next five years.	

3.4.5.2.2 Customer perceived risk

While there are quite a few empirical studies available which mention customer perceived risk, most of these studies were qualitative in nature and therefore could not provide much guidance about the instruments to measure customer perceived risk. Among the few studies that provided measures, Mu et al. (2009) has provided a single item to measure customer perceived risk in Chinese NPD projects. The item was communication with customers about the potential benefits of the product. Polk et al., (1996) also suggested a single measure, the satisfaction of customers with existing products, in the context of USA manufacturing sector.

Keizer et al. (2002) provided a comprehensive list of measures for customer perceived risk in the context of fast-moving consumer good (FMCG). The items suggested were product specifications meet customer demands and standards, new products fit consumer habits and user condition, new product offer unique features or attributes to customers, new product offer additional enjoyment compare to competitor product, new product appeals to generally accepted values e.g., health, safety, nature and environment, and finally new product will be communicated successfully to target customers.

There are a few empirical studies in the context of software development which prescribed measures for customer perceived risk such as Jun et al. (2011) and Wallace et al. (2004). However, these measures were not considered further due to their development in software context application. For the purpose of this research, I adopt the measures provided by Keizer et al. (2002) due to two reasons. First, it offers multiple items for measuring customer perceived risk. Second, items proposed by Mu et al. (2009) and Polk et al., (1996) were also covered in Keizer et al.'s (2002) study. The only drawback of Keizer study is that, while these items were generated through a systematic and extensive qualitative study, these were not tested or adopted as such by other researchers. The items are summarized below in Table 3-5.

Table 3-5: Items for customer perceived risk

Sample items	Scale development
Product specifications meet customer demands and standards	Items mainly adopted from Keizer et al., (2002) and Mu et al., (2009) and Polk et al., (1996) and anchored on 6-point Likert scale
New product fits consumer habits and user conditions	
New product offer unique features or attributes to customers	
New product offers additional enjoyment in less cost compare to competitor products	
New product appeals to generally accepted value e.g., health, safety, nature, and environment	

3.4.5.2.3 Marketing capability

While there are a large number of empirical studies which investigates the notion of marketing risk and poor firm marketing capabilities, most of these studies are case-based research (Tang et al., 2009) and therefore do not provide much guidance about the instruments to measure marketing capability of a firm. Among the few studies that provide measures, Mu et al. (2009) offered the following items to measure firm marketing capabilities: good understanding of customer requirements and needs by the NPD team; well-organized marketing channel; and good management of external marketing relationships. These items were used to study marketing risk management practices in Chinese manufacturing companies through a large-scale empirical survey. Nidumolu, (1995) also described the internal marketing capability through several items. However, I excluded that study because of the software context used in the study and because authors proposed only one item: poor internal mechanisms or procedures to convert customer needs into product specifications. Therefore, for this research, I propose to adopt the items suggested by Mu et al. (2009) which are summarized in Table 3-6.

Table 3-6: Items for marketing capability

Sample items	Scale development
The NPD team understands well the customer needs and requirements.	Mu et al., 2009 and anchored on 6-point Likert scale
There is a well-organized marketing channel.	
The firm manages external marketing relationships well.	

3.4.5.2.4 Competition

The extensive literature review suggests that many competition measurement items have been developed and validated in previous studies. Some researchers described it with a single item only. For example, Bstieler and Gross, (2003) and Bstieler, (2005) described it in terms of degree of marketing competition. Mu et al. (2009) suggest a single measure: adequate evaluation of competitors, which was validated in NPD manufacturing sectors at China.

Other studies such as Polk et al., (1996) provided several items to measure competition risk: dominant large share competitor in the market; many competitors in the market and highly competitive market; intense price competition in the market; and large market size. Similarly, Floricel and Ibanescue, (2008) suggested the measures for competition risk in terms of frequent entry of new competitors, the threat from established competitors, the effect on a product due to competitor action and availability of low-cost substitute. For the purpose of this research, I propose to adopt the items provided by Floricel and Ibanescue, (2008) and Polk et al., (1996) due to their comprehensive coverage of different aspects of competition. The items are summarized below in Table 3-7.

Table 3-7: Items for competition

Sample items	Scale development
Very often, new competitors enter the sector with innovative products	Adapted from Floricel and Ibanescue, (2008) and Polk et al.,(1996) and anchored on 6-point Likert scale
Established competitors constantly challenge our positions	
Our products are constantly under attack from low-cost substitutes	

3.4.5.3 Operational risk

3.4.5.3.1 Resource risk

Resource risk emerges due to unavailability of any of critical resources such as equipment and facilities (Gon and Choi, 2012).

Mu et al. (2009), in the context of Chinese NPD projects, used a single item related to resource: "the availability of monetary and other resources for the project". Similarly, Keizer et al. (2002) provided two items as i) availability of required resources whenever required and ii) sufficiency of raw materials. Polk et al., (1996), however, provided more specific items for measuring resources risk: adequacy of engineering skills and resources; and adequacy of production skills and resources. In this research, Iadopted the scales used by Polk et al., (1996) and Keizer et al. (2002) as these are more specific and clear in terms of scope. The items are summarized below in Table 3-8.

Table 3-8: Items for resource

Sample items	Scale development
The firm has adequate required engineering resources	Adapted from Polk et al. (1996) and Keizer et al. (2002) and anchored on 6-point Likert Scale
The firm has adequate production resources	
The firm has access to sufficient raw materials to meet technical requirements	

3.4.5.3.2 Human resource risk

While, there are only a few studies which have provided instruments for measuring human resource risk, these measures were mainly validated in the software development sector (e.g. Barki et al. 2001; Huang and Han, 2008; Jiang and Klein, 1999; Jun et al., 2011; Wallace et al. 2004). The instruments used in these studies did not vary substantially except for minor wording modifications and specificity of a few items. For example, Jiang and Klein (1999) and Wallace et al. (2004) used six items to describe the nature of risks which occur among the human resources. This includes conflict among team members, frequent turnover of people, the unfamiliarity of tasks by team members, lacking specialized skills, inexperienced team members, and inadequately trained team members. Other authors such as Hang and Huan, (2008) and Jun et al. (2011) have adopted similar items in their studies.

Keizer et al. (2002) suggested a single item for measuring human resource issue as the sufficient qualification of project team members.

For the purpose of this research, I adopted the measures provided by Wallace et al. (2004) and other studies conducted in software development sectors as these provide more specific and comprehensive items. The items are summarized below in Table 3-9.

Table 3-9: Items for human resource

Sample items	Scale development
Frequent turnover of staff within the project team	Adapted from Wallace et al. (2004); Jiang and Klein, (1999) and anchored on 6-point Likert scale
Team members lack specialized skills required by the project	

3.4.5.3.3 Planning risk

Keizer et al. (2002) suggested items to measure planning related risks in terms of feasibility of project goals and objectives, defining roles, tasks, and responsibilities of all NPD team members and reliable and feasible estimation of required resources.

In the context of software development, several studies made an attempt to provide items for measuring planning risk. For example, Jiang and Klein, (1999) developed two items for planning risk related to lack of clarity of role definitions only. Schmidt et al. (2001) also suggested items as understanding of project objectives by team members, devising deadlines for projects and effective planning for the project. Wallace et al. (2004) also developed multi-scale items quite similar to Schmidt et al.

(2001) in terms of effective project planning, the setting of project milestones, estimation of required resources and project schedule.

From the above, I proposed to choose the items suggested by Wallace et al. (2004) and Jiang and Klein, (1999) because they offer a comprehensive conceptualization of planning risk (Table 3-10).

Table 3-10: Items for planning risk

Sample items	Scale development
Special attention is paid to project planning	Adapted from Wallace et al. (2004); Jiang and Klein, (1999) and anchored on 6-point Likert scale
Project milestones are clearly defined	
Members of the project team are clear to their roles and responsibilities	
Relevant resources and schedule is adequately estimated	

3.4.5.3.4 Control risk

Various studies have proposed control risk measures in different contexts. For example, Mu et al. (2009) developed measures for control risk in terms of cross-functional cooperation and need for a mechanism for contingency planning. These measures were validated in the Chinese manufacturing sector. Keizer et al. (2002) also proposed measures for issues pertinent to control risk in terms of effective decision-making process, effective communication among the team members, monitoring of project progress and contingency planning.

In the context of software development projects, Wallace et al. (2004) developed the measures for control risk in terms of monitoring of project progress, project management methodology and effective communication. Schmidt et al. (2001) proposed measures for control risk factors in terms of the development process, change management process and risk management process used by the firm to develop a product. Other studies also suggest similar measures including monitoring the performance and lack of communication (Han and Huang, 2008), communication (Jiang and Klein, 1999), and intensity of conflicts (Barki et al., 2001).

Items suggested by any single study are not sufficient to represent the concepts mentioned in our definition of control risk earlier. It requires us therefore to integrate the items suggested by Mu et al. (2009), Wallace et al. (2004) and Schmidt et al. (2001). The items are summarized below in Table 3-11.

Table 3-11: Items for control

Sample items	Scale development
Project progress is monitored closely enough	Adapted from Mu et al. (2009); Wallace et al., (2004); Schmidt et al. (2001)and Keizer et al. (2002) and anchored on 6-point Likert scale
Communication within the project team is effective	
The firm can respond quickly to changes in its NPD plan	
There is good cross-functional cooperation.	
The standards for effective development process/methodology are met	

3.4.5.3.5 Strategic management

Keizer et al. (2002) suggested measures for strategic management risk in terms of favorable internal political climate and top management supports. Wallace et al. (2004), refers strategic management risk as the organizational environment and developed its measure with the help of a literature review and a field study. They suggested the following items: top management support; change in organizational management; restructuring of the organization during the project; unstable organizational environment; corporate politics; and change in organizational priorities. Similar measures were then adopted by Huang and Han, (2008). Finally, Schmidt et al. (2001) developed the measures for strategic management risk in terms of climate change in organizational environment, the mismatch between culture and business process, politically motivated projects, unstable corporate environment, changes in ownership during the project and lack of top management commitment.

From the above, I propose to adopt measures suggested by Schmidt, (2001) due to the fact that these are not only matches with measures provide by other authors, but at the same time, offered additional measures. The items are summarized below in Table 3-12.

Table 3-12: Items for strategic management

Sample items	Scale development
Resources shifted away from the project because of changes in organizational priorities	Adapted from Schmidt et al., (2001) and anchored on 6-point Likert scale
Change in organizational management during the project	
Corporate politics with negative effect on project	
Organization undergoing restructuring during the project	
Lack of top management support and commitment to the project	

3.4.5.4 Supply chain risk

While NPD literature increasingly addresses supply chain risks and their interactions with NPD project, I failed to locate any large scale quantitative empirical study which could provide existing measures for supplier-related risks. Only the study by Keizer et al. (2002) provided a few measures for supplier-related risks. As mentioned earlier, the drawback of Keizer et al.'s study is that these items were developed through field work conducted in a single large firm and there is no evidence that these were adopted or validated by other researchers. I also consulted supply chain literature to ensure the reliability of the items suggested by Keizer et al. (2002). Key papers consulted were of Wagner and Bode, (2008) and Punniyamoorthy et al. (2011). They suggested the items summarized below in Table 3-13.

Table 3-13 Items for supplier related risks

Sample items	Scale development
Appropriate selection criteria is adopted when selecting supplier (i.e. financial position of supplier is sound; past experience with each supplier is positive, and suppliers are flexible to accept modifications)	Adapted from Keizer et al. (2002); Wagner and Bode (2008); Punniyamoorthy et al. (2011) and anchored on 6-point Likert scale
Appropriate contract management with supplier is settled	
Supplier will be reliable in delivering according to agreement	
Supplier will meet required quality	
Contingency options is available for each of the selected suppliers	
The firm manages the supplier relationship well	

3.4.5.5 Financial risk

3.4.5.5.1 Financial unpredictability

Very few studies investigated the notion of financial risk empirically, and so there was only one study which could provide the items to measure the financial risk (Schmidt et al., 2001). They suggested measures for financial unpredictability in terms of under-funding of budget and estimation of costs and related financial indexes. For the purpose of this study, I adopt the same measures. The items are summarized below in Table 3-14.

Table 3-14: Items for financial unpredictability

Sample items	Scale development
Under-funding of development: Setting the budget for a development effort before the scope and requirements are defined or without regard to them.	Adapted from Schmidt et al. (2001) and anchored on 6-point Likert scale
Bad estimation: Lack of effective tools, structured techniques, and skills to properly estimate the scope of work.	

3.4.5.5.2 Unavailability of adequate finances and budgets

Keizer et al.(2002) and Mu et al.(2009) provided a single item to measure unavailability of funding. For the purpose of this study, I adopt the same single measure which is summarized below in Table 3-15.

Table 3-15: Items for unavailability of adequate finances and budgets

Sample items	Scale development
There are stable funding resources for the project.	Adapted from Mu et al. (2009) and Keizer et al. (2002) and anchored on 6-point Likert scale

3.4.5.6 Environmental risk

3.4.5.6.1 Political factors

While there are some case studies in the NPD literature which describe the implications of political factors on NPD projects, I could not locate any empirical study that could provide the instruments for measuring the impact of political factors on NPD project. The definition of political factor suggests two important constructs (political instability and policy instability). Based on this, I adopt the two-item instrument provided by supply chain discipline (Wagner and Bode, 2008) for measuring political risk. The items are summarized below in Table 3-16.

Table 3-16: Items for political factor

Sample items	Scale development
The extent to which firm has faced negative influence on NPD project due to changes or the introduction of new laws, stipulations, etc.	Adapted from Wagner and Bode, (2008) and anchored on 6-point Likert scale
The extent to which firm has faced negative influence on NPD project due to political instability, war, civil unrest or other socio-political crises.	

3.4.5.6.2 Social factors

Freise and Seuring, (2015) developed the instruments for measuring social related risk and their influence on European clothing and retailer industry. For the purpose of this study, I adopt the measures suggested by them which are summarized in Table 3-17.

Table 3-17: Items for social factors

Sample items	Scale development
Products and processes of our company are influenced by legal demand on social issues	Taken from and Freise and Seuring, (2015) and anchored on 6-point Likert scale
The key opinion formers for the new product are known, and their support is assured	
Possible negative external reaction will be effectively anticipated	

3.4.5.6.3 Macroeconomic factors

Gon and Choi, (2012) and Van thuyet et al.(2007) suggested a single item measure for macroeconomic factors in their empirical studies in terms of the influence of a change in exchange rate, fluctuation rate, and macroeconomic situation. Consequently, I adopt that measure (Table 3-18).

Table 3-18: Items for macroeconomic factors

Sample items	Scale development
Product and processes in our firm are influenced by sudden change in macroeconomic such as exchange rate and fluctuation rate	Taken from Van thuyet et al.(2007) and Gon and Choi, (2012) and anchored on 6-point Likert scale

3.4.5.6.4 Natural factors

While there was no study in the NPD literature to describe the measures for natural factors, I adopt the two-item instruments provided in the supply chain discipline (Wagner and Bode, 2009) for measuring natural factors (Table 3-19)

Table 3-19: Items for natural factors

Sample items	Scale development
The extent to which firm has faced negative influence on NPD project due to diseases or epidemics (e.g., SARS, foot and mouth Disease).	Adapted from Wagner and Bode,(2008) and anchored on 6-point Likert scale
The extent to which firm has faced negative influence on NPD project due to natural disasters (e.g., earthquake, flooding, extreme climate, tsunami).	

3.4.5.7 Hypothesized moderating effect of NPD type

The moderating factor NPD project type will be operationalised using a 4-item scale that was proposed in several studies (e.g. Keizer et al., 2002; Keizer et al., 2007 and Keizer and Halman, 2009) and later validated by Valle and Vazquez-Bustelo, (2009). The measurement model for the factor is displayed in Table 3-20.

Table 3-20: Items for distinguishing NPD project type

Sample items	Scale development
Degree of technological uncertainties	Keizer et al., 2002; Keizer and Halman., 2007 and Keizer and Halman, 2009) and later validated by Valle and Vazquez-Bustelo, (2009).
Degree of market uncertainty	
Degree of novelty	
Degree of project complexity	

3.4.5.8 The use of firm size as a moderating variable

To assess the firm size, respondents will be asked to classify their firm as per the number of the employees.

3.4.5.9 The use of industry type as control variable

To assess the industry type, respondents will be asked to classify their industry from the drop down list.

3.5 The use of single construct

Please note that after the pilot study, the items used for each risk measure were reduced to 1. I.e. each risk factor was evaluated with single constructs only. The decision for using the single item construct was an informed decision which was based on several reasons. First, the management literature suggests that decision to use single construct depend upon the nature of the construct whether is it concrete construct or an abstract construct? (Rossiter, 2002) In this thesis, it was ensured that all constructs were concrete. The respondents were provided a cover letter where each risk construct was specifically defined so that respondents do not take alternate meaning of risk construct. Furthermore, the existing scales proposed in the literature were often redundant in nature as evident from tables 3-1 to 3-20. To ensure no redundancy, I chose a single instrument with highest loading factor for each risk construct (Albers and Hildebrandt, 2006). The literature further recommends that when survey is to be administered to a wider range of population and involves multiple stakeholders (which is the case in this thesis), then the use of single item construct is more advantageous (Gorsuch and McPherson, 1989, p. 352).

3.6 Sample frame and procedure (pilot study)

The sampled firms in the pilot study were randomly selected from the FAME database, social media sources and through personal contacts. Surveys were mailed to the managers, with a cover letter and explanation of the survey items (See Appendix 3). In total, 50 responses were recorded.

While the constructs employed for this research are well grounded in the literature and have also been previously tested and validated in the extant research, the pilot sample responses were used to purify measures and provide evidence of the validity and reliability of scale items. Following Churchill's (1979) recommendations, all measures were purified using the data collected from the pilot study.

3.6.1 Reliability analysis

The reliability measurement of data collection instrument indicates how reliably the scales have measured a construct via a set of items (Field, 2013). For this purpose, Cronbach's alpha coefficient is a widely accepted tool that indicates the average correlation between the items that constitute a construct. The value of Cronbach alpha oscillates between 0 and 1. The value above 0.60 is generally accepted as reliable (Field, 2013). In this research, I started looking the existing scales and instruments in the past studies. Previously tested and validated instruments allow the researcher to conduct research that is methodologically sound and produces results that easily lend themselves to comparison with other studies (Lee and Johnson. 2010). Therefore, I preferred to re-use the existing instruments and validate them for my research rather than re-inventing the wheel again (Wallace et al., 2004). The reuse of validated instruments also ensures that researchers are measuring the same constructs in the same way and will strengthen the relationship among studies through the triangulation and confirmation of earlier results (Cook and Campbell, 1979). I also noticed that the items developed by existent studies do not vary substantially despite development in different contexts (e.g. software development, FMCG sectors). The process of adopting the instruments for every construct of this research is explained in hypothesis development section (2).

3.6.2 Content validity

The content validity refers to the extent to which an instrument provides adequate coverage for the construct domain. In accordance with the recommended procedure (Anderson and Gerbing, 1988; Field, 2013; Tabachnick and Fidell, 2014), a systematic approach for content validity was carried out:

I. The content validity of the instrument was first carried out by grounding the constructs, scales, and items in existing literature (as explained in hypothesis development chapter).

II. Nine fellow researchers, faculty members with NPD experience at Cranfield University (UK), King Fahd University of Petroleum and Minerals (Saudi Arabia), Sharja American University (UAE) and the Technische Universität München (Germany) were asked to evaluate the questionnaire in terms of structure, readability, and ambiguity. A pilot study was carried out with the help of 50 NPD project professionals in the UK. The purpose of conducting the pilot study was to examine the validity and reliability of each of the measures employed in the questionnaire.

3.7 Data from different Sources and its potential implication

In this thesis, I used internet technology such as the Fame database and social media tools including Linked-in and Xing. The use of these technologies offered me a rich, naturally-occurring data and I managed to recruit 70% of the total responses through them. Additionally, I use research seminars as a strategy to reach to respondents which otherwise was seen to be impossible. Researchers can get benefit of this experience and could broad their data collection toolkits particularly in the case of survey research and when recruiting the respondents. One benefit for conducting the survey through research seminars was that almost all respondents were relatively compelled to answer the questions. So the return rate was almost 100 % compare to the questionnaires send through internet technology. In order to check if there was a significant difference between the responses for any of the variables, a one–way analysis of variance (ANOVA) was conducted. The results of the ANOVA procedure showed no significant differences between the responses achieved from internet technology and social media, and those responses which were achieved through seminars and one to one basis. Overall, the findings conclude that achieving data from different sources did not reveal any sort of significant concern and bias (Hair et al., 2010; Field, 2013).

3.8 Data reduction and analysis

Before I started analysing the data, I performed a thorough check on data set for errors. When checking for errors, I primarily looked for values that fall outside the range of possible values for each of the risk variable (Field, 2013). I further inspected the frequencies for each of the variables and ensured that each value from respondents make sense. Here, I found three types of problems: non-serious response, values not making sense and missing values. I identified a couple of non-serious responses by many respondents. For example, instead of filling the open-ended questions with relevant answer, these respondents used irrelevant language. All such responses were discarded from the sample. In the case of missing values and those values which did not make sense, mean substitution based imputation technique was adopted to substitute such cases (Hair et al., 2011). The reason for adopting this technique rather than discarding all missing values was to avoid the risk of low response which could then potentially affect the data analysis (Pallant, 2007).

The questionnaires were coded and entered into IBM's Statistical Package for Social Sciences (SPSS) for onward analysis. The sample size of 263 was considered adequate to conduct parametric analysis as per the rule of thumb of 10 cases for each predictor variable (Tabachnick and Fidell, 2014). Therefore, the sample size assumption of the central limit theorem was applied to conduct parametric analysis (Field, 2013; Hair et al., 2011).

3.8.1 Analysis for descriptive analysis

I first conducted descriptive statistics to gain insight of the basic features of the data. Descriptive statistics enabled me to present the data in a more meaningful way, which allows simpler interpretation of the data. I used bar charts to show the number of cases in particular categories. As shown later, I used bar charts for illustrating the patterns for development budget for NPD projects allocated by firms, annual turnover, the frequency of respondents based on NPD project types and firm sizes. Besides using bar charts, I also used cross-tabulation which is a joint frequency distribution of cases based on two or more categorical variables e.g., analyzing the relationship between firm sizes and NPD project budget by cross tabulation. To confirm the association between cross-tabulated variables, I then conducted chi-square test to see whether two categorical variables are significantly associated. Chi-square test determines whether two variables are statistically independent. It does this by comparing the observed frequencies in the cells with the expected frequencies (Field, 2013). The greater the association between the two variables, the greater the observed frequencies compare to the expected frequencies. The converse is also true (Field, 2013). To run the chi-square test for association, three assumptions were satisfied:

i) **There have to be two categorical variables:** All variables which were analyzed through chi-square test were categorical variables e.g. (SMEs, large firms) or (Incremental NPD, Radical NPD).

ii) **Independence of observations:** Independence of observations means that there is no relationship between the observations in the groups of the categorical variables or between the groups themselves (Pallant, 2007). More explicitly, independent groups (in a chi-square test for association) are groups where there is no relationship between the participants in any of the groups. This was ensured simply by having different participants in each group.

iii) **Expected count in each cell greater than five:** There were more than five observations in each cell.

3.8.2 Analysis for research question 1: What risks do managers of NPD projects perceive?

The objective of research question 1 was to identify most frequent perceptions of respondents about probability and impact of every risk types. This was achieved through two ways:

1) **By measuring central tendency and measure of spread:** I described the central position of different constructs by using a number of statistics, including the mode and mean and standard deviation. The mean (or average) is the most popular and well-known measure of central tendency. It is equal to the sum of

all the values in the data set divided by the number of values in the data set (Field, 2013). Mathematically it is represented as:

Equation 1

$$\bar{x} = \frac{(x_1 + x_2 + \cdots + x_n)}{n}$$

The mode is the most frequent score in the data set. In the case of this research, it is the most frequent perception of respondents towards NPD project risks. The standard deviation is a measure of the spread of scores within a set of data. The standard deviation can either be calculated from entire population or sample of the population (Altman and Bland, 2005). Because the data, I collected is a sample of the population, I estimated the population standard deviation from a sample standard deviation. In addition to these, I draw bar-chart for the probability of occurrence and potential negative impact of each risk types.

2) **By conducting one sample t-test:**

The one-sample t-test (also called the "single-parameter t-test" or "single-sample t-test") is used to determine whether a sample comes from a population with a specific mean. It can also be used to compare a value from a sample to a criterion measure (i.e. to some other value) (Altman and Bland, 2005). This test was used to gain further insight into research question 1. With the help of test, I compared the mean values for both probability and impact of each risk type with a criterion measure (i.e., a hypothesized value). The criterion measure in this case was adopted from the likert scale levels as shown in Table 3-21. I chose hypothesized scores of 4 (representing likely) and 5 (representing extremely likely) for the probability of occurrence. In the case of potential negative impact, the value 4 represent major impact and 5 represent extreme impact. In other words, whenever any risk factor, achieve a score of (4 or 5 either in probability and impact), is deemed to have either high likelihood of occurrence or potential negative impact on NPD project.

Table 3-21: Risk assessment scales (probabilities and level of impact)

Level	Probability of occurrence	Level	Impact on project
1	Extremely unlikely	1	None
2	Unlikely	2	Minor
3	Neither likely nor unlikely	3	Moderate
4	Likely	4	Major
5	Extremely likely	5	Extreme
6	Do not know	6	Do not know

For this purpose, the one-sample t-test was used to determine whether there was a statistically significant difference between the mean perceptions of NPD respondents on probability and impact of each risk types and the criterion measure (mean value of probability and impact > 3).

The null hypothesis (H_0) for the one-sample t-test was as follows:

$$H_0: \mu = \mu_0$$

Where μ = population mean (estimated from a sample) and μ_0 is a known or hypothesized population mean. In words, the null hypothesis states that the population mean (estimated from a sample) is equal to a known or hypothesized population mean.

Based on this, I formulated the hypothesis as

there is no difference in the mean perception of respondents about the probability of NPD project risk and the hypothesized criterion measure (i.e. likelihood >3)

there is no difference in the mean perception level of respondents about the impact of NPD poject risk and the hypothesized criterion measure (i.e. likelihood >3)

The alternative hypothesis (H_A) for the one-sample t-test is:

$$H_A: \mu \neq \mu_0$$

In words, the population mean (estimated from a sample) is not equal to a known or hypothesized population mean. The alternative hypothesis states that the population mean (estimated from a sample) is not equal to a known or hypothesized population mean. Based on this, I formulated the hypothesis as

there is a difference in the mean perception of respondents about the probability of NPD project risk and the hypothesized criterion measure (i.e. likelihood >3)

there is a difference in the mean perception of respondents about the impact of NPD project risk and the hypothesized criterion measure (i.e. likelihood >3)

A critical part of the process involves four assumptions that need to be satisfied before one sample t- test can be conducted:

i) **Continuous dependent variable:** All risk types scored on the 6 point lickert scale by respondents were regarded as continuous variables.

ii) **Independence of observations:** All observations were independent.

iii) **Should be no significant outliers:** Outliers can have a large negative effect on the results of one sample t-test because they can exert a large influence (i.e., change) on the mean and standard deviation of the each risk type, which can affect the statistical test results (Field, 2013). All outliers were removed from the sample.

iv) **All risk variables need to be normally distributed:** The assumption of normality is necessary for statistical significance testing using a one-sample t-test. However, the one-sample t-test is considered "robust" to violations of normality (Field, 2013). This means that some violation of this assumption can be tolerated and the test will still provide valid results (Cohen, 1990). In this research, I argue that by considering the sample size assumption of the central limit theorem, all the risk types are normally distributed (Hair et al., 2011; Field, 2013).

3.8.3 Analysis of research questions 2: How, and in which ways, do risks in NPD projects vary with (i) project type and (ii) firm size iii)industry sector

By answering this question, this work empirically identified if both, probability of occurrence and impact of every risk type differed significantly in different

a) Project types (Incremental vs. radical).
b) Firm sizes (SMEs vs. large firms)
c) Industry sector

Because both project type and firm size were binary variable i.e. they have two categories only, I conducted the analysis in the following way.

1) By conducting ANOVA

To determine whether there are any statistically significant differences between the means of two or more independent groups, a one-way analysis of variance (ANOVA) is used. Because one-way ANOVA is an omnibus test statistic and cannot tell which specific groups were significantly different from each other; it only tells that at least two groups were different (Field, 2013). To test this, the null hypothesis is stated as 'there are no differences in population means between the groups'. Mathematically, it is mentioned as

H_0: all group population means are equal (i.e., $\mu_1 = \mu_2 = \mu_3 = ... = \mu_k$)

where μ = population mean and *k* = number of groups.

In the case of this research, the null hypothesis for NPD project type

H_0: The means values for NPD project risks in incremental product is equal to the mean values for NPD project risks in radical products (i.e., $\mu_{incremental} = \mu_{radical}$)

My aim however, is to find evidence against this null hypothesis and accept the alternative hypothesis, which states that there are differences between the group population means

H_A: at least one group population mean is different (i.e., they are not all equal)

The one-way ANOVA calculates an *F* ratio based on the variability between groups versus the variability within groups (Kirk, 1996). The probability (*p*-value) of finding an F ratio as large as the one calculated by the one-way ANOVA is used to either reject or not reject the null hypothesis. If this probability value is less than .05 (i.e., $p < .05$), there is a less than 5 in 100 (5%) chance of the F ratio being as large as calculated, given that the null hypothesis is true (Kirk, 1996).

A critical part of the process involves six assumptions that need to be satisfied before one-way ANOVA can be conducted (Rutherford, 2011). The first three assumptions of the one-way ANOVA relate to the study design: first to have a continuous dependent variable; second independent variable is categorical with two or more independent groups and third, independence of observations. All three assumptions are satisfied for the study design. The other three assumptions were related to how empirical data fits the one-way ANOVA model. Among these, the first one is related to outliers in the dataset. Outliers can have a large negative effect on the results because they can exert a large influence (i.e., change) on the mean and standard deviation for that group, which can affect the statistical test results. All outliers were removed from the sample. The second assumption is the normality of data sets. For this research, the sample size assumption of the central limit theorem suggests that all the risk types are normally distributed (Field, 2013; Hair et al., 2011; Tabachnick and Fidell, 2014). The final assumption is associated to the homogeneity of variances which states that the population variance for each group of the independent variable is the same. The assumption of homogeneity of variances is tested using Levene's test of equality of variances, which determine whether the variances between groups for the dependent variable are equal. If Levene's test is statistically significant (i.e., $p < .05$), then it means groups do not have equal variances and have violated the assumption of homogeneity of variances (i.e. group has heterogeneous variances). On the other hand, if Levene's test is not statistically significant (i.e. $p > .05$), then there is equal variances, and there is no any violation of the assumption of homogeneity of variances (Field, 2013; Rutherford, 2011).

2) By conducting binary logistic regression

A binary logistic regression predicts the probability that an observation falls into one of two categories of a dichotomous dependent variable based on one or more independent variable (Cohen, 1990). For the purpose of this research, I decided to use binary logistic regression to predict whether different NPD project risks will occur in a) radical or incremental NPD projects or b) SMEs or large firms. For the illustration purpose, here, the dichotomous dependent variable would be "NPD project types", which has two categories “increment" and "radical" and independent variables are all NPD project risk types. Logistic regression provides a coefficient b which measures each independent variable’s partial contribution to variations in the dependent variable (Pallant, 2007). The goal is to correctly predict the category of outcome for individual cases using the most parsimonious model (Cohen, 1990). For example, if I consider independent variables to be "all NPD project risk" and the dependent variable to be "NPD project type", a binary logistic regression models the following:

$$\textbf{logit(NPD project type)} = \beta_0 + \beta_1\textbf{Tech.Rap.Risk} + \beta_2\textbf{Tech.Cap.Risk} + \beta_3\textbf{Mar.Rap. Risk} + \ldots\ldots + \varepsilon$$

Where

β_0 is the intercept (also known as the constant), β_1 is the slope parameter (also known as the slope coefficient) for technological rapidity risk, and so forth, and ε represents the errors (Laerd Statistics, 2015).

The binary logistic regression analysis was performed to ascertain the effects of all 18 sub-categories of NPD project risks on: i) NPD project types and ii) firm sizes. In the case of NPD project type, I run two logistic models separately for both incremental and radical NPD types. In the first model, radical NPD type was coded as 1 and incremental NPD type as 0. In the second model, incremental NPD type was coded 1 and radical NPD type as 0. Before running the models, there are six assumptions that should not be violated (Cohen, 1990). The first four assumptions relate to the study design and include (a) dependent variable should be dichotomous; (b) there have to be two or more independent variables, which can be either continuous variables (i.e., an interval or ratio variable) or nominal variables; (c) there should be independence of observations; (c) the categories of the dichotomous dependent variable and all nominal independent variables should be mutually exclusive and exhaustive; and (d) there should be a bare minimum of 15 cases per independent variable. All these four assumptions were satisfied in this case. The other two assumptions relate to the nature of data. Among these, the first one is the assumption of linearity which requires that there is a linear relationship between the continuous independent variables (in this case all the NPD project risks) and the logit transformation of the dependent variable (NPD project types). The linearity of the continuous variables with respect to the logit of the dependent variable was assessed via the Box-Tidwell (1962) procedure (Laerd Statistics, 2015). The second assumption is that there should be not any significant outliers. Once all the assumptions are satisfied, I ran the model.

From the output, there are three important tables that need to be considered to make sense of the analysis (Laerd Statistics, 2015). The first table Omnibus tests of model coefficient provide the overall statistical significance of the model. The model is statistically significant as long as ($p < .0005$). The second table is for the explanation of variance in the models i.e. how much variation in the dependent variable can be explained by the model (Cohen, 1990). For this, I used Cox and Snell R Square and Nagelkerke R Square values which are both methods of calculating the explained variation (Laerd Statistics, 2015). The third table is titled as the Variables in the Equation table shows the contribution of each independent variable to the model and its statistical significance (Laerd Statistics, 2015). The Wald test is used to determine statistical significance for each of the independent variables. For example, as clear from Appendix 5, there is a strong significant negative association ($p <0.015$) between the probability of marketing capability risk and radical NPD type. The B coefficients are used in the equation to predict the probability of an event occurring. The output also includes the odds ratios of each of the independent variables. This informs the change in the odds for each increase in one unit of the independent variable. For example, a unit increase in the probability/impact of risks decreases the odds of radical NPD to be developed by certain proportion (Appendix 5a & 5b).

For industry sector, I performed the analysis as follow. A one-way analysis of variance (ANOVA) was conducted for which the same procedure for ANOVA test was followed as mentioned in part (7a&7b). Based on the nature of research question, the following hypotheses were proposed.

Null hypothesis

'there is no significant difference in the a)likelihood of occurrence and *b) negative impact of different risks within NPD projects associated with different industry types.*

Alternative hypothesis

'there is significant difference in the a)likelihood of occurrence and b) negative impact of different risks within NPD projects associated with different industry types.

3.8.4 Analysis of research questions 3: How do perceptions of NPD projects' risks vary among the team members with different backgrounds and managerial roles involve in NPD project?

By answering this question, this work empirically identified if perceptions of NPD projects' risks vary among the team members with different backgrounds and managerial roles involve in NPD project. Specifically, I compared the perceptions of:

a) Team members from technological functions (e.g., R&D, product design etc) versus all others (e.g. manufacturing, supply chain or finance etc)
b) Team members from top management (e.g., CEO, general manager or BOD member) versus all others (middle and lower level management)

Based on the nature of research question, the independent sample t-test was used to determine whether there was a statistically significant difference between the mean perceptions of team members. This test is used to determine if a difference exists between the means of two independent groups on a continuous dependent variable (Laerd Statistics, 2015). For this purpose, I formulated following hypotheses:

Null hypothesis

'there is no difference in the mean perception level of NPD project risks among the team members

Alternative hypothesis

'there is a difference in the mean perception level of NPD project risks among the team members

It is important to mention here that t-test requires that the assumption of homogeneity of variances is met. If it is not met, the result might not be valid. However, a modification can be made to the standard t-test to accommodate unequal variances. This modified t-test is often referred to as the unequal variance t-test**,** separate variances t-test**,** or the Welch t-test (Welch, 1951).

4 Descriptive analysis of the data

4.1 Introduction

Chapter 1 presents the descriptive analysis of the data collected for this research which comprised of 263 NPD projects from UK firms. The chapter is structured as follow. First, the basic profile of the respondents including budget, firm size and managerial role is reported (sections 4.2 to 4.7). Then, a cross tabulation is conducted between important variables to identify if any pattern emerges from the data (sections 4.8 to 4.12). Finally, a summary of descriptive analysis is provided (4.13).

4.2 Development budget for NPD projects

From Table 4-1 and Figure 4-1, I can see that across many industries, there are numerous examples of low-cost products (about 45 % of total). Products associated with low budget categories (up to £100k) were dispersed but with majority from software developments (as low as up to £20k). Other low cost development products included food products, jewellery and some customized wooden and apparel products such as special table, chairs, carpets and rugs. Developments in computer and electronic related products ranged from £100k up to £10M. High budget development products were often associated with defence, aerospace and large scale engineering projects (Table 4-1; Figure 4-1)

4.3 Firm sizes

Most respondents were from larger firms between (251-1000) and (more than 1000) employees categories (61% in total). Remaining responses came from micro, small and medium sized enterprises (i.e. less than 250 employees) for which the percentage is (39%) of total data (Figure 4-2).

4.4 Annual turnover

Figure 4-3 indicated that the annual turnover for the majority of firms (207 firms; almost 80 % of total sample) was more than £1.0 M. Out of these 207 firms, 46 firms had annual turnover more than £ 50 M. Only 56 firms had an annual turnover of less than £1.0 M.

Table 4-1: Development budget for NPD projects

	Count	**Examples**
Up to £50 k	76	Software development, food, jewellery, precious stones, polypropylene bags, customized woods product, customized rugs and carpets, fishing & hunting, display stands, chemical products, drugs, chandelier, animal food, textile, soaps & detergents.
Between £50k - £100k	37	Pen and pencils, software, oil and gas related machines and spare parts, construction related equipment, art &craft, chemicals, foods, cutlery, clothes, wood products,
Between £100k - £500k	56	Electronic or computer related equipments & parts, oil & gas related machinery and spare parts, auto spare parts, software and adhesive & sealants,
Between £500k - £1.0 M	45	Computer & office equipments, drugs, tobacco, leather bags, apparel products, telecom products, electronics & computer products, household appliances and software
Between £1.0M - £10 M	43	Computer & electronics, industrial instruments, aircraft related equipments & spare parts, welding & fabrication equipments, children toys, oil & gas pipelines & pumps, medical related devices
Between £10M - £50 M	5	Defence related products, energy supply related equipments, large scale software developments,
More than £50 M	1	Electronics & computers i.e. motherboards

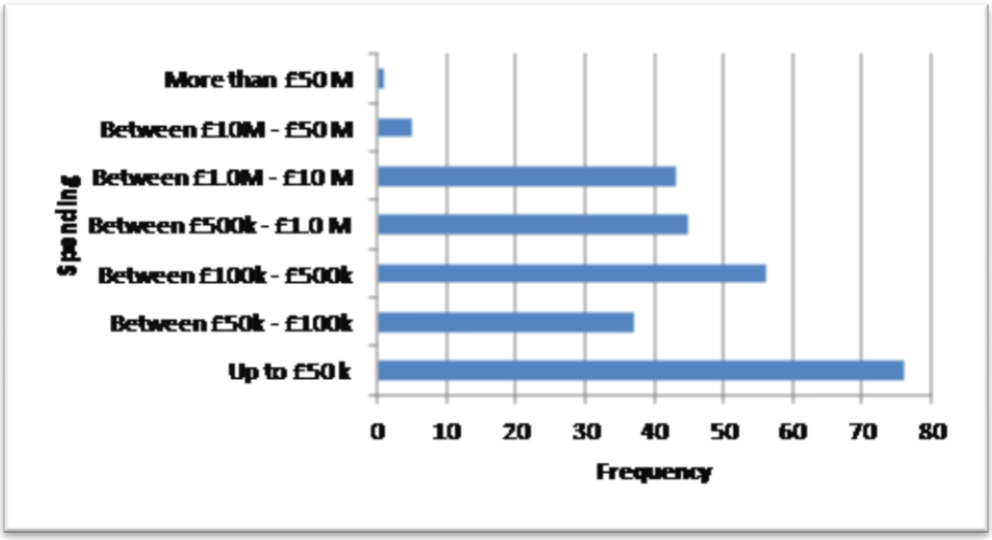

Figure 4-1 NPD budget

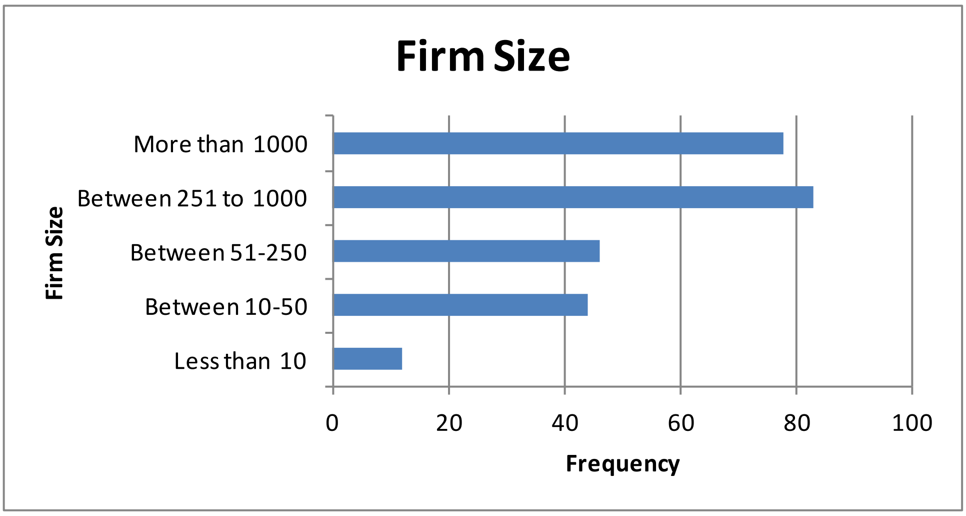

Figure 4-2 Classification of respondents according to firm size

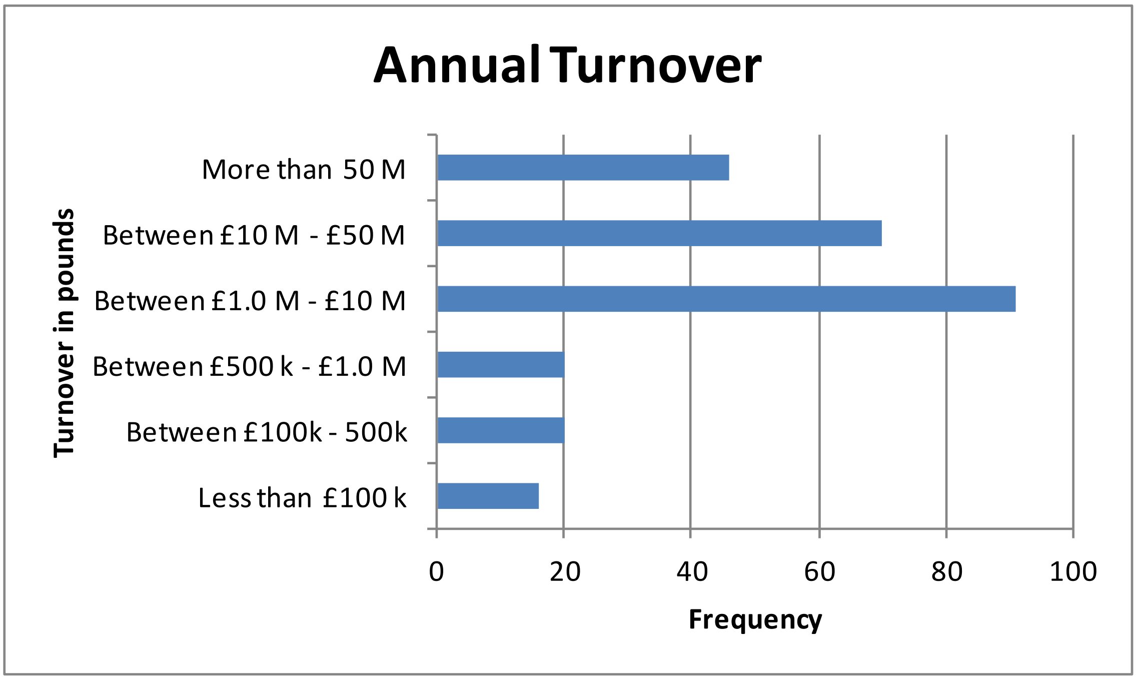

Figure 4-3 Classification of respondents according to annual turnover

4.5 Functional\Management role

The findings (Figure 4-4) indicated that the NPD projects involve respondents from a variety of occupations related to NPD. The majority of the respondents (98) were associated with either R&D or technical aspect such as product design. This was followed by senior management (CEO, MD, owners, general manager and board of director = 45). The smallest group was associated with professionals from marketing, sales, and finance functions.

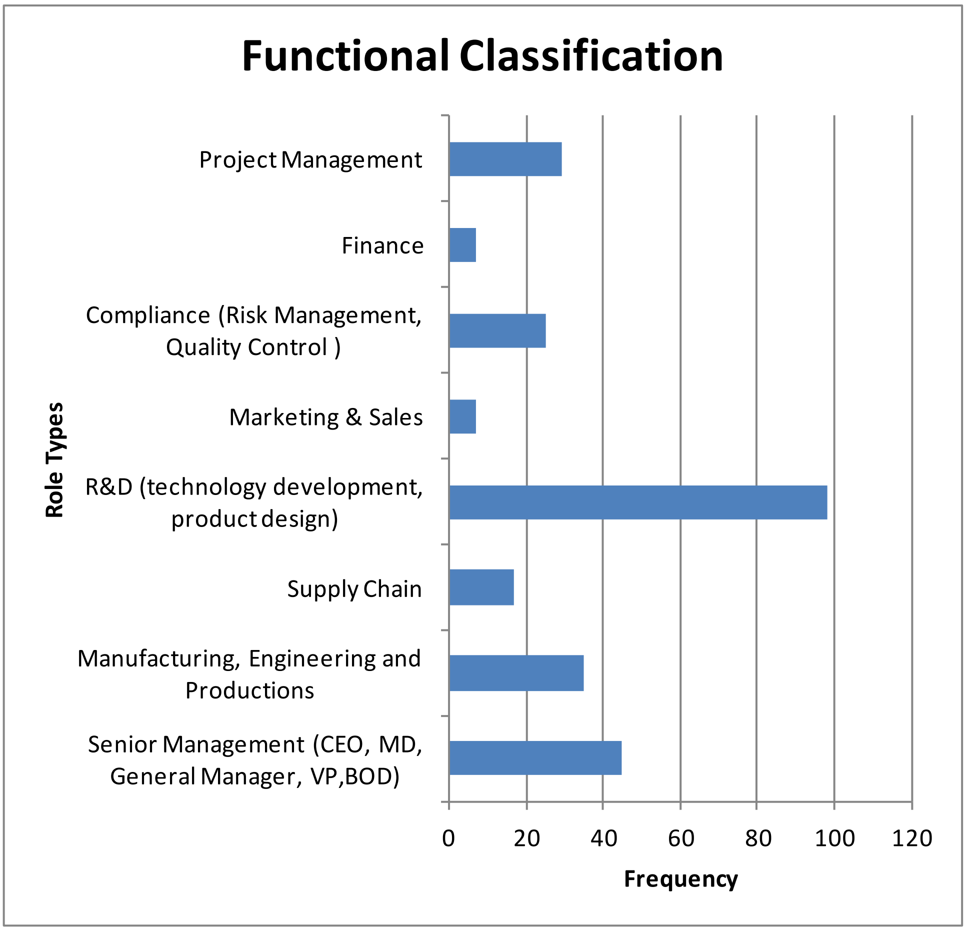

Figure 4-4: Respondents' functional profiles

4.6 Industrial classification

For this study, UK standard industrial classification codes 2007 (UK SIC 2007) were used to classify firms. Figure 4-5 revealed that firms in this survey conducting NPD projects were spread across all the sectors but with a majority from fast moving consumer goods (FMCG) (69), computers & electronic related products (40), software & information systems related (36), others category which include rubber, glass, metal and plastic products (23) and textile and apparel products (22). Other key classifications but with low responses including automotive & other means of transportation (15), chemical products (13), wood products (11), large engineering projects (9), home appliances (7), pharmacy (7), Oil and gas (6) and aerospace & defence (5).

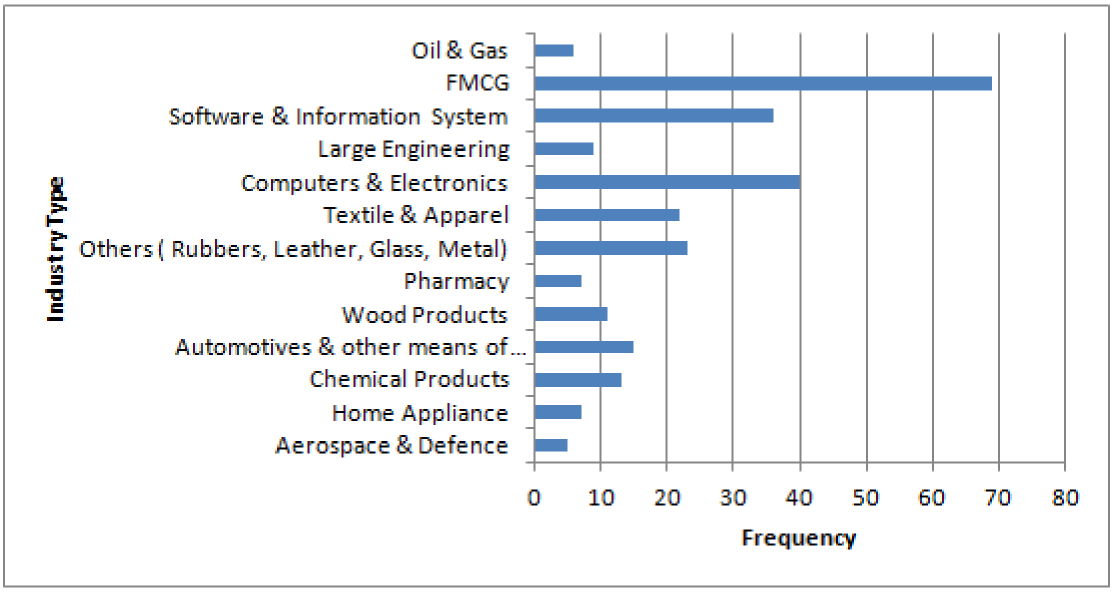

Figure 4-5: Industry classification

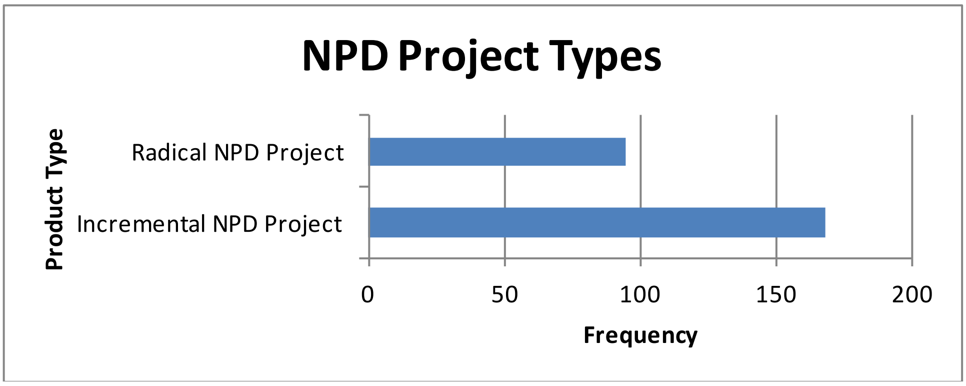

Figure 4-6: NPD project types

4.7 NPD project types

Respondents were asked to classify the products as a radical or incremental. The definition, measures, and constructs used for this classification are well established in the innovation literature (e.g. Valle and Vazques-Bustelo, 2009 and Song and Montoya-Weiss, 1998) and explicitly described in methodology section (see section 3.4.5.7). The research design resulted in a balanced distribution of the surveyed NPD projects and it included 159 incremental NPD projects and 104 radical NPD projects (Figure 4-6).

4.8 Firm size vs. NPD project budget

Figure 4-7 provided the cross tabulation between firm sizes and average NPD project budget. Here, I tried to empirically test if there is any relationship between the firm' size and the frequency of NPD projects conducted by that firms. There were 161 NPD projects in large firms and 102 NPD projects in SMEs. Based on the findings of the chi-square test, NPD spend was significantly greater in large firms than small firms: $\chi^2(24) = 70.759$, $p < 0.018$. No small firms spent more than £10m. Large firms spent more than small firms in each budget category except for NPD spending up to £50k.

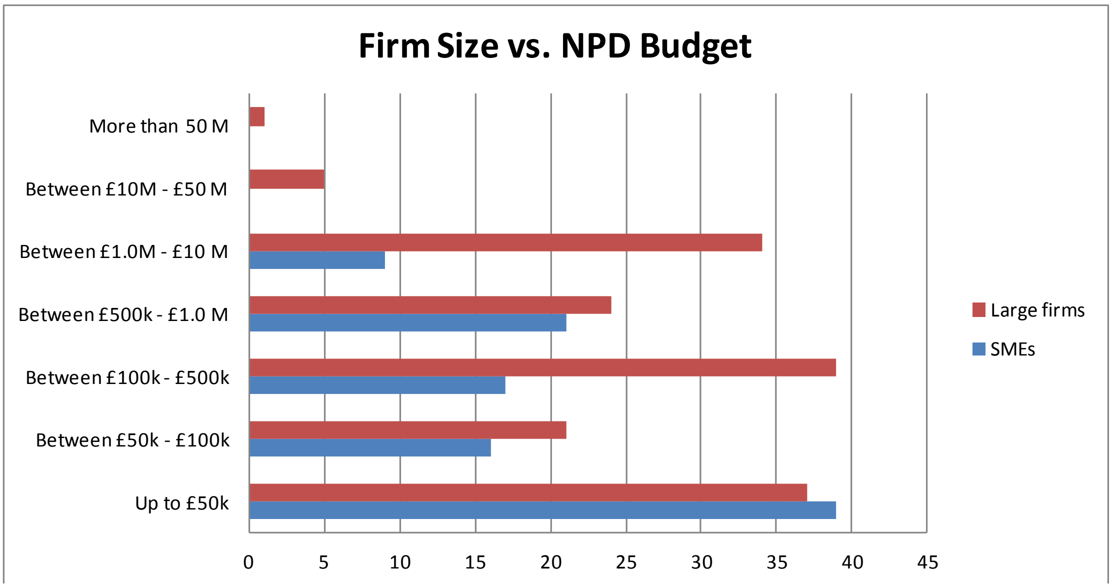

Figure 4-7: Firm size vs. NPD budget

4.9 NPD project type vs. NPD project budget

I also empirically examined if there is any relationship between firms from all categories of R&D spending and NPD project types i.e. incremental or radical products. The chi-square test suggested that there were more incremental projects than radical ones. A considerable proportion of this difference was accounted for in the lowest category of NPD spend (Fig 4-8). Many incremental NPD projects cost less than £50k. Radical NPD projects were more common than incremental ones at between (£100k - £500k) and between (£10m and £50m). These distributions were significantly different ($\chi^2(6) = 14.248$, $p = 0.027$)

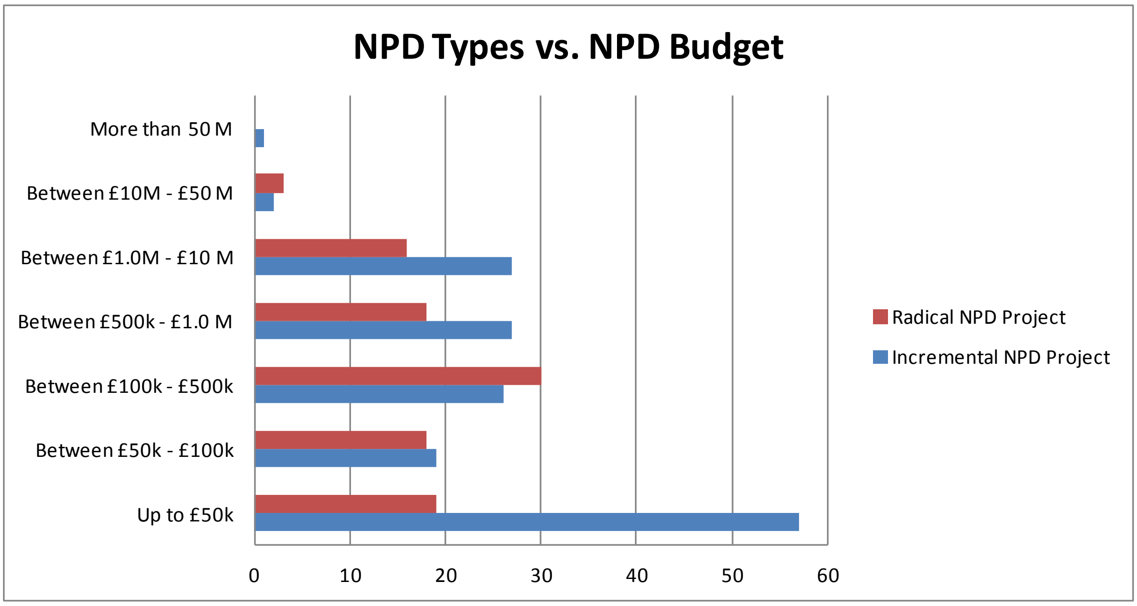

Figure 4-8: NPD types vs. NPD budget

4.10 NPD project type vs. firm size

Here, I empirically examined whether firms of particular size i.e. SMEs or large firms have preference when developing any particular product types (e.g. increment or radical). While, the chart shows that firm often tend to develop more incremental than radical product, a chi-square test ($\chi^2(4)$ = 6.667, p = 0.154 > 0.05) revealed no significant relationship between firm size and the type of NPD project (Figure 4-9).

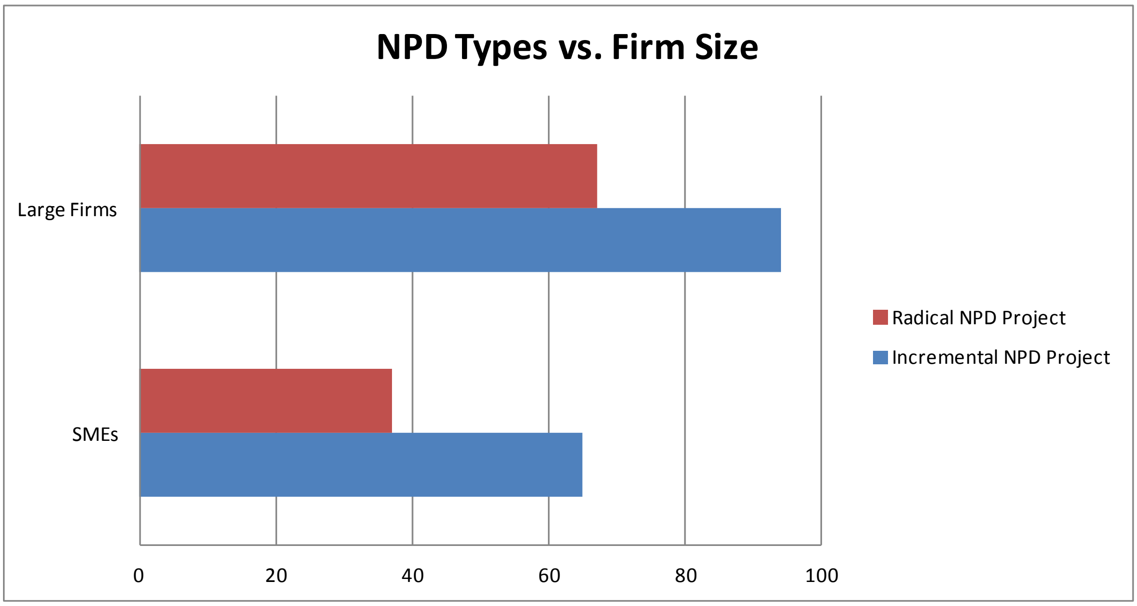

Figure 4-9: NPD project type vs. firm size

4.11 NPD project type vs. Industry

Table 4-10: NPD Project Type vs. Industry

Industry Type	NPD Project Type		Total
	Incremental NPD Project	Radical NPD Project	
Aerospace & Defence	2	3	5
Home Appliance	5	2	7
Chemical Products	6	7	13
Automotives & other means of Transportation	11	4	15
Wood Products	4	7	11
Pharmacy	3	4	7
Others (Rubbers, Leather, Glass, Metal)	18	5	23
Textile & Apparel	10	12	22
Computers & Electronics	28	12	40
Large Engineering	5	4	9
Software & Information System	17	19	36
FMCG	46	23	69
Oil & Gas	4	2	6
Total	159	104	263

Here, I empirically examined whether firms from any particular sector have preference when developing any particular product types (e.g. increment or radical). While, the table shows that firms from all sectors develop more incremental than radical product, firms from FMCG, software, textile and electronic sectors developed radical products in greater extent than any other sector (Table 4-10).

Table 4-11: Industry Type vs. Budget

Industry Types	**Development budget for NPD project**							**Total**
	Up to £50k	**£50k- £100k**	**£100k - £500k**	**£500k - £1.0 M**	**£1.0M - £10 M**	**£10M - £50 M**	**More than £50 M**	
Aerospace & Defense	0	0	0	1	3	1	0	5
Home Appliance	2	3	0	2	0	0	0	7
Chemical Products	1	3	7	1	1	0	0	13
Automotives & other means of Transportation	3	2	4	5	1	0	0	15
Wood Products	3	6	2	0	0	0	0	11
Pharmacy	1	0	3	2	1	0	0	7
Others (Rubbers, Leather, Glass, Metal)	7	2	6	2	6	0	0	23
Textile & Apparel	8	5	3	4	2	0	0	22
Computers & Electronics	3	3	7	15	11	0	1	40
Large Engineering	1	1	4	1	1	1	0	9
Software & Information System	15	2	6	5	6	2	0	36
FMCG	32	9	12	7	8	1	0	69
Oil & Gas	0	1	2	0	3	0	0	6
Total	76	37	56	45	43	5	1	263

4.12 Industry vs. Budget

Here, I empirically examined whether firms from any particular sector have greater spending on NPD project than others? According to the Table 4-3, firms in FMCG sector often tend to develop products up to 50,000 UK pounds. On the other hand, firms from electronic sector develop products which cost more than 1 million (Table 4-11)

4.13 Summary of descriptive findings

The results of the descriptive analysis revealed interesting findings. The annual turnover for the majority of firms (80%) was more than £1.0 out of which 27% firms were more than £ 50 M. Similarly, Only 20% firms had an annual turnover of less than £1.0 M. Most new product development efforts fall in low budget categories. A possible explanation would be that given the current economic situation, most firms have adopted low-cost product development strategy to be competitive. Due to a successful turnover rate, low-cost NPD strategy appeared to be successful. A large number of NPD efforts were made by SMEs (40%). Most of the NPD efforts were incremental in nature and largely associated with FMCG and software sectors. There was not any significant difference in terms of firm's choice of NPD types. Both SMEs and large size firms appeared to have mixed project portfolios.

5 Empirical findings: RQ1: Identifying NPD project risks

5.1 Introduction

This section presents the empirical findings pertaining to the first research question (RQ1) proposed for this work:

What risks do managers of NPD projects perceive?

Research question 1 is broken down into two aspects of probability and impact.

- What is the probability of occurrence of different risks in NPD projects?
- What is the impact of these risks on NPD projects?

The objective of research question 1 was to identify most frequent perceptions of respondents about probability and impact of every risk types. I empirically tested the hypothesis both for probability and impact for every risk type and reported the results in the following sections.

5.1.1 Technological risk

The technological risk was comprised of two sub-categories: technological rapidity and technological capability.

5.1.1.1 Technological rapidity

Respondents were decisive in perceiving the probability of technological rapidity risk as extremely likely (34.2%) or likely (25.5%). The mean scores for the probability of technological rapidity risk of either likely or extremely likely were statistically significantly higher by .551(95% CI, .39 to .72) than those respondents who perceived the probability of risk either unlikely to happen or neutral ($p < 0.0005$). Similarly, respondents were also decisive in perceiving the negative impact of risk on NPD project as extreme (7.6%) or major (38%). This was evident from the mean scores for respondents' perceptions about impact as major or extreme which were statistically significantly higher by 0.198(95% CI, .07 to .33) than those respondents who perceived the impact of risk either moderate, minor or non-existent ($p < 0.0005$) (Appendix 4-a & 4-b; Figure 5-1).

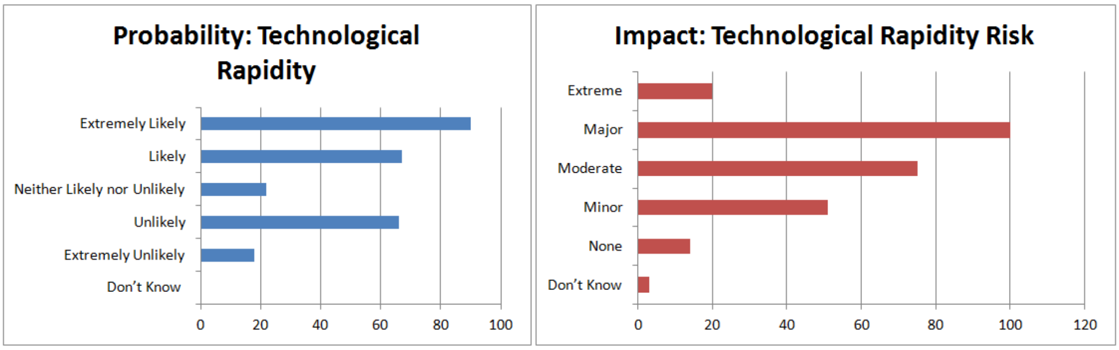

Figure 5-1 Probability and impact of technological rapidity

5.1.1.2 Technological capability

As figure 5-2 indicates, there was not a notable difference among the respondents who perceived the probability of technological capability risk either extremely likely (19.4 %) or likely (20.2 %) and those who perceived it as extremely unlikely (21.7 %) or unlikely (13.7 %). About one-fourth of respondents (24.7%) also regarded the probability of technological capability as neutral. In case of potential negative impact, respondents were decisive in perceiving the risk less risky as the mean values for respondents who perceived it minor, moderate or non-existent were higher 0.251(-0.42 to 0.08) ($p < 0.003$) than those who perceived its impact as extreme or major (Appendix 4-a & 4-b; Figure 5-2).

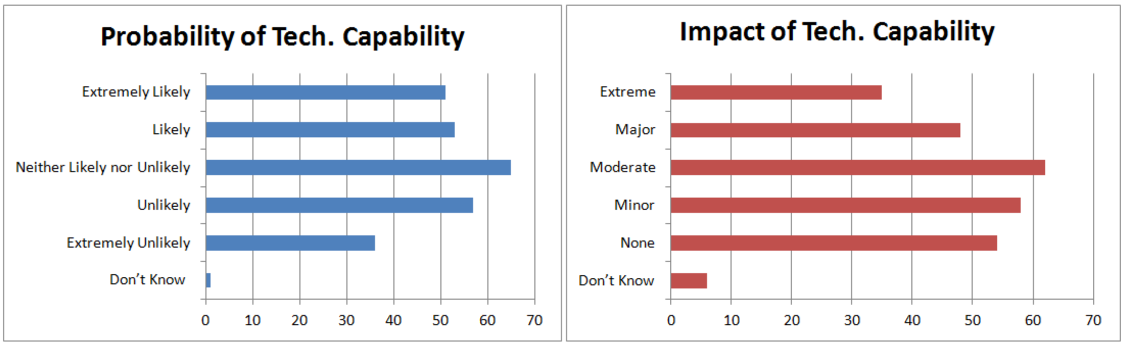

Figure 5-2 Probability and impact of technological capability risk

5.1.1.3 Summary of technological risk

Based on the outcomes of descriptive analysis and one sample t –test, it is concluded that respondents assigned more importance to technological rapidity risk than technological capability risk both in terms of probability of occurrence and potential negative impact. A possible explanation might be that technological rapidity is an external/exogenous risk which firms can neither control nor mitigate by internal measures (Mu et al., 2009). Technological capability, in contrast, is an endogenous/ internal risk for which firms can employ best practices to mitigate (Mu et al., 2009).

5.1.2 Marketing risk

Marketing risk, in this research, is comprised of four sub-categories: marketing rapidity risk, customer perceived risk, marketing capability risk and competition risk.

5.1.2.1 Marketing rapidity risk

Respondents were significantly decisive ($p<0.0005$) in perceiving the probability of marketing rapidity risk as high (either likely or extremely likely: 54%). The mean scores for the probability was statistically significantly higher by .365(95% CI, .20 to .53) than the hypothesized criterion measure of 3 ($p <0.0005$). In contrast, there was not notable difference among the respondents who perceived the potential negative impact of marketing rapidity risk either major (29%) or minor (35%). A reasonable number of respondents (33%) also scored the risk as neutral (Appendix 4-a & 4-b; Figure 5-3)

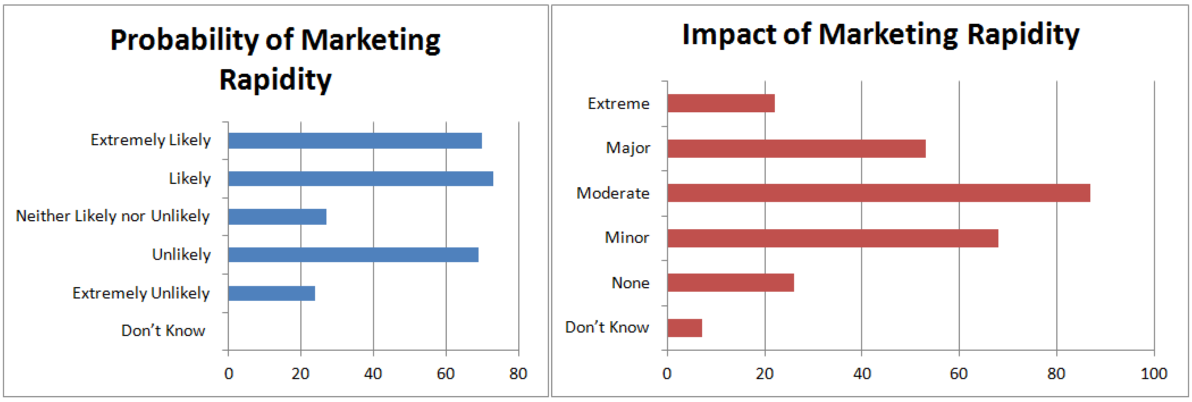

Figure 5-3: Probability and Impact of marketing rapidity risk

5.1.2.2 Customer perceived risk (CPR)

While the proportion of respondents who perceived the likelihood of occurrence of CPR as high was (43%), it was not notably different from the proportion of those who actually did not consider the probability of risk high (40%). Further to this, 17 % of the

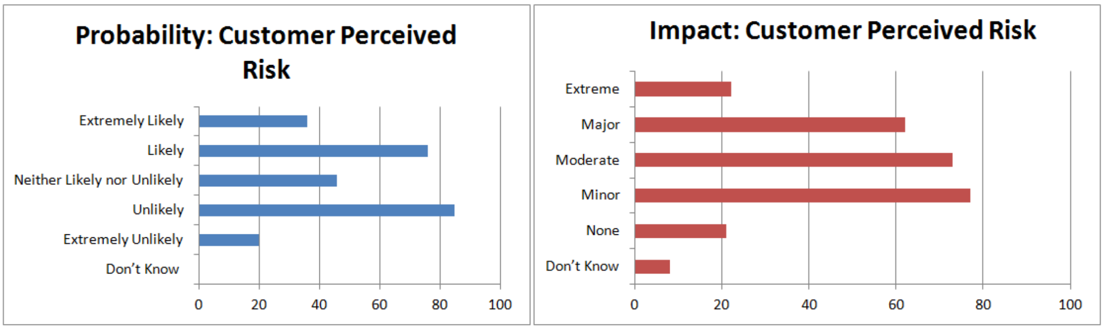

Figure 5-4 Probability and impact of customer perceived risk

respondents also thought it as neutral. The distribution of the responses on potential negative impact of CPR risk was also unclear as there was not any notable difference among the respondents who perceived the impact as major (32 %), minor (37%) or neutral (28%)(Appendix 4-a &4-b; Figure 5-4).

5.1.2.3 Marketing capability

Respondents were significantly decisive ($p<0.0005$) in perceiving the probability of marketing capability risk as high (the sum of proportions of likely and extremely likely is 47%) than those who perceived it low (the sum of unlikely and extremely unlikely is 28%) or those who perceived it neutral (24%). The mean scores for the probability was statistically significantly higher by .319(95% CI, .16 to .47) than the hypothesized criterion measure of 3 ($p <0.0005$).In contrast, the proportions of those respondents who perceived the potential negative impact of marketing capability risk as minor was (43%) than those who perceived it major (31%) or neutral (24%) (Appendix 4-a & 4-b; Figure 5-5).

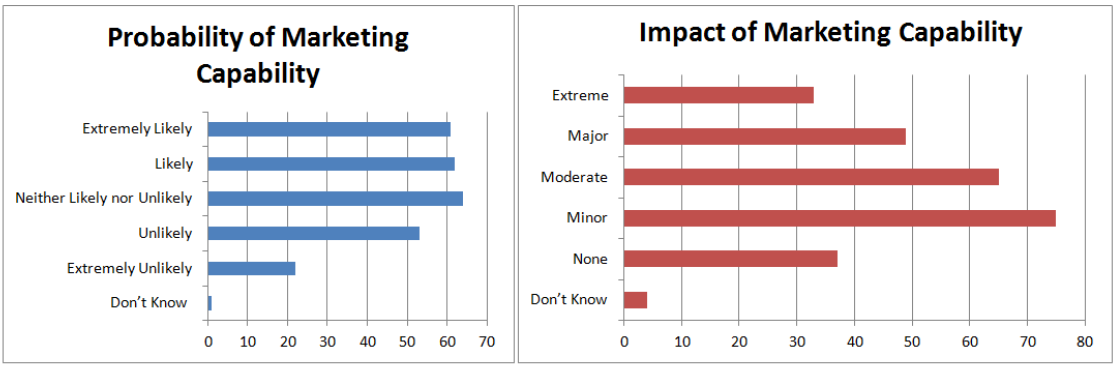

Figure 5-5 Probability and impact of marketing capability

5.1.2.4 Competition

Respondents assigned a mixed score to the probability of occurrence of competition risk. For example, the large numbers of proportions of responses for probability were high (46%), they did not significantly differ from the proportions of respondents who scored the risk as low in probability (38%). In contrast, the proportions of those respondents who perceived the potential negative impact of competition risk as extreme and major was higher by 0.167(95% CI, .01 to .33) than those who perceived it neutral or minor (Appendix 4-a & 4-b; Figure 5-6)

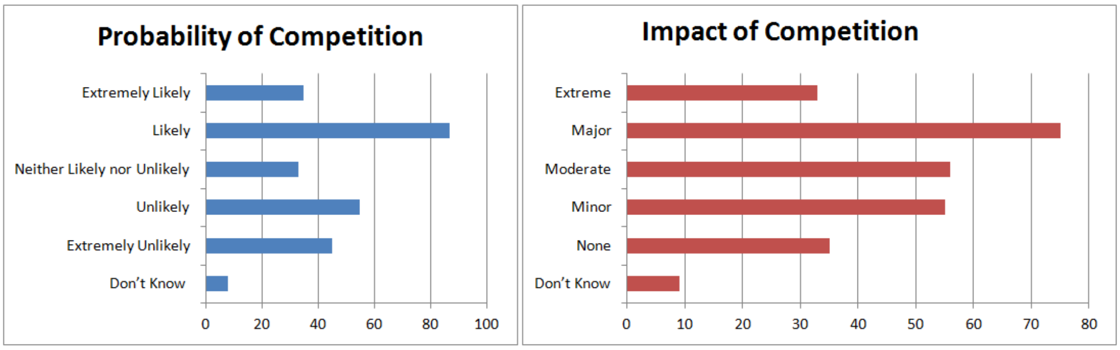

Figure 5-6 Probability and impact of competition

5.1.2.5 Summary of marketing risk

Respondents, in general, regarded their NPD project vulnerable to marketing rapidity and marketing capability risks. While the majority of respondents significantly agreed about the likelihood of occurrences of these two risks, they were uncertain about the extent to which these risks can harm their NPD projects. In term of competition risk, the respondents were more concerned about its potential negative impact rather than its likelihood of occurrence.

5.1.3 Operations risk

Operations risk in this research is conceptualized in terms of resource risk, human resource risk, planning risk, control risk and strategic management risk.

5.1.3.1 Resource risk

Respondents were significantly decisive ($p < 0.0005$) in perceiving the resource risk as highly likely to occur (64%) and its potential negative impact as major (49%). The mean scores for the probability were statistically significantly higher by .567(95% CI, .40 to .73) than the hypothesized criterion measure of 3 (p <0.0005). Similarly, the mean scores for the impact was statistically significantly higher by .183(95% CI, .004 to .33) than the hypothesized criterion measure of 3 (p <0.012) (Appendix 4-a & 4-b; Figure 5-7).

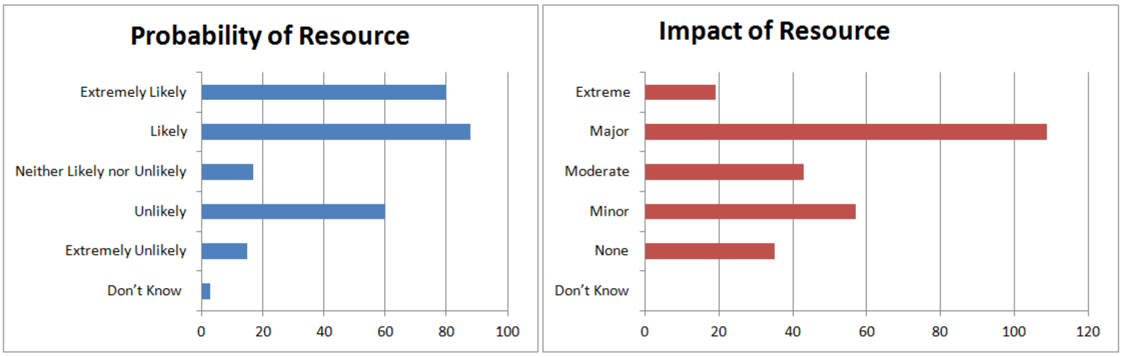

Figure 5-7 Probability and impact of resource risk

5.1.3.2 Human resource risk

There was a significant difference among the perceptions of respondents who regarded the probability of human resource risk high (32%) and those who did not regard as high (24%). A major proportion of respondents (43%) assigned a neutral score to it. The mean scores for the probability were statistically significantly higher by .270(95% CI, .20 to .53) than the hypothesized criterion measure of 3 (p <0.0005). Respondents were decisive in perceiving the potential negative impact of human resource risk as minor (44%) i.e. lower from the hypothesized criterion value by -0.297(-0.45 to -0.14) (p <0.0005) (Appendix 2-a & 2-b; Figure 5-8).

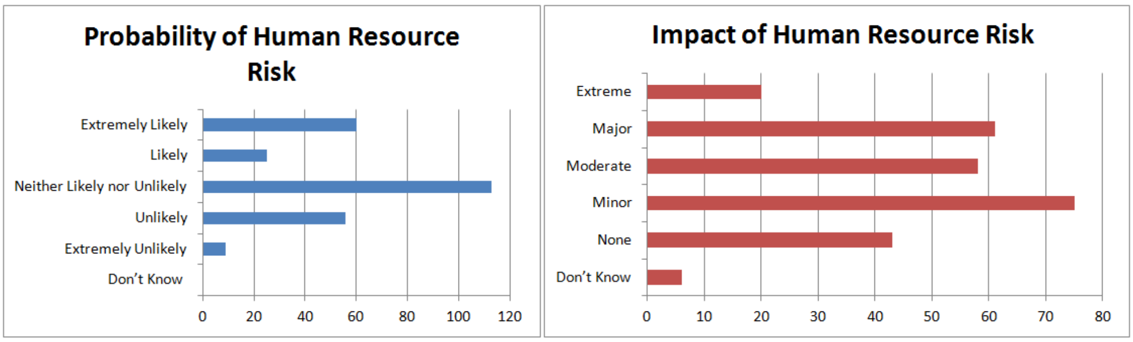

Figure 5-8 Probability and impact of human resource risk

5.1.3.3 Planning risk

A large number of respondents perceived the likelihood of occurrence of planning risk high (63%). The mean scores for the probability were statistically significantly higher by .563(95% CI, .43 to .69) than the hypothesized criterion measure of 3 ($p < 0.0005$). However, there was not any difference among the proportions of respondents who regarded it less risky in terms of occurrence (17%) and those who remained neutral (17%). Unlike to its high likelihood of occurrence, the potential impact of planning risk was largely perceived to be minor (41%) than major (29%) or moderate (21%). The t-test' statistics was significant for the negative impact as the mean value was lower by 0.194 (95% CI, -0.35 to -0.04) (Appendix 4-a & 4-b; Figure 5-9).

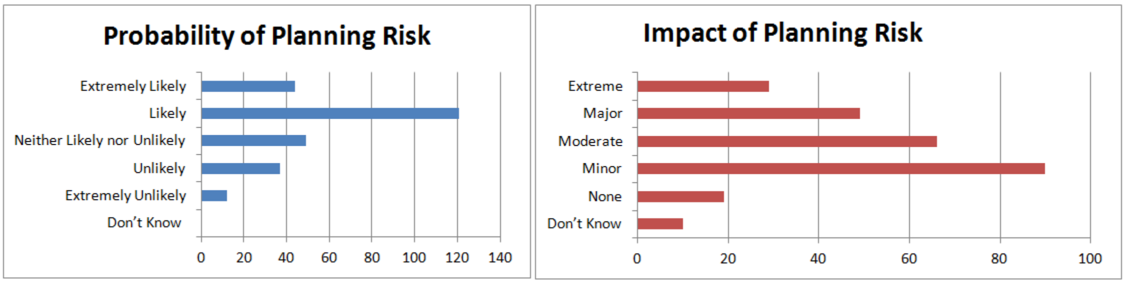

Figure 5-9 Probability and impact of planning risk

5.1.3.4 Control risk

The likelihood of occurrence of control risk was perceived to be extremely high (73%) by respondents. The mean scores for the probability were statistically significantly higher by .764(95% CI, .62 to .91) than the hypothesized criterion measure of 3 ($p < 0.0005$). There was not notable difference among the perceptions of respondents about its potential negative impact as major (31%), minor (38%) and moderate (28%) (Appendix 4-a & 4-b; Figure 5-10).

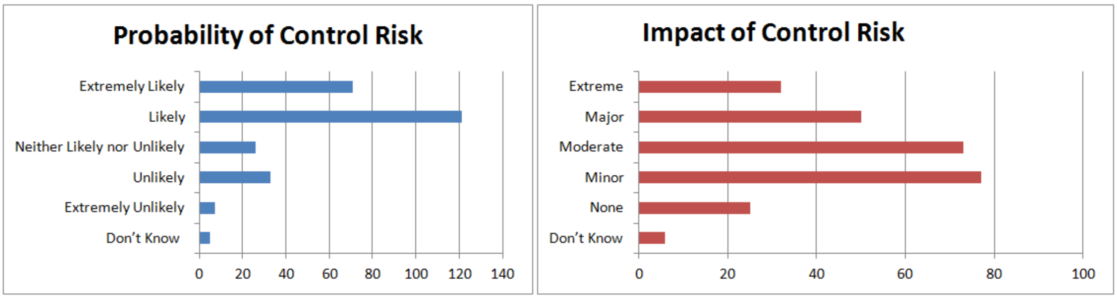

Figure 5-10 Probability and impact of control risk

5.1.3.5 Strategic management risk

About 80 % of respondents declared strategic management risk a risk with a high likelihood of occurrences (with p-value < 0.0001). The mean value for the probability was higher by 0.958 (95% CI, 0.83 to 1.08) than the hypothesized criterion measure of 3 (p <0.0005). The difference was not, however, significantly statistically different from the proportions of the respondents who thought it as a risk with major impact (44%) with those who perceived it minor (42%) (Appendix 4-a & 4-b; Figure 5-11).

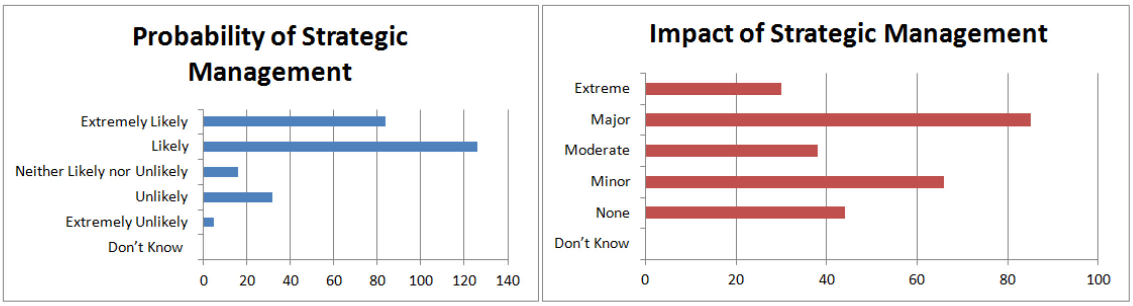

Figure 5-11 Probability and impact of strategic management risk

5.1.3.6 Summary of operations risk

With the exception of human resource risk, respondents largely declared all sub-dimensions of operations risk as high threat in terms of probability. However, in most cases (except resource risk), respondents lacked consensus on the potential negative impact of these risks.

5.1.4 Supply chain risk

Although, not very large but still statistically significant (p <0.012), more respondents perceived the probability of supply chain risks as high (51%) than low (35%). The mean value for the probability was higher by 0.217 (95% CI, 0.05 to 0.39) than the hypothesized criterion measure of 3 (p <0.0005). A similar pattern was noted about the negative impact of supply chain risk. While more respondents (56%) declared the impact of risk as a major, about 24 % and 17% of respondents also assigned the supply chain risk neutral and minor scores respectively. The mean value for the potential negative impact was higher by 0.540 (95% CI, 0.40 to 0.68) than the hypothesized criterion measure of 3 (p <0.0005). (Appendix 4-a & 4-b; Figure 5-12).

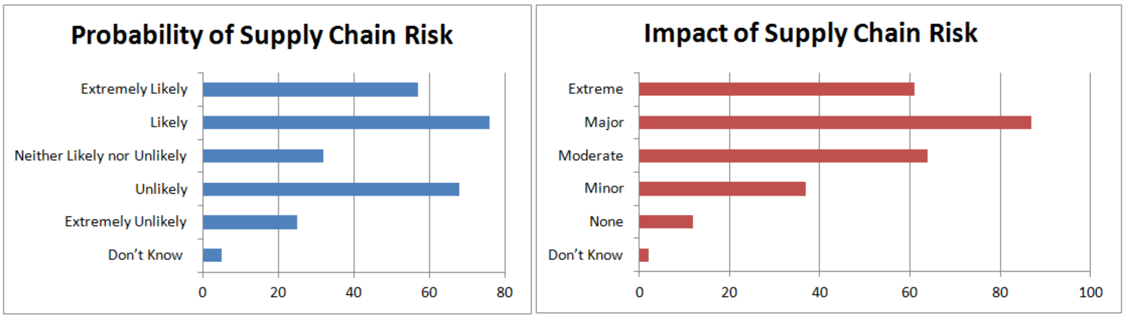

Figure 5-12 Probability and impact of supply chain risk

5.1.5 Finance risk

Finance risk in this research is conceptualized in terms of financial unpredictability and lack of funding.

5.1.5.1 Financial unpredictability

Respondents largely (about 60% which was statistically significant) perceived the likelihood of financial unpredictability as low. The mean value for the probability was lower by 0.567 (95% CI, -0.73 to -0.41) than the hypothesized criterion measure of 3 (p <0.0005). Similarly, there was a significant notable difference in the proportions of respondents who perceived its potential negative impact as major (39%), minor (37%) or thought it neutral (27%). The mean value for the potential negative impact was lower by 0.202 (95% CI, -0.36 to -0.05) than the hypothesized criterion measure of 3 (p <0.012). (Appendix 4-a & 4-b; Figure 5-13)

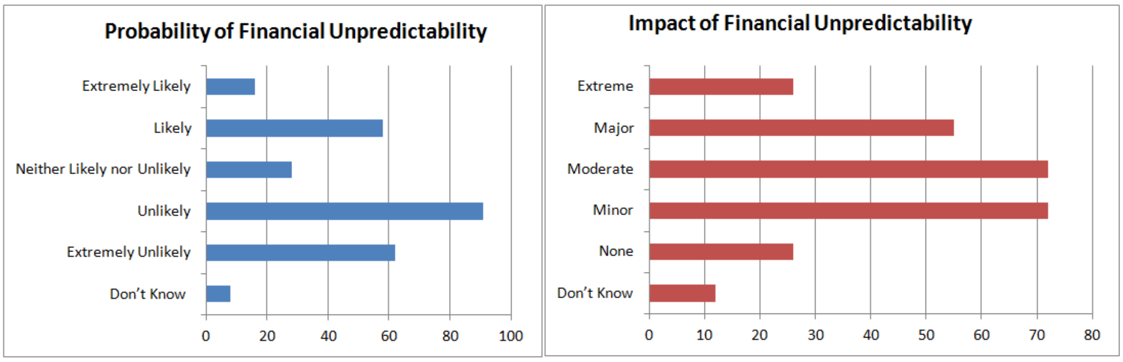

Figure 5-13 Probability and impact of financial unpredictability

5.1.5.2 Lack of funding

The majority of the respondents (60%) perceived the probability of risk of lack of funding as high as the mean value for the probability was higher by 0.449 (95% CI, 0.29 to 0.61) than the hypothesized criterion measure of 3 ($p < 0.0005$). Additionally, there was notable difference in the proportions of respondents who perceived its potential negative impact as major as it was higher by 0.224 (95% CI, 0.08 to 0.37) and those who perceived it as minor (Appendix 4-a & 4-b; Figure 5-14).

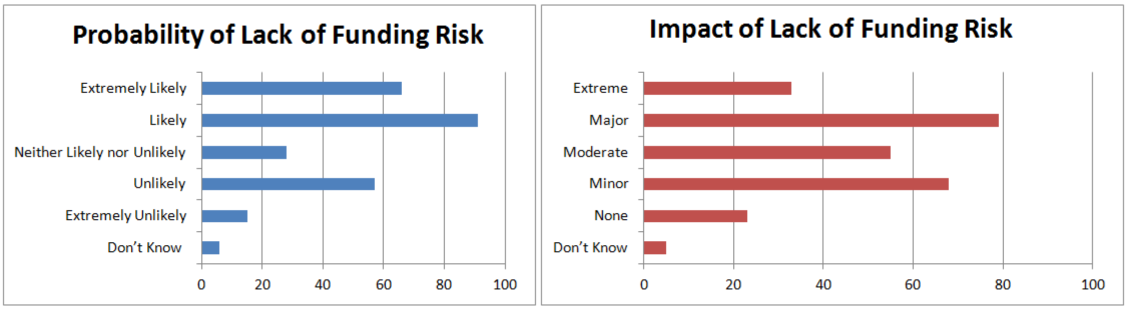

Figure 5-14 Probability and impact of lack of funding risk

5.1.5.3 Summary of finance risk

While there is a consensus among the respondents about the likelihood of occurrence and potential negative impact of lack of funding risk, respondents, in general, were lacking agreement about the potential negative impact of financial unpredictability risk.

5.1.6 Environmental risk

Environmental risk in this research is conceptualized in terms of political risk, social risk, macro-economic risk and natural risk.

5.1.6.1 Political risk

Respondents, largely, assigned a low score to political risks both in terms of likelihood of occurrence (73%) and potential negative impact (65%). The mean values for probability and impact were statistically significantly lower by 1.110 (95% CI, -1.25 to -0.97) and 0.867 (95% CI, -1.02 to -0.71) than the hypothesized criterion measure of 3 ($p < 0.0005$) (Appendix 4-a & 4-b; Figure 5-15).

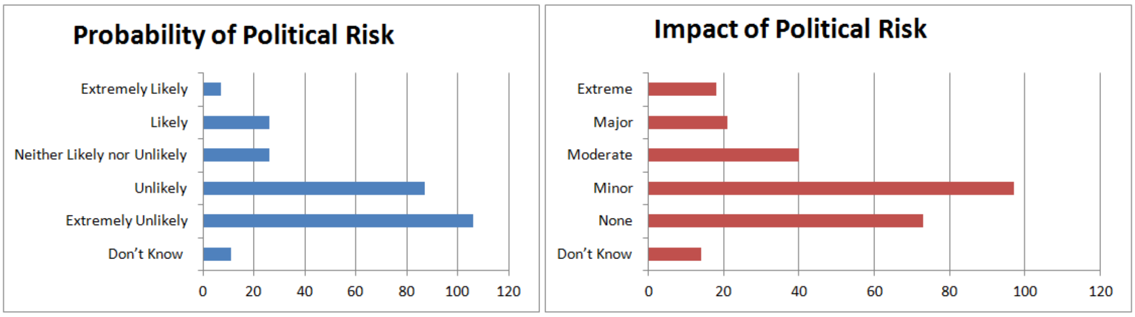

Figure 5-15 Probability and impact of political risk

5.1.6.2 Macroeconomic risk

Likewise the political risk, a large number of respondents also significantly ($p < 0.0005$) perceived the probability of macroeconomic risk to be occurred as low (55%) and negative impact as the minor (54%). The mean values for probability and impact were statistically significantly lower by 0.574 (95% CI, -0.73 to -0.42) and 0.563 (95% CI, -0.71 to -0.42) than the hypothesized criterion measure of 3 ($p < 0.0005$) (Appendix 4-a & 4-b; Figure 5-16).

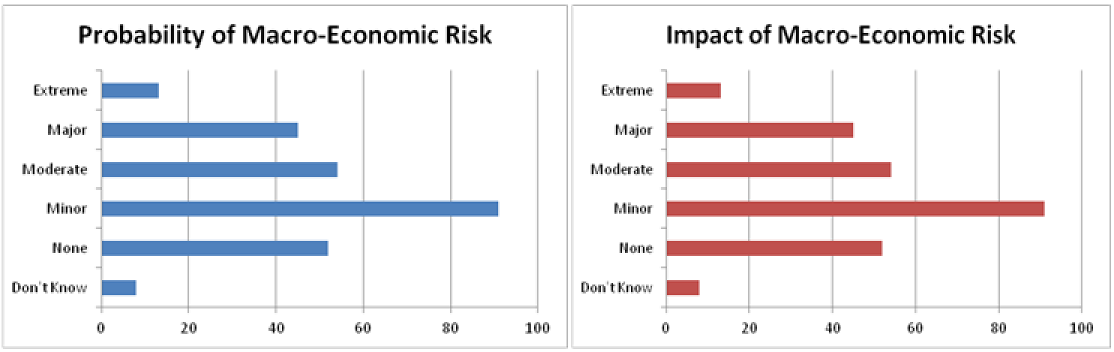

Figure 5-16 Probability and impact of macroeconomic risk

5.1.6.3 Social risk

A large proportion of respondents perceived the probability of occurrence of social risk low (60%) and its potential impact as minor (56%). The mean values for both probability and impact were statistically significantly lower by 0.696 (95% CI, -0.85 to -0.55) and 0.597 (95% CI, -0.75 to -0.44) than the hypothesized criterion measure of 3 ($p < 0.0005$) ($p < 0.0005$) (Appendix 4-a & 4-b; Figure 5-17).

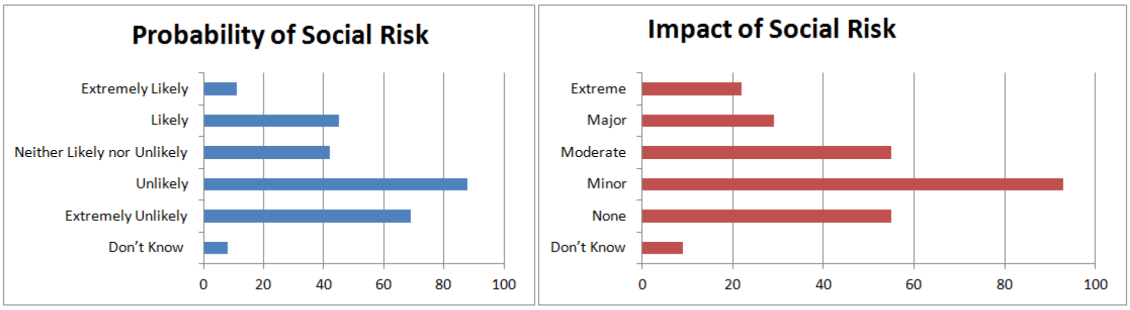

Figure 5-17 Probability and impact of social risk

Natural risk

In the case of natural risk, a large proportion of respondents perceived the probability of occurrence of social risk low (67%) and its potential impact as minor (66%). The mean values for both probability and impact were statistically significantly lower by 1.144 (95% CI, -1.29 to -1) and 0.935 (95% CI, -1.09 to -0.78) than the hypothesized criterion measure of 3 ($p < 0.0005$) (Appendix 4-a & 4-b; Figure 5-18).

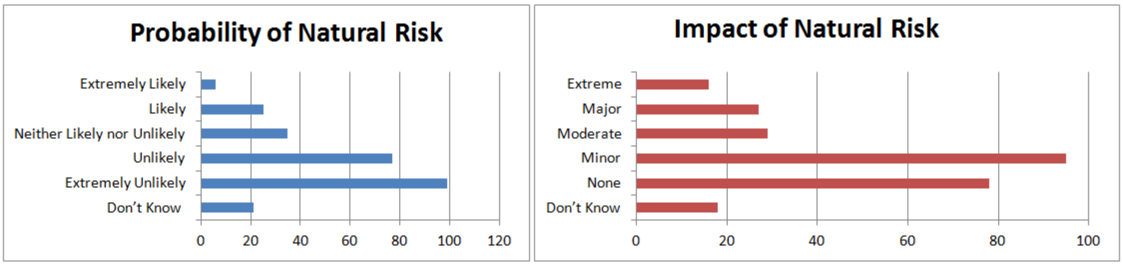

Figure 5-18 Probability and impact of natural risk

5.1.6.4 Summary of environment risk

When compared with hypothesized criterion measure (i.e. 3), all the sub-categories of environmental risks were found to be significantly lower which showed that the environment risk was least important.

5.2 Summary of research question 1

In this section, I provide the basic descriptive statistics for every risk dimensions by calculating means, mode values, bar charts and conducting one sample t-test. The summary of the findings can be seen in Table 5-1 which provided the mode and mean values for every risk type and their significance values. I ranked the risks dimensions in descending order i.e. starting from high probability and high impact to low probability and low impact. According to the table, the probability of occurrence and potential negative impact of NPD project risks are significantly different. The high value of mean for probability means a high likelihood of risk to occur, and a high value of impact mean severe negative consequences are associated with risk. By computing the average of risk factors, a baseline threshold for 18 risk components was set for both probabilities (3.06) and impact (2.81). As can be seen in Table, only six risk components (competition risk, financial unpredictability and four components of environmental risk) could not cross the baseline threshold meaning that their risks are less likely to occur. All other risk factors possess high likelihood of occurrence. In case of impact, the mean values for seven risk components including financial unpredictability, technological capability risk, human resource risk and four components of environmental risk were less than baseline threshold meaning that the potential negative

Table 5-1 Summary of research question 1

Risk types	Mode	Mean	Comments	Risk types	Mode	Mean	Comments
Strategic management risk	4	**3.96***	P<0.0005	Supply chain risk	4	**3.54***	P<0.0005
Control risk	4	**3.76***	P<0.0005	Lack of funding	4	**3.22***	P<0.003
Resource risk	4	**3.57***	P<0.0005	Technological rapidity risk	4	**3.20***	P<0.003
Planning risk	4	**3.56***	P<0.0005	Resource risk	4	**3.18***	P<0.012
Technological rapidity risk	5	**3.55***	P<0.0005	Competition risk	4	**3.17***	P<0.04
Lack of funding	4	**3.45***	P<0.0005	Strategic management risk	4	2.97	P>0.671
Marketing rapidity risk	4	**3.37***	P<0.0005	Control risk	2	2.88	P>0.126
Marketing capability risk	3	**3.32***	P<0.0005	Customer perceived risk	2	2.86	P<0.059
Human resource risk	3	**3.27***	P<0.0005	Marketing capability risk	2	2.83	P<0.028
Supply chain risk	4	**3.22***	P<0.012	Marketing rapidity risk	3	2.83	P<0.028
Technological capability risk	3	3.09	P>0.288	Planning risk	2	2.81	P<0.013
Customer perceived risk	2	3.09	P>0.242	Financial unpredictability risk	2	2.80	P<0.0005
Competition risk	4	2.95	P>0.604	Technological capability risk	3	2.75	P<0.003
Financial unpredictability risk	2	2.43	P<0.0005	Human resource risk	2	2.70	P<0.0005
Macroeconomic risk	2	2.43	P<0.0005	Macroeconomic risk	2	2.44	P<0.0005
Social risk	2	2.30	P<0.0005	Social risk	2	2.40	P<0.0005
Political risk	1	1.89	P<0.0005	Political risk	2	2.13	P<0.0005
Natural risk	1	1.86	P<0.0005	Natural risk	2	2.06	P<0.0005
Baseline threshold	**3.06**			Baseline threshold	**2.81**		

impact for these risks was not perceived to be high. However, all other risk factors possess severe negative impact with them.

6 Empirical findings: RQ2: Relationship between NPD project risks and contingency factors

6.1 Introduction

By answering this question, this work empirically identified if both probability of occurrence and impact of every risk type differed significantly in different

- NPD project type (Incremental vs. radical).
- Firm sizes (SMEs vs. large firms)
- Industrial sector

6.2 NPD project type (radical vs. incremental)

Binomial logistic regression analysis was performed to ascertain the effects of all 18 sub-categories of NPD project risks and NPD project types. I run two logistic models separately for both incremental and radical NPD types. In the first model, radical NPD type was coded as 1 and incremental NPD type as (0). In the second model, incremental NPD type was coded 1 and radical NPD type as 0. Linearity of the continuous variables with respect to the logit of the dependent variable was assessed via the Box-Tidwell (1962) procedure (Laerd Statistics, 2015). A Bonferroni correction was applied in the model resulting in statistical significance being accepted when $p < .0052$ (Tabachnick and Fidell, 2014). Based on this assessment, all continuous independent variables were found to be linearly related to the logit of the dependent variable. Both logistic regression models were statistically significant, $\chi2(36) = 120.728$, $p < .0005$. Both models explained 50.0% of the variance in NPD types and correctly classified 80.0% of cases. Of the 36 predictor variables (since the regression was carried out twice), only 8 were statistically significant ($p < .005$) and 9 were quasi-significant (i.e. nearly significant). Tables 6-1 and 6-2 provide the detailed description of both logistics models. In the following sections, I have interpreted the significant and quasi significant relationships of predictor variables and dependent variables (NPD types) as follows:

6.2.1 Radical NPD project types vs. NPD project risks

Table 6-1: Radical NPD Projects

	Likelihood of Occurrence				Impact of Risks			
	Sig.	Exp(B)	95% C.I.for EXP(B)		Sig.	Exp(B)	95% C.I.for EXP(B)	
			Lower	Upper			Lower	Upper
Technological Rapidity Risk	.258	.864	.671	1.113	.049	.725	.513	1.025
Technological Capability Risk	.015	.671	.486	.927	.000	1.926	1.387	2.673
Marketing Rapidity Risk	.555	.902	.640	1.271	.047	.620	.379	1.015
Marketing CPR	.054	.730	.531	1.005	.062	1.500	.979	2.298
Marketing Capability Risk	.084	1.255	.970	1.623	.635	1.096	.750	1.602
Competition Risk	.265	.846	.631	1.135	.034	.742	.542	1.017
Operation Resources	.109	1.376	.931	2.034	.149	.772	.543	1.098
Operation HR	.009	1.608	1.123	2.302	.058	.881	.528	1.470
Operation Planning	.461	1.159	.782	1.718	.853	1.058	.584	1.915
Operation Control	.734	.933	.624	1.394	.500	.823	.466	1.451
Operation SM	.078	.937	.621	1.415	.086	1.305	.963	1.768
Supply Chain	.013	1.550	1.095	2.194	.018	.656	.462	.930
Finance Unpredictability	.737	.943	.671	1.326	.014	.628	.433	.910
Finance lack funding	.013	1.547	1.096	2.184	.735	1.056	.771	1.446
Environment Political	.229	1.290	.852	1.953	.650	1.110	.707	1.742
Environment Macro	.469	1.149	.788	1.676	.054	.608	.366	1.009
Environent Social	.069	1.300	.938	1.801	.079	1.902	1.302	2.778
Environment Natural	.825	.957	.649	1.412	.079	.685	.449	1.044

A strong negative association between certain risk types and radical NPD type was observed. This include

- a strong significant negative association ($p < 0.015$) between the probability of technological capability risk and radical NPD type
- a strong significant negative association ($p < 0.05$) between the probability of customer perceived risk and radical NPD type
- a strong significant negative association ($p < 0.047$) between the impact of customer perceived risk and radical NPD type
- a strong significant negative association ($p < 0.009$) between the probability of human resource risk and radical NPD type
- a strong significant negative association ($p < 0.058$) between the impact of human resource risk and radical NPD type

Statistically, such a relationship is interpreted as ‘a unit increase in the probability/impact of these three risks decreases the odds of radical NPD to be developed by certain proportion (Appendix 5a & 5b). Practically, it can be interpreted as ‘the higher the levels of these risks, the lower the chances of radical product to be developed by firms’. For example, if there is a high probability that technological capability is considered to be a risk then it is less likely for radical NPD to occur. And, if the likely impact of customer perceived risk and human resource risk is high then radical NPD is less likely to occur. Other statistics which show negative association between radical NPD projects and different risk types were quasi significant (i.e. p-value slightly greater than 0.05). The risks were

- the impact of strategic management ($p < 0.078$)
- probability of social risk ($p < 0.069$)
- impact of social risk ($p < 0.079$)

Statistically, a quasi significant relationship is interpreted in a similar way as strongly significance relationship i.e. a unit increase in the negative likelihood of occurrence/impact of these risks mean a decrease in the odds of radical NPD type to be developed by certain proportion. For example, if there is a high probability of strategic management risk then it is less likely for radical NPD to occur. And, if the likely impact of social risk is high then radical NPD is less likely to occur. However, in the case of quasi-significant relationships, such results need to be considered with caution.

6.2.2 Incremental NPD projects vs. NPD project risks

A strong negative association between certain risk types and incremental NPD type was observed. These risks were including

- impact of technological rapidity (p <0.049)
- probability of competition risk (p <0.009)
- Impact of competition risk (p <0.034)

The interpretation of the above is as follow: a unit increase in the impact of technological rapidity, there will be a decrease in the odds of incremental NPD to be developed by 0.519. i.e. if the likely impacts of technological rapidity is high then incremental NPD is less likely to occur. Similarly, if the probability and impact of competition risk is high then it is less likely for incremental NPD to occur.

Table 6-2: Incremental NPD Projects

	Likelihood of Occurrence				Impact of Risks			
	Sig.	Exp(B)	95% C.I.for EXP(B)		Sig.	Exp(B)	95% C.I.for EXP(B)	
			Lower	Upper			Lower	Upper
Technological Rapidity Risk	.258	1.157	.898	1.490	.049	1.379	.976	1.947
Technological Capability Risk	.015	.671	.486	.927	.000	.519	.374	.721
Marketing Rapidity	.555	1.109	.787	1.563	.057	1.612	.986	2.637
Marketing CPR	.054	1.369	.995	1.885	.047	.667	.435	1.021
Marketing Capability	.015	1.489	1.079	2.056	.635	.912	.624	1.333
Competition	.265	1.181	.881	1.584	.034	1.347	.983	1.845
Operation Resources	.109	.727	.492	1.074	.149	1.296	.911	1.843
Operation HR	.009	.622	.434	.890	.058	1.135	.680	1.893
Operation Planning	.461	.863	.582	1.278	.853	.946	.522	1.712
Operation Control	.734	1.072	.717	1.602	.500	1.216	.689	2.144
Operation SM	.078	1.067	.707	1.611	.086	.766	.566	1.038
Supply chain Risk	.013	.645	.456	.913	.018	1.525	1.075	2.163
Finance Unpredictability	.737	1.060	.754	1.490	.014	.628	.433	.910
Finance lack funding	.013	.646	.458	.912	.735	.947	.692	1.297
Environment Political	.229	.775	.512	1.174	.650	.901	.574	1.414
Environment Macro	.469	.870	.597	1.269	.054	1.646	.991	2.732
Environment Social	.069	.769	.555	1.066	.079	.526	.360	.768
Environment Natural	.825	1.045	.708	1.541	.059	1.460	.957	2.228

6.3 Firm size (SMEs vs. large firms)

In this section, I tried to empirically identify if both probability of occurrence and impact of every risk type is significantly differ in different firm sizes (SMEs and Large firms). For this purpose, I run two logistic regression models where I labelled each of firms' size as follow. In the first model, SMEs were coded as 1 and large firms as (0). In the second model, large firms were coded 1 and SMEs as 0. Linearity of the continuous variables with respect to the logit of the dependent variable was assessed via the Box-Tidwell (1962) procedure (Laerd Statistics, 2015). A Bonferroni correction was applied

in the model resulting in statistical significance being accepted when $p < .005$ (Tabachnick and Fidell, 2014). Based on this assessment, all continuous independent variables were found to be linearly related to the logit of the dependent variable. Both logistic regression models were statistically significant ($p < .005$). Of the 36 predictor variables, only 8 were statistically significant ($p < .005$) and 9 were quasi-significant (i.e. nearly significant). Tables 6-3 and 6-4 provide the detailed description of both logistics models. In the following sections, I have interpreted the significant and quasi significant relationships of predictor variables and dependent variables (SMEs and large size firms) as follows:

6.3.1 Large firms vs. NPD project risks

A strong negative association between certain risk types and large firms was observed. These risks were

- probability of supply chain risk ($p < 0.0005$)
- probability of political risks ($p < 0.001$)
- Impact of political risks ($p < 0.050$)

In addition to these risks, there were few other risks for which a quasi significance negative association was observed. These were

- Probability of strategic management risk ($p < 0.077$)

The interpretation of significance relationship and quasi-significant relationship between above mentioned four risk types and large firms is as follow: If the

Table 6-3: Large firms vs. NPD project risks

	Likelihood of Occurrence				Impact of Risks			
	Sig.	Exp(B)	95% C.I.for EXP(B)		Sig.	Exp(B)	95% C.I.for EXP(B)	
			Lower	Upper			Lower	Upper
Technological Rapidity Risk	.291	1.151	.887	1.494	.103	.758	.543	1.057
Technological Capability Risk	.002	.648	.490	.856	.030	1.055	.796	1.399
Prob Marketing Rapidity	.602	1.089	.791	1.499	.215	.762	.496	1.171
Prob Marketing CPR	.555	.888	.599	1.317	.077	1.432	.962	2.132
Prob Marketing Capability	.029	.831	.615	1.123	.010	.612	.420	.891
Prob Competition	.332	.871	.660	1.151	.115	1.266	.944	1.698
Prob Operation Resources	.069	1.342	.977	1.842	.056	1.060	.733	1.534
Prob Operation HR	.013	.641	.451	.910	.042	1.044	.639	1.706
Prob Operation Planning	.695	.926	.630	1.360	.764	.924	.551	1.548
Prob Operation Control	.483	1.145	.784	1.673	.011	.835	.487	1.431
Prob Operation SM	.077	.826	.549	1.244	.281	.848	.628	1.145
Prob Supply chain	.000	2.094	1.466	2.992	.111	.760	.543	1.065
Prob Finance Unpredictability	.006	.616	.436	.872	.705	1.069	.756	1.511
Prob Finance lack funding	.167	.795	.574	1.101	.000	.532	.383	.740
Prob Environment Political	.001	2.040	1.320	3.152	.807	1.055	.687	1.619
Prob Environment Macro	.838	.962	.665	1.393	.857	.956	.587	1.558
Prob Environment Social	.312	.851	.622	1.164	.854	.969	.693	1.355
Prob Environment Natural	.386	1.193	.801	1.777	.836	1.045	.688	1.588

probabilities of supply chain and political rsk are high then it is less likely for large firms to conduct NPD. Another possible interpretation is that large firms are more likely to face supply chain and political risks when developing new products. In case of quasi significant associations, one need to be more careful to interpret that if the probability of strategic management is high, large firms are less likely to conduct NPD projects.

6.3.2 SMEs vs. NPD project risks

The SMEs were significantly negative associated with following risk types:

- Probability of technological capability ($p < 0.002$)
- Impact of technological capability ($p < 0.030$)
- Probability of marketing capability ($p < 0.029$)
- Impact of marketing capability ($p < 0.010$)
- Probability of human resources ($p <0.013$)
- Impact of human resources ($p <0.042$)
- Impact of lack of resources ($p <0.056$)
- Impact of control risk ($p <0.011$)
- Impact of lack of funding ($p <0.0005$)
- Probability of financial unpredictability ($p < 0.006$)

The interpretation of significance relationship between above mentioned 7 risk types and SMEs is as follow: If the probabilities of technological capability, human resource and financial unpredictability are high then it is less likely for large firms to conduct NPD. Similarly, when the potential negative impacts of marketing capability, lack of funding risk, financial unpredictability risk and control risk is high, SMEs are reluctant to conduct NPD projects.

Table 6-4: SMEs firms vs. NPD project risks

	Likelihood of Occurrence				Impact of Risks			
	Sig.	Exp(B)	95% C.I.for EXP(B)		Sig.	Exp(B)	95% C.I.for EXP(B)	
			Lower	Upper			Lower	Upper
Technological Rapidity Risk	.291	.869	.669	1.128	.103	1.320	.946	1.842
Technological Capability Risk	.002	1.544	1.168	2.040	.030	.948	.715	1.257
Marketing Rapidity Risk	.602	.918	.667	1.264	.215	1.312	.854	2.016
Marketing CPR	.555	1.126	.759	1.670	.077	.698	.469	1.039
Marketing Capability Risk	.029	1.203	.890	1.625	.010	1.634	1.122	2.379
Competition Risk	.332	1.148	.869	1.516	.115	.790	.589	1.059
Prob Operation Resources	.069	.745	.543	1.023	.056	.943	.652	1.364
Prob Operation HR	.013	1.560	1.099	2.216	.042	.957	.586	1.564
Prob Operation Planning	.695	1.080	.735	1.586	.764	1.082	.646	1.813
Prob Operation Control	.483	.873	.598	1.275	.011	1.198	.699	2.054
Prob Operation SM	.077	1.210	.804	1.822	.281	1.180	.874	1.593
Prob Supply Chain	.000	.478	.334	.682	.111	1.316	.939	1.843
-Prob Finance Unpredictability	.006	1.623	1.147	2.296	.705	.935	.662	1.322
Prob Finance lack funding	.167	1.258	.908	1.743	.000	1.880	1.352	2.613
Prob Environment Political	.001	.490	.317	.758	.807	.948	.618	1.455
Prob Environment Macro	.838	1.039	.718	1.505	.857	1.046	.642	1.704
Prob Environent Social	.312	1.175	.859	1.608	.854	1.032	.738	1.443
Prob Environment Natural	.386	.838	.563	1.249	.836	.957	.630	1.454

6.4 Industry sector

In this research, the work empirically identified the risk factors associated to firms from different industries. For this purpose, a one way analysis of variance (ANOVA) was conducted. Based on the nature of research question, the following hypotheses were proposed.

Null hypothesis

'there is no significant difference in the a)likelihood of occurrence and b) negative impact of different risks within NPD projects associated to different industry types.

Alternative hypothesis

'there is significant difference in the a)likelihood of occurrence and b) negative impact of different risks within NPD projects associated to different industry types.

The findings suggest that there is significant statistical difference in the likelihood of occurrence of different risks and their potential negative impact on NPD projects for different industry sectors. This was evident from the one-way ANOVA test results (Please see Table 6-5 and for more information see Appendices 7a, 7c and 7d). Different industries were classified into 6 distinct groups: i) FMCG, ii) software & information system, iii) computers & electronics, iv) textile & apparel, v) automotives & other means of transportation and vi) all others. There were no outliers in the data and data was normally distributed for each group, as assessed by Shapiro-Wilk test ($p > .05$) (Appendix 7a); and there was homogeneity of variances, as assessed by Levene's test of homogeneity of variances ($p > .05$ for each risk factor)(Appendix 7b). Data is presented as mean ± standard deviation. Out of the list of risk factors, following risk factors were statistically significant as perceived by respondents from different categories of industry types (Appendix 7c).

- Probability of marketing rapidity risk: $F(5,257) = 2.995$ ($p < 0.012$)
- Probability of competition risk: $F(5,257) = 3.010$ ($p < 0.012$)
- Impact of marketing rapidity risk: $F(5,257) = 4.883$ ($p < 0.005$)

Table 6-5: Levene Test (NPD Project Risk versus Industry Type)

	Levene Statistic	df1	df2	Sig.
Probability of Technological Rapidity Risk	.588	5	257	.709
Probability of Technological Capability Risk new	1.173	5	257	.323
Impact of Technological Rapidity Risk	.448	5	257	.815
Impact of Technological Capability Risk	.669	5	257	.647
Probability of Marketing Rapidity Risk	.394	5	257	.853
Probability of Customer Perceived Risk	.559	5	257	.731
Probability of Marketing Capability Risk	.880	5	257	.495
Probability of Competition Risk	1.369	5	257	.236
Impact of Marketing Rapidity Risk	1.254	5	257	.284
Impact of Customer Perceived Risk	2.195	5	257	.055
Impact of Marketing Capability Risknew	.779	5	257	.566
Impact of Competition Risk	.654	5	257	.659
Probability of Resource Risk	4.126	5	257	.007
Probability of Human Resource Risk	1.344	5	257	.246
Probability of Planning Risk	2.928	5	257	.054
Probability of Control Risk	3.526	5	257	.064
Probability of Strategic Management Risk	.429	5	257	.828
Impact of Resource Risk	.625	5	257	.681
Impact of Human Resource Risk	.318	5	257	.902
Impact of Planning Risk	1.571	5	257	.169
Impact of Control Risk	.303	5	257	.911
Impact of Strategic Management Risk	.412	5	257	.841
Probability of Supply Chain Risk	.626	5	257	.680
Impact of Supply Chain Risk	.628	5	257	.678
Probability of Financial Unpredictability Risk	.757	5	257	.581
Probability of Lack of Funding	2.478	5	257	.063
Impact of Financial Unpredictability Risk	2.451	5	257	.074
Impact of Lack of Funding	.807	5	257	.545
Probability of Political Risk	4.701	5	257	.094
Probability of Macro-Economic Risk	3.082	5	257	.080
Probability of Social Risk	1.644	5	257	.149
Probability of Natural Risk	1.979	5	257	.082
Impact of Political Risk	.788	5	257	.559
Impact of Macro-Economic Risk	.728	5	257	.603
Impact of Social Risk	2.995	5	257	.072
Impact of Natural Risk	2.334	5	257	.073

- Impact of marketing capability risk: $F(5,257) = 3.858$ ($p < 0.002$)
- Impact of control risk: $F(5,257) = 2.385$ ($p < 0.039$)
- Probability of supply chain risk $F(5,257)= 2.591$ ($p < 0.026$)
- Probability of financial unpredictability risk $F(5,257)= 2.591$ ($p < 0.006$)
- Probability of lack of funding risk $F(5,257)= 3.138$ ($p < 0.009$)
- Probability of macroeconomic risk $F(5,257)= 2.996$ ($p < 0.012$)
- Probability of natural risk $F(5,257)= 3.884$ ($p < 0.015$)
- Impact of natural risk $F(5,257)= 2.581$ ($p < 0.027$)

To locate exact association between industry sectors and different NPD project risks and between means that exists across the industry sectors, Tukey post hoc analysis was conducted (Appendix 7d)

The post hoc tests established that:

- In case of probability of marketing rapidity risk, the mean score for the firms associated to FMCG (Mean= 3.62, SD= 1.330) was significantly different from firms associated to computer & electronics sector (Mean= 2.62, SD= 1.330). Firms from other industrial sectors did not differ significantly from firms associated to either FMCG or computer and electronics.
- In case of probability of competition risk, the mean score for the firms associated to FMCG (Mean= 3.38, SD= 1.456) was significantly different from firms associated to all others sector (Mean= 2.62, SD= 1.374). Firms from other industrial sectors did not differ significantly from firms associated to either FMCG or other sectors.
- In case of impact of marketing capability risk, the mean score for the firms associated to FMCG (Mean= 2.58, SD= 1.253) was significantly different from firms associated to software & information system (Mean= 3.50, SD= 1.404). Firms from other industrial sectors did not differ significantly from firms associated to either FMCG or software & information systems.
- In case of impact of competition risk, the mean score for the firms associated to FMCG (Mean= 2.88, SD= 1.451) was significantly different from firms

associated to software & information system (Mean= 3.22, SD= 1.333). Firms from other industrial sectors did not differ significantly from firms associated to either FMCG or software & information systems.

- In case of probability of supply chain risk, the mean score for the firms associated to software & information system (Mean= 3.86, SD= 1.588) was significantly different from firms associated to computers & electronics (Mean= 2.85, SD= 1.388). Firms from other industrial sectors did not differ significantly from firms associated to either software & information systems and computers & electronics.
- In case of probability of financial unpredictability risk, the mean score for the firms associated to software & information system (Mean= 2.22, SD= 1.396) was significantly different from firms associated to computers & electronics (Mean= 3.08, SD= 1.228). Firms from other industrial sectors did not differ significantly from firms associated to either software & information systems and computers & electronics.
- In case of probability of lack of funding risk, the mean score for the firms associated to computers & electronics (Mean= 2.88, SD= 1.181) was significantly different from firms associated to all others sectors (Mean= 3.73, SD= 1.215). Firms from other industrial sectors did not differ significantly from firms associated to either computer & electronics and all other sectors.
- In case of probability of macro-economic risk, the mean score for the firms associated to software & information system (Mean= 1.92, SD= 0.996) was significantly different from firms associated to computers & electronics (Mean= 2.90, SD= 1.499). Firms from other industrial sectors did not differ significantly from firms associated to either software & information systems and computers & electronics.
- In case of impact of natural risk, the mean score for the firms associated to computers & electronics (Mean= 2.65, SD= 1.460) was significantly different from firms associated to all others sectors (Mean= 1.79, SD= 1.045). Firms from other industrial sectors did not differ significantly from firms associated to either computer & electronics and all other sectors.

6.5 Summary of research question 2

The results of binomial logistic regressions indicated that there are important factors (risks types) determining whether different types of NPD will occur and firms of different sizes proceed to conduct NPD.

The risks were different for the two types of NPD projects. For example, of the 18 predictor variables (risk types), only 5 risks were either statistically significantly or quasi significantly associated with radical NPD projects. These risks included the probability of technological capability risk, impact of technological capability risk, probability of customer perceived risk, impact of customer perceived risk, probability of human resource risk, impact of human resource risk, impact of strategic management risk, probability and impact of social risk. In contrast, only 2 risk dimensions were statistically (strongly or quasi) associated with incremental NPD projects. These risks were the impact of technological rapidity and probability and impact of competition risk.

In the case of firm sizes, these risks were different for both SMEs and large firms. For example, of the 18 predictor variables (risk types), only 4 risks were either statistically significantly or quasi significantly associated with SMEs. These risks included the probability and impact of technological capability, probability and impact of marketing capability, probability and impact of human resources, impact of lack of resources, impact of control risk, impact of lack of funding and probability of financial unpredictability.

In case of industry sectors, the findings suggest that there was significant statistical difference in the likelihood of occurrence of different risks and their potential negative impact in NPD projects of different firms. The significance difference lied on the risks such as probability of marketing rapidity risk, probability of competition risk, impact of marketing rapidity risk, impact of marketing capability risk, impact of control risk, probability of supply chain risk, probability of financial unpredictability risk, probability of lack of funding risk, probability of macro-economic risk, probability of natural risk and impact of natural risk.

7 Empirical findings: RQ3: Identifying NPD team member's perceptions

The analysis in research question 3 is limited to gain an understanding of the perceptions of:

- Team members from technological functions (e.g., R&D, product design, etc) versus all others (e.g. manufacturing, supply chain or finance, etc)
- Team members from top management (e.g., CEO, general manager or BOD member) versus all others (middle and lower level management)

7.1 Team members from technological functions (e.g., R&D, product design, etc) versus all others (e.g. manufacturing, supply chain or finance, etc)

In this analysis, a one-sample t-test was used to determine whether there is a statistically significant difference between the mean perceptions of team members from technological functions and team members from other functions. This leads to the following hypotheses:

Null hypothesis

'there is no difference in the mean perception of NPD project risks among the team members from technological functions (e.g., R&D, product design, etc) versus all others (e.g. manufacturing, supply chain or finance, etc)

Alternative hypothesis

'there is a difference in the mean perception of NPD project risks among the team members from technological functions (e.g., R&D, product design, etc) versus all others (e.g. manufacturing, supply chain or finance, etc)

It is important to mention here that t-test requires that the assumption of homogeneity of variances is met. If it is not met, the result might not be valid. However, a modification can be made to the standard t-test to accommodate unequal variances and still deliver a valid test result. This modified t-test is often referred to as the unequal variance t-test**,** separate variances t-test**,** or the Welch t-test (Welch, 1951). In this analysis, there were at least three risk types where the assumption of homogeneity of variance was violated as assessed by Levene's test for equality of variances i.e. the probability of technological rapidity, the probability of marketing rapidity, the probability of marketing capability, the probability of supply chain risk and the probability of lack of funding. For these risk types, the output of modified t-test was used to accept or reject the null hypothesis (Appendices 8a and 8b).

The findings suggest that there was significant statistical difference in the mean perception of few NPD project risks among the team members from technological functions (e.g., R&D, product design, etc) and team members from all others functions (e.g. manufacturing, supply chain or finance, etc). These differences are described below.

7.1.1 Technological rapidity risk

Team members from technological functions were decisive in perceiving the probability and impact of technological rapidity risk than the team members from other functions. The mean scores for both probability and impact of technological rapidity risk as perceived by member from technical function were statistically significantly higher by .994(95% CI, .673 to 1.314) and 0.342(95% CI, .082 to .601) than team members from other functions ($p < 0.010$) (Appendices 8a and 8b).

7.1.2 Technological capability risk

Team members from technological functions were less decisive in perceiving the probability of technological capability risk than the team members from other functions. The mean scores for the probability of technological capability risk as perceived by a member from technical function were statistically significantly lower by .717(95% CI, -1.041 to -0.393) than team members from other functions ($p < 0.0005$) (Appendices 8a and 8b).

7.1.3 Marketing rapidity risk

Team members from technological functions were decisive in perceiving the probability of marketing rapidity risk than the team members from other functions. The mean scores for the probability of marketing rapidity risk as perceived by a member from technical function were statistically significantly higher by .672(95% CI, 0.356 to 0.988) than team members from other functions (p <0.0005) (Appendices 8a and 8b).

7.1.4 Marketing capability risk

Team members from technological functions were less decisive in perceiving the probability of marketing capability risk than the team members from other functions. The mean scores for the probability of marketing capability risk as perceived by a member from technical function were statistically significantly lower by .817(95% CI, -1.140 to -0.493) than team members from other functions (p <0.0005) (Appendices 8a and 8b).

7.1.5 Competition risk

Team members from technological functions were less decisive in perceiving the probability of competition risk than the team members from other functions. The mean scores for the probability of competition risk as perceived by a member from technical function were statistically significantly lower by .0.772(95% CI, -1.119 to -0.426) than team members from other functions (p <0.0005) (Appendices 8a and 8b).

7.1.6 Planning risk

Team members from technological functions were less decisive in perceiving the probability of planning risk than the team members from other functions. The mean scores for the probability of planning risk as perceived by a member from technical function were statistically significantly lower by .246(95% CI, -0.513 to 0.021) than team members from other functions (p <0.070) (Appendices 8a and 8b).

7.1.7 Lack of funding risk

Team members from technological functions were less decisive in perceiving the probability of lack of funding than the team members from other functions. The mean scores for the probability of lack of funding as perceived by a member from technical function were statistically significantly lower by .780(95% CI, -1.105 to -0.456) than team members from other functions (p <0.0005) (Appendices 8a and 8b).

7.1.8 Financial unpredictability risk

Team members from technological functions were decisive in perceiving the probability of financial unpredictability risk than the team members from other functions. The mean scores for the probability of financial unpredictability risk as perceived by a member from technical function were statistically significantly higher by .415(95% CI, 0.090 to 0.740) than team members from other functions ($p < 0.013$) (Appendices 8a and 8b).

7.1.9 Supply chain risk

Team members from technological functions were less decisive in perceiving the probability of supply chain risk than the team members from other functions. The mean scores for the probability of supply chain risk as perceived by a member from technical function were statistically significantly lower by .508(95% CI, -0.853 to -0.164) than team members from other functions ($p < 0.033$) (Appendices 8a and 8b).

7.2 Team members from top management (CEO, general manager or BOD member) versus all others (middle and lower level management)

This analysis was also conducted by using one-sample t-test to determine whether there is a statistically significant difference between the mean perceptions of NPD risks of team members representing top management and team members representing middle or low-level management. The hypotheses set for this purpose were as follows:

Null hypothesis

> *'There is no difference in the mean perception of NPD project risks of team members representing top management and team members representing middle and lower level management".*

Alternative hypothesis

> *'There is difference in the mean perception of NPD project risks of team members representing top management and team members representing middle and lower level management".*

The findings suggest that there was significant statistical difference in the mean perception of NPD project risks among the team members representing top management and other team members. These differences are described below.

7.2.1 Technological rapidity risk

Top management were decisive in perceiving the probability of technological rapidity risk than the middle or low-level management. The mean score for the probability of technological rapidity risk as perceived by top management was statistically quasi-significantly higher by .367(95% CI, -0.070 to 0.805) than middle or lower management (p <0.099) (Appendices 8c and 8d).

7.2.2 Technological capability risk

Top management were decisive in perceiving the probability of technological capability risk than the middle or low-level management. The mean score for the probability of technological capability risk as perceived by top management was statistically significantly higher by .513(95% CI, 0.098 to 0.927) than middle or lower management (p <0.016). In contrast, middle or low-level management were more decisive in perceiving the impact of technological capability risk than the top management as the mean score for their perception about the impact was higher than top management by 0.770 (95% CI, -1.206 to -0.334) (p <0.050) (Appendices 8c and 8d).

7.2.3 Marketing capability risk

Middle or low level management were more decisive in perceiving the probability of marketing capability risk than the top management as the mean score for their perception about the probability was higher than top management' perception by 0.352 (95% CI, -0.765 to 0.061) (p <0.050) (Appendices 8c and 8d).

7.2.4 Resource risk

Middle or low level management were more decisive in perceiving the probability of resource risk than the top management as the mean score for their perception about the probability was higher than top management' perception by 0.387 (95% CI, -0.773 to 0.000) (p <0.050) (Appendices 8c and 8d).

7.2.5 Human resource risk

Top management was less decisive in perceiving the probability of human resource risk than the middle or low-level management. The mean scores for the probability of human resource risk as perceived by top management were statistically significantly lower by -.661(95% CI, -1.061 to -0.261) than middle or low-level management (p <0.001) (Appendices 8c and 8d).

7.2.6 Planning risk

Middle or low level management were more decisive in perceiving the probability of planning risk than the top management as the mean score for their perception about the probability was higher than top management' perception by 0.409 (95% CI, -0.811 to -0.008)(p <0.046) (Appendices 8c and 8d).

7.2.7 Control risk

Top management was less decisive in perceiving the probability of control risk than the middle or low-level management. The mean scores for the probability of control risk as perceived by top management were statistically significantly lower by -.501(95% CI, -0.898 to -0.104) than middle or low-level management (p <0.014) (Appendices 8c and 8d).

7.2.8 Lack of funding risk

Middle or low-level management were more decisive in perceiving the probability of lack of funding risk than the top management as the mean score for their perception about the probability was higher than top management' perception by 0.897 (95% CI, -1.372 to -0.422) (Appendices 8c and 8d).

7.2.9 Financial unpredictability risk

Top management was decisive in perceiving the probability of financial unpredictability risk than the middle or low-level management. The mean score for probability of financial unpredictability as perceived by top management was statistically significantly higher by .816(95% CI, 0.289 to 1.344) than middle or lower management (p <0.016) (Appendices 8c and 8d)

7.2.10 Political risk

Top management was decisive in perceiving the probability of political risk than the middle or low-level management. The mean score for probability of political risk as perceived by top management was statistically significantly higher by .428(95% CI, 0.047 to 0.808) than middle or lower management ($p < 0.028$) (Appendices 8c and 8d)

7.2.11 Macroeconomic risk

Top management was decisive in perceiving the impact of macroeconomic risk than the middle or low-level management. The mean score for impact of macroeconomic risk as perceived by top management was statistically significantly higher by 1.160(95% CI, 0.788 to 1.532) than middle or lower management ($p < 0.0005$) (Appendices 8c and 8d)

7.3 Summary

A one-sample t-test was conducted to determine whether there is a statistically significant difference between the mean perceptions of team members from technological functions and team members from other functions. Team members from technological background gave more importance to both probability and impact of technological rapidity risk, the probability of marketing rapidity risk and the probability of financial unpredictability risk. In contrast, risk factors such as the probability of technological capability risk, the probability of marketing capability risk, the probability of competition risk, the probability of planning risk, the probability of lack of funding and probability of supply chain risk were given more importance by team members from other functions. For the remaining risk factors, there were no statistical differences in the perceptions of team members with the varying background.

Another one-sample t-test was conducted to determine whether there is a statistically significant difference between the mean perceptions of top management and team members from middle or low-level management. Top management gave more importance to the probability of technological rapidity risk, the probability of technological capability risk, the probability of financial unpredictability risk, the probability of financial unpredictability risk and impact of macroeconomic risk. In relation to their perceptions, middle level or low-level management gave more importance to risk factors such as the impact of technological capability risk, the impact of marketing capability risk, the impact of resource risk, the impact of human resource risk, the impact of planning risk, the impact of control risk and the probability of lack of funding risk. For the remaining risk factors, there was not any significant difference in the perceptions of top management and middle or low-level management. In other words, they viewed remaining risk factors equally important or unimportant.

With the help of mode values and independent sample t test, I tried to determine whether there was significant statistical difference in the mean perception of team members from technological functions associated with SMEs and large firms. According to the result, there was a clear difference of perceptions about certain risk factors by R&D respondents from both SMEs and large firms. For example, R&D respondents from SMEs emphasized their worries for the high likelihood of marketing capability and potential negative impact of lack of funding. In contrast, R&D respondents from large firms were more inclined towards the negative impact of competition risk and resource risks.

8 Discussion

The purpose of this chapter is to build on the findings from the empirical elements of the study reported previously. The section begins with the synthesis of the findings presented in the descriptive statistics section. Next, the findings related to the research question (RQ1), research question (RQ2) and research question 3(RQ3) are discussed and synthesised. By doing so, this work aimed to empirically identify and confirm the risks prevalent to NPD projects and identify how perceptions of risk changes according to different contingency factors. Finally, a summary is presented to conclude the chapter.

8.1 Introduction

New product development (NPD) is a key aspect of innovation and is one of the most important strategic and operational tools; an organization can use to sustain growth and profitability (Kok and Lightart, 2014). Firms increasingly develop new products to respond to market change, develop competitive advantages, and increase their chances of survival (Kok and Lightart, 2014). Market changes require firms to develop not just incremental products, but also radical products that they can commercialize (Kok and Lightart, 2014; O'Connor et al., 2008). While radical NPD requires new knowledge based on new competencies and practices, incremental NPD, in contrast, builds on existing competencies and practices (Christensen, 1997; O'Connor, 2008).

There are several significant incentives for firms to continuously introduce new products (increment or radical) to the markets. First, the financial return from successful NPD can help firms overcome the slowing growth and profitability of existing products that are approaching the maturity stages of their life cycles (Ahmad et al., 2013). For example, according to a study by the Marketing Science Institute (USA), 25% of successful firms' current sales were derived from new products introduced in the last three years (Dahan and Hauser, 2002). Second, the reputation of the firm and its brands is heavily influenced by the number of successful NPD projects it conduct (Dahan and Hauser, 2002). For example, Nike has enhanced its overall brand reputation, well beyond athletic footwear by introducing golf equipment and supplies, swimwear, soccer equipment and apparel (Dahan and Hauser, 2002). Third, NPD can be a potential source of significant economies of scale for the firm (Beverland et al., 2016). New products may be able to use many of the same raw material inputs as the firm's existing products and may be able to be sold by the firm's existing sales force resulting in substantially lower unit costs (and in turn higher margins) for the firm.

Although NPD creates value for firms, each NPD project involves some degree of uncertainty and risk (Cui and Wu, 2016; Keizer et al., 2005). Yet, many firms assume that their entire portfolio of NPD projects will succeed, and fail to identify and analyse the risks associated with each NPD project. This orientation will lead to the failure of NPD projects (Raz et al., 2002). There is considerable evidence that NPD projects suffer from risks and are prone to serious cost and schedule overrun and decline in targeted technical performance of the product. For example, according to a report published in 2013 by the Product Development and Management Association (Markham and Lee, 2013), only 61% of launched products succeeded in the market. Given the high ratio of NPD project failures, firms cannot continue to carry NPD projects which are prone to risks. They need to be prepared for NPD project risks and be ready to manage these risks effectively (Raz et al., 2002). Consequently, the awareness of NPD project risks has gained considerable attention among both academics and practitioners.

While existing academic literature provides an extensive discussion of risk management tools and methods, it was found that no classification of NPD project risks existed despite regular calls for its development (Schmidt et al., 2001; Wallace et al., 2004) that would allow comprehensive insight into NPD project risks and permit comparisons of NPD project risks for different NPD types (incremental or radical), different firm sizes (i.e. SMEs vs. Large firms) and for different industries. This is considered to be a major omission because, without a clear overview of risks and a proper understanding of the interaction between risks and different contingency factors (e.g. different NPD types and firms sizes), the policy makers may fail to devise an effective risk management strategy (Wallace et al., 2004). Therefore, the purpose of this research was to fill in this significant gap in the literature by developing inductively from the existing studies, a classification of main risk types, each with a number of sub-categories, providing definitions and supporting evidence for each and empirically validating the proposed taxonomy of risks.

Because, NPD literature also suggests that NPD projects differ from each other in several characteristics such as size, duration, product type, industry (Raz et al., 2002) and that NPD practices depend on these project's characteristics (Griffin, 1997). Therefore, any NPD related construct which needs to be investigated should be analyzed in the context of these project characteristics. The same applies to NPD project risks. One cannot expect that a single universal list of risk factors would apply to all types of NPD projects. Just as there are different types of projects, there can be different types of risks (Raz et al., 2002). Because the interactions between NPD project risks and different project characteristics were not studied extensively, I decided to analyze this interaction between risks and different contingency factors that may influence NPD projects? Particularly, I focused on three characteristics: NPD project type i.e. radical vs. incremental, firms' size (SMEs and large firms) and industry type.

To achieve the objectives, I first adopted an inductive approach mentioned by Armstrong et al. (2012), Pittaway and Cope (2007) and Pittaway et al. (2004) to produce an extensive list of risk factors. In this approach, each article was coded using an emergent coding scheme which allowed the key themes to emerge from the data. This process led to the emergence of 18 risk types which were organized into six main categories: technological risk, marketing risk, operations risk, supply chain risk, finance risk and environmental risk. The research first empirically examined the extent to which this proposed list of risk factors was associated with UK firms conducting NPD operations. Then I analyzed their interactions with three different contingency factors by employing large-scale survey of 263 respondents. In the following sections, I will provide a synthesis of the findings in the light of past literature and provide extensive discussion on each risk type. I will start with the discussion of the key points of the descriptive findings.

8.2 An insight from descriptive findings

The analysis of the data obtained from 263 respondents from UK firms conducting NPD projects revealed several examples of low-cost products (about 45 % of the total sample were comprised of low-cost products). This confirmed the notion that the rules of traditional product development are rapidly changing and firms have adopted low-cost product development strategy to remain competitive (Mohanbir, 2016; Brown and Eisenhardt, 1995). The low-cost products are not just a phenomenon for emerging markets but a major trend for developed markets, given the current economic situation (Simon, 2016). The analysis of data also suggests that it was not SMEs only but large firms as well which were developing the low-cost products the proportion of large firms conducting NPD projects of budget up to £100k was 50 % (Section 4.2, Chapter 4).

Another key observation from the data was that both SMEs and large firms tend to develop more incremental than radical NPD e.g. the proportion of incremental to radical products types in both large firms and SMEs was 60:40. The finding is consistent with the extant literature which suggests that the majority of firms prioritize incremental NPD projects rather than radical projects in their NPD portfolios (Markham and Lee, 2013). It has been argued that developing incremental NPD projects appeared to be negatively correlated with firm's performance in the long term (Adam and Boike, 2004). Furthermore, the firm's overall success is strongly linked to the mixed NPD efforts (i.e. both incremental and radical) (Chao and Kavadias, 2006), yet firms often tend to develop more incremental than radical. A possible explanation is that both incremental and radical products are different in nature and managing radical NPD projects is a challenging task for firms because of scarce resources, high uncertainties and product/project complexities associated with it (Kavadias and Loch, 2003). Since radical innovations introduce major changes to the existing products in terms of new market, technology and potential application of the product, firms encounter obstacles in developing such products (Kok and Lightart, 2014). Furthermore, firms often tend to invest in conventional technologies rather than new technologies. A possible explanation might be that firms fail to make sense of the limitation of existing technologies and hence avoid allocating resources in potentially new technologies (Beverland et al., 2016).

It was further observed from the data that there were significant differences in R&D spending on radical NPD projects and incremental NPD projects by firms, i.e. more R&D budget was allocated to radical NPD project. A possible explanation might be that because developing a radical new product is a more complicated process than incremental and requiring a series of activities which incremental NPD projects might not need. Therefore, managing radical NPD process is not only difficult but extremely expensive (Fullagar, 2015). This also provides the argument to the previous finding which suggests that firms tend to develop more incremental products than radical ones.

In the following sections, I will provide extensive discussion on the results of the likelihood of occurrences and impact of various NPD risk sources and their interaction with different contingency factors.

8.3 Technological risk

The technological risk in this research is conceptualized in accordance with the past innovation literature which refers to a firm's inability in understanding the surrounding technological environment and launching a new product successfully. Two important aspects of technological risks often discussed are technological rapidity and technological capability (Mu et al., 2009; Kim and Vonortas, 2014). Lacking technological capability is an internal risk which reflects the firm's inability to launch a new product successfully (Browning et al., 2002; Kayis et al., 2007). This may include the firm's lack of technological orientation, technological resources and in-house expertise necessary to understand or design new forms of technologies (Schmidt et al., 2001; Jun et al., 2011; Wu and Wu, 2014) and thereafter developing a product. In contrast, technological rapidity risk is an exogenous risk which falls outside the realm of a firm. It refers to the extent to which technology changes over time or becomes obsolete during the NPD project (Buganza et al., 2009) and consequently impacts NPD project negatively.

Technological rapidity risk, in this empirical research, is classified as a high probability-high impact risk factor due to its high score in the likelihood of occurrence and potential negative impact perceived by respondents (Appendix and Figure 5.19). In contrast, technological capability risk is classified as high probability and low impact risk. Overall, the respondents of this study assigned a higher score to the likelihood of occurrence and potential negative impact of technological rapidity risk than technological capability risk. A possible explanation for the finding is that the characteristics of technological rapidity risk differ from those of technological capability risk. For example, as mentioned at the beginning of the section, technological rapidity is an exogenous risk, which makes it harder for firms to predict its probability and the impact on different stages of the NPD process (Ilevbare et al., 2014) especially given the fast changing nature of technology. In the case of technological capability risk, however, firms do not pursue any NPD project until they can ensure that they have the right technological capabilities and skills essential to conducting NPD project. This reduces a lot the likelihood of occurrence and the negative impact of technological capability risk. When I asked respondents about their opinion on technological risk through open-ended question, many respondents expressed their satisfaction with existing technological capabilities of their firms and did not seem to be concerned. It was also noted from their responses that their firms are being successful in managing the technological capability risk by employing suitable risk management strategies. A few were confident because of the latest technological equipment they were using in developing the products as mentioned by a manager from the fabric design printing company:

"technological capability risk is low as we use machinery with advanced technology".

A few firms held long technological experience. For example, a business manager from painting firm mentioned that the firm had

"very limited technological capability risk as our company is leader in painting industry with massive technological experience".

In general, the analysis of their opened ended answers revealed that their firms often employ control strategies including networking with external firms and R&D groups and building a strong internal technological orientation to respond to this risk.

Technological rapidity risk, however, remains a big challenge for firms as both its likelihood of occurrence and impact was scored high. For example, as mentioned by a respondent from a software firm:

“its hard to mitigate for this (technological rapidity risk), we all wish we could predict the future” .

This finding, in general, aligns with the previous research indicating the negative influence of technological rapidity on NPD project performance (Owens, 2007; Unger and Eppinger, 2009). However, more importantly, it is this research which has clearly gauged the extent of probability and impact of technological rapidity risk in relation to other NPD project risks which was the missing aspect in the extant literature. In addition, respondents failed to demonstrate mitigation strategies for managing technological rapidity risk. Managers and scholars, therefore, need to pay more attention in devising the assessment and mitigation strategies for technological rapidity risk.

Expanding our analysis further to understand how perceptions of technological rapidity and technological capability risk change with different project types (incremental and radical) and different firm sizes (SMEs and large size firms), I conducted MANOVA tests. To the best of the researcher’s knowledge, the previous literature did not gauge such relationships either. The analysis revealed a strong negative association between the impact of technological rapidity risk and incremental NPD projects. The finding may be deemed surprising given the definition and conceptualization of incremental and radical NPD projects. Incremental NPD projects, in general, are linear, predictable, encounter fewer uncertainties and less complex collaboration (Keizer et al., 2002). The target market and customer needs are generally known (Holahan et al., 2014). Also, the technology required is not usually very different from the existing ones and the production processes used are well-understood and existent (Keizer and Halman, 2009). In contrast, radical innovation gives rise to new products which are new to the company and the industry and involve a high level of uncertainty and complexity in the new product requirements, technology, customers’ needs and competitors’ actions (Song and Montoya-Weiss, 1998). Furthermore, the process infrastructure for conducting such a project may still be at the development stage or non-existent (Lynn et al., 1996). Based on this, one can argue that radical NPD projects should be more vulnerable to technological rapidity risk than incremental. However, this research suggests that incremental NPD projects are more negatively correlated with technological rapidity risk than radical NPD projects. A possible reason may be the attitude of NPD team towards incremental NPD projects potentially due to their overconfidence on existing technology. An alternative explanation may be that NPD project managers are more sensitive to radical NPD projects and will not allow the potential negative effect of technological rapidity risk on radical NPD projects. However, it is concluded from the research that incremental NPD projects are the ones, which actually suffer from technological rapidity risk. In fact, previous studies have shown that firms conducting incremental projects are often unsure about the compatibility of new technology with the existing ones (Yong-Li et al., 2007) and therefore face severe negative consequences with a change in technology. In general, these finding, emphasises the importance of looking at ways to enable companies to deal better with technological rapidity risk as it has a high likelihood of occurrence and significant negative impact.

It was further observed a strong association between the technological capability risk (both probability and impact) and radical NPD projects, i.e. respondents from radical NPD projects assigned a high score to the probability and impact of technological capability risk. A possible explanation is that radical NPD projects require major changes to the existing NPD processes, demand advanced technological capabilities and skills (Steven, 2014; Stockstrom and Herstatt, 2008). Firms, in general, lack the complex knowledge and information required to understand the radical technological environment (Segismundo and Miguel, 2008), the established procedures to conduct radical projects (Nidumolu, 1995) and technological resources to design and develop the radical products (Li et al., 2008).

I further observed the significant change in the perception of respondents when both components of technological risk were compared and contrasted in terms of firm size. A significant association between SMEs and technological capability risk was observed. This does not seem surprising with the widespread perceptions from past literature which suggests that SMEs are much more vulnerable to various types of risk (Millward and Lewis, 2005) and have much higher probabilities for facing such risks than their larger and established counterparts (OECD, 2001). In particular, from the innovation literature, I found both empirical and anecdotal evidence which suggests that SMEs are challenged in terms of technological development resources and skills (Kim and Vonortas, 2014). I dig down further within SMEs and found that SMEs, in general, are vulnerable to technological capability risk, i.e. there is no significant difference, among incremental or radical NPD projects within SMEs in terms of facing the technological capability risk. With regard to technological rapidity risk, there was no statistical difference between the respondents of large firms and SMEs in perceiving its likelihood of occurrence and potential negative impact on NPD project. Technological change affects both large and small firms equally.

8.4 Marketing risk

Marketing risk in this research is conceptualized as failing to understand customer requirements that can be satisfied by a particular product (Mu et al., 2009). It is also associated with risks concerning competitor's actions and behaviours (Kim and Vonartas, 2014). In line with the existing research (Kim and Vonortas, 2014; Mu et al., 2009), I identify four important elements of marketing risk: market rapidity, customer perceived risk, marketing capability and competition.

Marketing rapidity risk refers to the extent to which customers' requirements change over time (Buganza et al., 2009). The dynamic nature of customers' requirement and exogenous nature of this risk makes it harder for firms to assess the likelihood of occurrence and potential negative impact of this risk during the NPD project (Thamhain and Skelton, 2007). Marketing rapidity risk, in this empirical research, is classified as a high probability-low impact risk factor (Appendix and Figure 5.19). The risk was largely studied in the innovation literature under different labels such as environmental turbulence or market turbulence (Buganza et al., 2009; Song and Montoya-Weiss, 2001). The literature suggests that when conducting NPD projects, firms experience turbulent environments to varying degrees. Gatignon and Xuereb, (1997) also noted that "the success of an innovation is not independent of the market in which the firm functions" (p. 80). Similarly, others regarded market turbulence as both a constraint and an opportunity that influences the internal structures and processes when developing new products (Bstieler, 2005; Lawrence and Lorsch, 1967). While there is significant support for market turbulence and its impact on new product projects (Buganza et al., 2009), due to contradictory evidence in the literature, it was unclear whether market turbulence influences NPD projects negatively or positively. This research adds to the existing literature by confirming the negative side of marketing rapidity risk. The high associated probability with marketing rapidity suggests that firms need to respond to marketing rapidity risk promptly as firms that do not respond, are most likely to underperform in relation to other firms (Bstieler, 2005).

The next important element of marketing risk is customer perceived risk which reflects customers doubts about whether the new product will meet their satisfaction or whether there may be a safety issue with the use of the product (Khan et al., 2008). Respondents of this study assigned the risk a high score (above the baseline thresholds) in terms of probability of occurrence and potential negative impact respectively. From this, I deduce that respondents in general show concern about customer's fear and reaction towards the products. In this empirical research, few respondents expressed their concern on customer perceived risk. For example, an NPD manager from a furniture company mentioned,

"the new product line will require huge marketing effort to change customers habits from using wooden furniture to plastic furniture.".

Another project manager from software development company mentioned,

"the main risk is from existing customers having a negative reaction to the new system. Keeping them informed, of all the changes, and showing them all the new benefits".

The past literature identifies several underlying causes for customer perceived risk. For example, customer perceived risk can mount due to the poor performance of the firm which results in adverse publicity of the product (Denning, 2013). Customers then change their commitment towards the product (Tang et al., 2009). Other factors due to which customer perceived risks increases are the fall of the product quality level below general accepted values, failure of the product to satisfy customer needs or customers experiencing problems while using the products (Mu et al., 2009 and Raharjo et al., 2008). A prominent example for customer perceived risk is the case of Boeing 787 Dreamliner. After facing several problems that resulted in a high cost and a series of delays, many customers lost their confidence in Boeing's aircraft development capability. As a result, these customers cancelled their orders for the Dreamliner 787, and a few migrated towards leasing contracts instead of purchasing the aeroplane outright (Tang et al., 2009). In general, results of this research suggest that managers need to analyze customer perceived risk during NPD project for the successful completion and sale of the products.

The next risk factor is the marketing capability risk which is an internal dimension of marketing risk and reflects firms failure to anticipate the exact customer requirements (Ogawa and Piller, 2006), to identify target customers (Ilevbare et al., 2014), to understand their demands for different product types (Zhang and Doll, 2001) and failing to aggregate this demand with the appropriate product characteristics to be incorporated in the product (Davis, 2002 and Zhang and Doll, 2001). Respondents in this study regarded marketing capability risk as a critical risk (scores for both probability and impact were above baseline threshold). A close analysis of respondents' responses revealed that a majority of them were not only concerned about anticipating exact customer requirements but also how to market their products. For example, the head of small business which is producing Halloumi cheese in Yorkshire stated that,

"Halloumi cheese is kind of cheese that is needed and the market exists. The key issue for us is the promotion of the product".

The findings are consistent with extant literature, and there is anecdotal and empirical evidence suggesting that identifying exact specification and potential sales volumes of new products is becoming more difficult than ever (e.g. Ogawa and Piller, 2006; Zhang and Doll, 2001), and this is mainly due to improper marketing (Hartley, 2006). This research confirmed this notion.

The fourth component of marketing risk is competition risk. This reflects a firm's inability to understand the current or future changes in the competitive market (Kim and Vonartas, 2014) and the potential for harm due to competitor actions (Souder and Bethay, 1993). Due to its external nature, it is also regarded as a key threat for NPD projects (e.g. Bstieler, 2005; Buganza et al., 2009). The mean values for the probability of occurrence and potential negative impact of competition risk were 2.95 and 3.17 respectively which classify the competition risk into high impact low probability risk. Various respondents expressed their opinions about the competition risk. For example, a project manager for an electronics firm mentioned that

“ company's market share is high and there is real competitive threat........”.

Similarly, an NPD manager from a small business developing lantern products noted that

“the simplicity of production will attract serious competition.”

Consistent with existing literature, the findings of this research support the notion that a firm is prone to high marketing risk when it is surrounded by established and dominant competitors who lead the market in the particular product or technology (Hise and Groth, 1995). Firms may potentially face sudden technology or product obsolescence when customer requirements change due to the influence of competitor pressure (Schmidt et al., 2001).

Expanding the analysis further on marketing risk, the research analyzes the relationship between all four sub-categories of marketing risks and different firm sizes. There was no statistical difference between the respondents of large firms and SMEs when perceiving the likelihood of occurrence and potential negative impact for marketing rapidity risk, customer perceived risk and competition risk. In other words, all three risks were equally perceived as a threat by most of the respondents. I, however, found a significant association between SMEs and marketing capability risk. As one would expect, the finding is not surprising insofar as empirical and anecdotal evidence suggests that SMEs are much more vulnerable to NPD project risks than their larger and more established counterparts due to limited resources and access to finance (Millward and Lewis, 2005). According to a case study conducted by Freel (2000), SMEs put too much emphasis on technology issues at the expense of effective marketing and commercial exploitation. This research adds into the literature by confirming this notion.

I further tried to analyze if marketing capability risk is associated with any particular product type (Appendix 5-a). The findings revealed that there is no significant difference between incremental and radical projects in terms of marketing capability risk in SMEs.

Further to this analysis, there was a significant association between customer perceived risk and radical NPD projects, i.e. customer perceived risk was mostly perceived by the respondents who were involved in radical NPD projects. Past literature on radical innovation also acknowledged that a lack of consumer acceptance of a product as a key factor in radical product failures (Castano et al., 2008; Keizer and Halman, 2009). A possible explanation is the fact that customers are exposed to a large number of new radical products and higher expectations of product quality and performance. Moreover, due to this, they become more cautious with radical products (Kleijnen and Antioco, 2010; Stone and Gronhaug, 1993). Others think that customer’s desire to preserve the status quo (Dalziel et al., 2011) and customer’s fear about product value (Castano et al., 2008) are the barriers for most radical products. In any case, this research confirms that radical NPD projects are vulnerable from customer perceived risk.

8.5 Operations risk

Operational risk, in this research, refers to the uncertainties or disruptions that materialize from the internal operations of a firm (Kim and Vonortas, 2014). In line with the past literature, the conceptualization of operations risk is based on the following key aspects: resources, human resources, planning, control and strategic management (Manuj and Mentzer, 2008). The respondents in this research, largely perceived all sub-dimensions of operations risk as high threats particularly in terms of likelihood of occurrence. Many respondents expressed their concern regarding operations risk. For example, according to a production manager at a steel factory:
“ Operational risk is high as the product line need advanced technology......”.

Another technical manager from a toy factory stated that,
“Risk is high due to the nature of production process. the company will create new manufacturing unit”.

The first dimension of operations risk was resource risk which was conceptualized in terms of physical assets, materials, and facilities required to conduct NPD operations (Gon and Choi, 2012). This conceptualization is in line with existing innovation literature (Keizer et al., 2002 and Kim and Vonortas, 2014). This risk was considered among the most critical NPD project risks where both probability and potential negative impact were perceived higher than all others. Some respondents particularly expressed their concern regarding resource risk. For example, a manager from a medium sized firm commented that,

“We have already done most of the resources to external companies but then again we are still exposed to problems such as delays in getting material.

Similarly, an operational manager for a large firm involved in developing electronic products commented that,

“Operational Risk is very serious as the change in the factory layout is a critical.... operational process and all company resources should be dedicated to the success of that operation at the minimum time”.

According to this empirical research, resource risk was particularly associated with SMEs. The significant association between SMEs and resource risk is in accordance with the existing literature which suggests that SMEs are much more challenged in terms of skills and resources. For example, Meyer et al. (2001) already found in their empirical investigation that the majority of respondents from SMEs had concerns about their manufacturing facilities. Their complaints were focused around the availability of proper tooling, inadequate plant facilities, and outdated manufacturing facilities. The current finding confirms this notion.

The second critical component of operations risk is human resource which ensures that the firm carrying out NPD operations has adequate team members with requisite skills (Keizer and Halman, 2009). In this empirical research, it was scored as an average both in terms of probability and impact, although some respondents particularly expressed their concern regarding human resource risk. For example, a CEO of a small firm commented that,

“one of our problems is the training of staff and their competency with the tasks at hand.”

The finding was consistent with the previous literature which suggests that human resource risk emerges from inadequate training of employees (Kim and Vonartas, 2014) and due to poor attraction and retaining the right calibre people (Khan et al., 2008). As expected, human resource risk was also significantly associated with SMEs. A closer look at the respondent’s surveys (this research) demonstrated that finding and retaining the right people in SMEs was mostly the key challenge for UK

SMEs. This was in line with previous literature which suggests that among the areas where small firms required support was that of human resources (HR) and employment (Birkett 2000; Mole et al. 2004). Another possible explanation of the association of human resource risk with SMEs might be the increasing burden of employment legislations. For example, SMEs are more likely to experience employee claims and to lose cases at employment tribunals than their counter parts i.e. large firms (Birkett 2000; Mole et al. 2004). In addition to this, the previous research has also shown that the actions of powerful individuals in firms, particularly in SMEs represent one of the barriers in terms of integrating design and development within a long-term business strategy (Faerns et al. 2005). For example, several case studies highlighted that the dominant owner/manager of a small business is the primary barrier to achieving successful product development. Their over-optimistic views and resistance to change puts pressure on different aspects of NPD projects (Freel, 2000). Millward and Lewis, (2005) conducted multiple case studies in small family-run manufacturing businesses which revealed that the actions of the owners/manager (operating in the role of managing director) were detrimental to the performance of in-house design and development of new products. This could be possibly due to the lack of experience or training relevant to design and development activities by manager or employees. It can further be due to the small company structure which might result in the owners and members of his/her family working on the shop floor doing design and manufacturing of the product. In such circumstances, it is highly likely that the owner/manager can impose his ideas about the product design and consequently hi-jack the design process (Millward and Lewis, 2005).

I further observed the close association between human resource risk and radical NPD projects, i.e. human resource risk was mostly associated with radical NPD projects. Past literature has evidenced that among the basic conditions for achieving success in radical innovations, a critical determinant is the individual level capabilities (human resources) of NPD project team (Keizer et al., 2007 and 2009; Rice et al., 2001). A possible explanation for this might be that the radical NPD projects are complex in nature and most people in SMEs lack the capability to deal with such complexities (O’Connor et al., 2008). Furthermore, the managerial practices that are usually applicable for the incremental NPD projects are not necessarily applicable in the case of radical NPD projects (Ahuja and Lampert, 2001).

The third critical component of operations risk is the planning risk which refers to risks associated with decisions about the scope and objectives of the NPD project, setting boundaries of operations and determining the roles and responsibilities of NPD project team members. Planning risk, in this research, was empirically classified as high probability-low impact risks. Several respondents expressed their opinions about planning risk. For example, a member of an NPD project team developing construction related equipments commented that,

"the challenging task for us is to establish clear operational requirements at early stage and progress project in parallel to capital approvals procedures".

Another project manager from energy-related equipment supplier firm indicated that,

"What our firm need to do is to make sure that procedures are clearly documented and *communicated to the persons involved."*

This empirical research further found that planning risk was not associated with any particular firm size and project type and therefore, equally regarded as a critical risk factor for both large firms and SMEs and incremental and radical NPD projects. The finding was consistent with the previous literature which suggests ill-defined, immature, unrealistic and poorly defined project objectives and scope caused significant disruptions to NPD projects (Conrow and Shishido, 1997; Schmidt et al. 2001). These can occur in any firm with any project. In the context of software development projects, Barki et al. (2001) reported poorly defined roles and responsibilities of project team members and the boundaries of operations as major threats for the software projects. Schmidt et al. (2001) collected software project managers' experiences through Delphi surveys in Hong Kong, USA, and Finland. These survey results suggested that unclear/misunderstood scope/objectives, the improper definition of roles and responsibilities, artificial deadlines and bad estimation were among the top rated risk factors for NPD projects. The findings of empirical research confirmed this notion and revealed that respondents from UK firms conducting NPD projects regard planning risk as critical for their operations.

The fourth component of operation risk, in this research was control risk. Control activities refer to activities, established procedures and mechanisms that a firm adopts to exert its control over operational processes (Kim and Wilemon, 2009). This conceptualization is consistent with existing literature. Several respondents expressed their opinions about control risk. For example, a functional manager of NPD projects related to electronic equipment commented that,

"Monitoring of the new project implementation should be there (currently not) because of the use of plastic instead of wood.

Another NPD project manager from wood furniture firm stated that

"more controlling with new technical facilities and quality assurance and control standards operational risk is critical."

Further analysis of control risk revealed that the risk is particularly associated with SMEs than large firms. A possible explanation might be due to the absence of management structure within SMEs (Millward and Lewis, 2005). SMEs, in general, do not follow any management structure as also evident from the case study conducted by Owens, (2007) that owner/managers within small manufacturing companies find it difficult to impose a management structure. They do not also tend to establish systematic procedures or processes for designing and developing the product. Instead, they tend to run the firms an ad-hoc basis to support their short-term and long-term strategic actions (Freel, 2000). Furthermore, particular roles and responsibilities are also not defined and allocated. Instead, roles and responsibilities evolve over time to suit the peculiarities and personalities of the management. Cooper, (1999) described such behaviour of SMEs top management as "lack of disciplined leadership" where they tend to run the processes on an ad-hoc basis rather than through established processes and procedures. Owens, (2007), reported that for NPD projects in SMEs twenty-nine percent of the respondents attributed development delays to poor project management practices, such as lack of control systems, complex matrix management structures not monitoring the project's progress, poor team and cross-functional meeting management practices and undefined and conflicting roles. This research adds to the literature by confirming that control risk is critical for NPD projects and the UK SMEs are particularly vulnerable from this risk type.

Finally, this research has conceptualized operations risk in terms of strategic management risk which refers to the risks surrounding the internal organizational environment in which NPD project takes place. The risk was identified as one of the most critical risks. Respondents assigned it high score both in probability and negative impact, and therefore it was classified as a high probability-high impact risk. Many respondents commented on strategic management risk in the open-ended question. For example, a project manager from a large size firm involved in developing oil and gas related machines mentioned that,

"Regular stakeholders and senior management engagement and strategic planning as part of wider NPD programme are missing currently."

Most respondents who perceived strategic management as a high risk were associated with large firms. Other key issues associated with strategic management risk highlighted by respondents were the lack of top management support for NPD project ideas, lack of regular meetings with the board of directors (BOD) members, lack of strategic planning and lack of mechanisms for regular reporting and keeping management up to date.

Further analysis of strategic management risk revealed that the risk was particularly associated with radical NPD projects. Past literature has witnessed that among the basic conditions for achieving success in radical innovations, a critical determinant is the organizational environment and conditions (strategic management) (Rice et al., 2001; Kezer et al., 2007 and 2009). Within the internal organizational environment, senior management support is a critical factor for radical innovation (Schmidt et al., 2001). The organizational support and top management involvement are necessary for allocating the funding, resources and organizational capabilities towards the radical project. Unfortunately, this is not the case mostly as evident from this empirical research. According to a Deloitte annual report on radical product growth, while investigating the board level member's strategy towards radical innovation, only 6% of board members were willing to consider radical innovations due to high uncertainty associated with it (Rygaard-Hjalsted, 2016). Furthermore, around 34% of board members were not willing to conduct radical NPD projects due to the fear of big financial risk (Rygaard-Hjalsted, 2016). Similarly, Dougherty and Hardy (1996) when investigating the relationship between innovation projects and their organizations noted that the organizational infrastructure in large established firms is not designed to enable innovation, but rather to detract from it.

8.6 Supply chain risk

Respondents in this research characterized supply chain risk as one of the critical risk factors, and it was scored as high probability high impact risk factors. A closer look at the respondent comments on supply chain risk revealed several issues related to supply chain risk.

For example, an NPD manager from large food firm mentioned that

"It is not possible to entirely mitigate supply chain risk. It happens for many reasons. We are human. However, I would say that supplies/suppliers related issues are the ones to begin with.......".

It was noted that within supplier-related risks, there were several issues. For example, the participants were asked to elaborate on supply chain risks further. Some pointed towards the risks associated with outsourcing decisions. According to a respondent who served as logistics manager for an FMCG firm

"For me, making the decision is most important thing in the whole process. It is deciding what to outsource, the delivery and the way in which my product is delivered".

The literature in the supply chain has witnessed similar risk (outsourcing decision), and several studies confirm the notion that firms often make outsourcing decisions without carefully considering short and long term issues (Khan et al., 2008; Tang et al., 2009). However, within the NPD literature, this empirical research is one of the first studies which confirmed that UK firms conducting NPD operations are facing similar risks. Some participants also viewed "understanding of focal firm's core and non-core competency" as one of the most problematic aspects in the supply chain. A participant from a medium size firm working in oil and gas sector commented that,

"I think core and noncore is more problematical. Most companies have trouble in deciding what is core and noncore".

Firms' unclear understanding about the core and noncore competencies during outsourcing decision is cited as a key risk factor in supply chain and outsourcing literature (Barthelemy, 2003). Similarly, several respondents highlighted other key issues within supply chain risk such as poor supply chain visibility, poor suppliers capability including quality and adherence to specification and regulatory compliance.

Further analysis on supply chain risk suggests that large firms conducting NPD operations were more vulnerable to supply chain risk than SMEs. A possible explanation is that large size firms have broader product portfolio and targeted to a broader set of customers (Wagner and Nishat, 2012). This broader service offering has to be delivered to the customers at a wider level which necessitates the need for complex and global supply chains (Wagner and Nishat, 2012). According to the empirical evidence suggested in supply chain literature, the global supply chain and its complexity increase the likelihood of supply chain risk for large firms (Roebuck et al., 1995). Furthermore, in the large size firms, more employees are involved in managing supply chains. With more employees, communication both inside (between different functions or departments) and outside the firm (with suppliers, customers, and other supply chain partners) becomes a challenge (Perrow, 2006). In contrast, within SMEs, due to a small number of employees, communication is less challenging. On this basis, exchanging tacit knowledge becomes more difficult in large firms (Roebuck et al. 1995) which potentially increases the chances of supply chain risks. Other researchers such as Perrow (2006) also note the challenges associated with hierarchies and layers of management and related complexities in large size firms which eventually lead to a higher supply chain risks than SMEs.

8.7 Financial risk

Financial risk refers to whether adequate financing or budgets are available for NPD projects (Wu and Wu, 2014) and whether the new product can be developed on the allocated budget (Unger and Eppinger, 2009; 2011). In accordance with other studies, this research conceptualized financial risk in terms of financial unpredictability and lack of funding (Keizet et al., 2009; Wu and Wu, 2014).

Financial unpredictability is a significant source of financial risks where the firm is unable to predict running development cost (Gon and Choi, 2012; Huchzermeier and Loch, 2001) or estimate profit margins (Keizer and Halman, 2009). Financial unpredictability, in general, was scored as low probability-low impact risk by respondents. However, several respondents expressed their fear about the risk. For example, an NPD manager noted that,

“the major risk for us is creating a realistic budget for the project at start.”

Another project manager from a large chemical firm expressed his concerns that

“Planning the project budget carefully and ensuring everything is considered before seeking approval to proceed is challenging.”

Extant literature provides various explanations for this risk. For example, financial unpredictability risk may be associated with the lack of tools and skills required to perform financial analysis (Schmidt et al., 2001; Wang and Yang, 2012). Previously, in a study of small firms, the costs associated with NPD projects had not been anticipated adequately by the company resulting in management attention being diverted in pursuit of potential alternative sources of funding. This distracted from the main focus of the programme and resulted in the further reduction of resources applied to the project itself (Millward and Lewis, 2005).

The second aspect of financial risk is the lack of funding, where a firm lacks adequate finances or budgets to run and complete an NPD project (Steven, 2014; Yeo and Ren, 2009). This risk was scored as “high probability high impact” risk. Several respondents expressed their fears about lack of funding. For example, a finance manager from an SMEs involved in developing jewellery products mentioned that

“Our funds are very limited, so if we suddenly don't get a payment we're relying on, this could be an issue.”

Another NPD project manager from a pen and pencils manufacturer mentioned that

“Funding these projects is a major concern and is looked at very carefully.......”.

According to the extant literature, firms may face a lack of funding risk due to the failure of gaining external funding from investors or government (Kim and Vonortas, 2014). Lack of cash also results from collection problems from the clients and other stakeholders (Miller and Waller, 2003; Steven, 2014; Wu and Wu, 2014) or unanticipated escalation in the development cost (Conrow and Shishido, 1997; Gon and Choi, 2012;). For example, O'Connor and Rice (2013) suggested that external financing made the difference between project continuation and termination for NPD projects in leading US companies.

A close investigation of respondents' perceptions revealed that both aspects of finance risks were, in particularly, associated with SMEs than large firms (Kim and Vonortas, 2014). The difficulties of SMEs both in terms of assessing financial cost and access to finance for NPD project is addressed in the extant literature. Several studies have tried to document the reasons behind the financial difficulties for SMEs. For example, a more frequent reason for the lack of funding is due to the trust gap between investors and owners of SMEs. The trust gap between both parties mounts due to information asymmetries. The trust gap makes the investor decision for investing more difficult (Kim and Vonortas, 2014).

8.8 Environmental risk

The role of the environment has received much attention in both strategic management research and in organizational theory. Business and organizational risks also emerge due to several environmental factors (Ritchie and Marshall, 1993). Environmental risk factors refer to those risk factors that affect the overall business across industries (Ritchie and Marshall, 1993). While the magnitude of the impact might be different across different industry, at least all the firms are affected to some extent (Kouvelis et al., 2006). Various conceptualizations of the environment and its constituent elements exist. This article applies Miller's (1991) notion of the environment which consists of political instability and government policy instability, macroeconomic uncertainties, social uncertainties, and natural uncertainties.

The respondents in this study, on average, perceived all sub-categories of environmental risks as low probability and low impact risk. A few respondents expressed their opinions about macroeconomic risk. Macroeconomic factors are related to fluctuations in the level of economic activity, wage rates, and interest rates. According to a respondent from a large firm conducting FMCG related NPD projects,

"Mostly we come across with exchange rate fluctuations which occur during the project."

Similarly, another project manager from the electronics sector mentioned that,

"Sudden changes in macro-economic environment are a major risk we face".

Moreover, it is not only the macroeconomic situation of UK but financial situation of foreign countries as well. For example, according to a project manager from auto spare part manufacturer,

"Foreign currency fluctuations raise the cost and may affect profits."

One respondent from electronic and computer products showed his experience with natural risk. Natural risk, in this research, refers to catastrophic events such as disaster, flood, and earthquake may affect NPD projects (Gon and Choi, 2012; Miller and Waller, 2003). According to the Respondent,

"Only proactive measures (in case of flood, all our stock was destroyed....we had to arrange emergency stock for customers...and allocated alternative distribution centres .."

This research further tried to analyse if there is a relationship between environmental risk factors and firm size. According to the analysis, there was a significant association between political risk and large firms. Political risk, in this research, refers to uncertainties associated with a change in government or their policies which can affect NPD projects (Miller and Waller, 2003). One possible explanation for such an association could be that large firms are more likely to attract the attention of political and governmental authorities (either positively or negatively) and this is likely to affect their exposure to risk (Henisz, 2000). Smaller firms, in contrast, are less likely to attract that attention. This behaviour is also supported by micro-political risk literature which suggests that firms employing a large number of employees are more likely to attract government attention (Wilkin, 2001).

8.9 An integrative view of NPD project risk

An understanding of the nature of NPD project risks by analyzing the probability of occurrence and impact on project performance can assist the project managers in adopting appropriate risk mitigation strategies for each of the different dimensions of NPD project' risk.

According to discussion provided in previous section, both attributes of NPD project risks were significantly different for different risks. It was further found that the technological rapidity risk, supply chain risk, lack of funding, and resource risk are the principal factors affecting the NPD projects because both their probability of occurrence and potential negative impacts were perceived as significantly higher than all other risk. While the likelihood of occurrence of strategic management risk, control risk, planning risk, marketing rapidity risk, marketing capability risk and human resource risks was perceived to be high, they posed a low degree of impact on NPD project. Competition risk, in contrast, was perceived to have a high degree of impact but a low probability of occurrence. Technological capability risk and four components of environmental risk (political risk, macroeconomic risk, social risk and natural risk) did not appear to have a profound effect on NPD project as all these risk factors were characterized by a low probability of occurrence and negative impact by respondents. In general, the findings of this research are consistent with the literature in terms of severity of above-mentioned risks. For example, there are several studies which demonstrated that technological risk and marketing risks have substantial negative impact on the performance of NPD project (Mu et al., 2009; Kim and Vonortas, 2014); however, it is this study which takes into consideration the frequency of occurrence and potential negative impact of these risks thus provide a more objective analysis of risks. Furthermore, based on the analysis, it prioritizes the lists the risk factors in a meaningful way i.e. in terms of probability of occurrence and negative impact.

Given that several risks such as environmental risk components including political, macroeconomic, social and natural risks occur less frequently than critical risks such as technological rapidity risk, lack of funding risk, supply chain risk and resource risk, these latter risk sources are in fact very important for achieving NPD performance. Therefore, firms need to pay attention to these four risk sources and need to adopt those strategies which can significantly reduce both the likelihood of occurrence and negative impact.

One implication which can be drawn from the list of factors (environmental risk factors) is that these are not types of risks that must be necessarily factored into NPD project decisions. However, this also seems to be irrational in the light of interest of researchers on understanding and managing the various components of environmental risks (Trkman and McCormack, 2009). An alternate explanation comes from the psychological literature which explains the misjudgement of NPD project risks in general and the role of environmental risks in NPD projects in particular. According to the psychologist researchers, people rely on limited number of heuristics rather than relying on statistics to predict the likelihood and impact of risks which can sometimes result in reasonable judgments and sometimes in serious errors (Kahneman and Tversky 1979). Furthermore, based on the theory of "availability heuristic," people make judgments based on what they can remember, not on complete data (Slovic et al. 1982). For example, judging the frequency or likelihood of risks in the day to day life based on personal experience or from media news. It is argued that management will be more aware of the risk factors and their potential influence on NPD project which they hear from a news feature. Similarly, things which are easier to imagine or in other words are more perceivable by the manager are paid more attention. In sum, managers do not often perceive the events rationally and according to the merit of probability and statistics (Stauffer, 2003). By considering the findings of this study on environmental risk and based on the argument come from psychology theorist, it is important for decision makers to understand which NPD project risk factors need to be considered depending on the context and cost associated with the decisions.

The management should consider an acceptable cost-benefit trade-off when mitigating the NPD project risks (Sarathy, 2006). This study advocates the allocation of scarce resources to the mitigation of most critical risk factors (first four critical risk factors), for the remaining risk factors, management can devise risk management strategy which can either reduce the probability or reduce the impact of risk. For example, in the case of the high probability of risks, management can look for those strategies which can decrease the probability of risk rather than invest their efforts in reducing their impact which might not be cost-effective.

8.10 NPD project risks and industry sectors

Another aspect of research question 2 was to investigate the influence of industry sector on NPD project risks. For this purpose, a general hypothesis that there is a significant difference in the likelihood of occurrence and the negative impact of NPD project risks in different industry sectors. Initially, the industry sectors were classified based on UK industry classification standards. However, by looking into the response rate of respondents from different industry sectors and considering the requirement of statistical analysis which permit a requirement of minimum data sets for each variable, I grouped the sectors further into 6 distinct groups: i) FMCG, ii) Software & Information System, iii) Computers & Electronics, iv) Textile & Apparel, v) Automotives & other means of Transportation and vi) All Others.

While most of the risks are associated with NPD project across industrial sectors, several sectors are particularly influenced by few risks (significant statistical findings). The FMCG sector was particularly associated with competition risk and marketing rapidity risk. A possible explanation might be because the focus of FMCG sector in general always is to bring high volume products at a low price to market which eventually increase the competition in FMCG sector. Similarly, according to a recent study, several factors which shape the new product introduction in the market particularly FMCG are including the cyclic slowdown of the economy with the transition towards more consumption which eventually affects customer purchasing choice.

The sector (software development and information system) was particularly influenced by marketing capability risk and competition risk. The lack of marketing capability was also cited as a critical risk factor in earlier empirical research in software development sector. For example, Schmidt et al., (2001) identified misunderstanding customer requirement as one of critical risk factors software industry facing.

The next exposed sector is the computer and electronics sector. According to the findings, the electronic and computer firms are mostly vulnerable from environmental risk particularly macroeconomic risk and natural risk. Macroeconomic factors are related to fluctuations in the level of economic activity, wage rates, and interest rates. Examples found in the NPD literature are changing economic conditions such as the recent global economic recession (Park, 2010), sudden changes in foreign exchange rates (Gon and Choi, 2012), changes in interest rates (Gon and Choi, 2012), or increases in material, labour and resettlement costs (Van thuyet et al., 2007). These all adversely impact NPD projects. Firms often, particularly the one operating in electronic sector outsource part of their NPD process to low-cost labor countries. Similarly, the suppliers who provide them components or parts for their products are also located globally. Despite the fact that the UK has a political and geographical stability, these firms face such risks due to their global operations.

8.11 Examining perception of team members about NPD project risk

NPD project requires different functions of a firm to coordinate effectively and efficiently to develop a new product (Mu et al., 2009). Moreover, because many NPD project risks are cross-functional, firms often put in place a cross- functional team for the management of these risks (Mu et al., 2009). Risk management process, in most firms, is conducted on an ad-hoc basis by certain individuals. Because, in many cases, respondents represent certain functions e.g. project management, engineering or manufacturing, marketing or could be a representative of top management, so their perceptions might represent the perspective of their own functions. Schmidt et al. (2001) argued that ‘it is quite possible that different stakeholders will have divergent opinions regarding what the risk factors are, as well as their relative importance,' (p. 29). In this research, i tried to examine how do perceptions of NPD projects’ risks vary among the team members with different backgrounds and managerial roles involve in NPD project? I particularly investigated the perceptions of respondents from technical background versus participants from the non-technical background. The rationale for investigating the perceptions of technical background participants versus non-technical participants is that NPD project is often led by R&D people and existing literature argued that R&D people are more likely to identify and diagnose risks associated with technological issues only (Smith, 1999). Therefore, they ignore other important risk factors. Similarly, the extant literature also suggests (e.g., Schmidt et al., 2001) the difference between the perceptions of top management and project managers in the software development context. According to their research, project managers perceive those risks as most essential that were controllable in nature i.e. risks that can be controlled and managed by manager such as technical risk; supplier relate risks. On the other hand, top management perceives those risks important which were strategic in nature and were uncontrollable such as catastrophic events, legal risks, and other environmental risks. This was the second aspect I further examined i.e. compare and contrast the perceptions of senior management and middle-level management on risk.

According to the findings, respondents from technical background emphasize on the following key risks: technological rapidity risk, marketing rapidity risk, lack of funding and supply chain risks. Technological rapidity refers to the extent to which technology changes over time or becomes obsolete during the NPD project (Buganza et al., 2009). A possible explanation for its association with technical background respondent is that because all aspect of technology clearly falls under the realm of respondents from technological functions. Such respondents become concern whether a particular technology will work and if it works, then how long for and to what extent unexpected or novel problems may occur during the adoption of the technology.

A possible explanation of the association of lack of funding risk with respondents from technical background might be due to the fact that lacking adequate finances, or budget brings negative consequences for NPD project and firms often fail to run and complete NPD project (Steven, 2014; Yeo and Ren, 2009). The NPD project is often led by technical background people. O'Connor and Rice (2013) also suggested that external financing made the difference between project continuation and termination for NPD projects in leading US companies.

Similarly, a possible explanation for the negative perception of technical respondents about supply chain risk is concerning the availability of material and other services from suppliers. The global changing practices of NPD require firms to involve suppliers in their NPD process. The concept of early supplier involvement (ESI) is gaining popularity in innovation literature where firms actually involve suppliers in their product design and manufacturing. Consequently, any delay from supplier side would be catastrophic for a firm and in particular respondents from the technical background.

All other respondents (non-technical background) assigned more importance to technological capability, marketing capability, competition, and planning risk. Technological capability risk reflects the firm's inability to launch a new product successfully (Browning et al., 2002; Kayis et al., 2007). Firms either do not possess the technological orientation at all or insufficiently to be able to handle new technology challenges (Tang et al., 2009; Wu and Wu, 2014). A possible explanation for the association of technological capability risk with non-technical background respondents can be explained on psychological grounds. One reason is that respondents from technical backgrounds are overconfident in their skills and capabilities that they do not see any risk factors falls in their domain such as technological capability risk. Moreover, respondents from other disciplines are more likely to pick them. Another explanation shows the general attitude of employees in the firm when employees blame project' poor performance problems and failures on risks that originate outside their sphere of control. In such cases, respondents from certain functions or departments point directly to others for not managing the risks effectively.

The comparison of the perceptions of top management and middle level or low-level management reveals several interesting results. Top management assigns more importance to the risks which are environmental in nature and fall outside the realm of firm i.e. technological rapidity risk and macroeconomic risks. In contrast, middle level or low-level management perceive operational level risk as most important such as technological and marketing capability risks, resource risk, planning, and control risks. This is consistent with the existing literature which suggests that senior management blames operational level managers for tactical level issues and risks including insufficient planning, weak leadership, and poor communications. This research confirms the notion and shows that both senior management and middle-level management have different perspectives about NPD project risks. Such difference in the perspectives of different stakeholders creates tensions and conflict which might result in the polarized perspective of NPD project risks. The result of the research also shows the potential need for improved communication and coordination among different NPD team members to develop a common perspective about NPD project risks.

9 Contributions, Implications and Future Research

9.1 Contributions

Previous studies have proposed that risk is a complex construct, consisting of many components, but no prior effort has apparently been undertaken to offer a holistic comprehensive view of the various risks that may affect NPD projects. Existing literature mostly offers a fragmented piecemeal pictures of risks in NPD projects. In addition some risk aspects have hardly been investigated in the literature despite their potential negative impact on NPD projects. Furthermore, existing studies of NPD risk (Ilevbare et al., 2014; Lee and Johnson, 2010) consistently indicate the need to identify additional sources of risk beyond those found in the particular study. This is considered to be a major omission because without a clear overview of risks, management are likely to overlook important risk factors and thus increasing the probability of potential failure of their NPD projects. This study fills in this important gap in the literature and adds to NPD theory by offering a comprehensive unifying framework and a conceptual model that aggregates and structures the risks in a parsimonious way.

Existing NPD project risk classifications are mostly developed out of qualitative contextual studies and have not been rigorously tested and validated on a larger scale. In an attempt to fill this gap, this research has provided a detailed operationalization of the NPD project risk constructs. Building on a thorough examination of NPD project risks proposed in the literature as well as on interviews with practitioners, this thesis compiled and empirically validated constructs for different NPD project risks. The existence of a validated and reliable measure of NPD project risk is considerable addition to NPD theory as it will enable researchers to approach the study of NPD project risk from the same perspective.

Existing theory on NPD project risk does not provide rigorous and objective measurement and assessment of risk factors. For example, it is hard to analyze the extent to which these risk factors occur in certain context and potentially can be harmful to certain types of NPD project. This thesis has added to NPD theory by providing an objective and rigorous measurements of the various risks identified in the taxonomy by testing and measuring the probability and the impact of each risk factor. Such an understanding of the nature of NPD project risks by analyzing the probability of occurrence and impact on project performance can assist the project managers in adopting appropriate risk mitigation strategies for each of the different dimensions of NPD project' risk.

Drawing on the **contingency theory**, a further examination was made to study the influence of NPD project risks in incremental and radical innovation, small and large firm sizes, and different industry types. Contingency theory suggests that the structural factors in organizations should suit the contextual factors to increase performance (Donaldson, 2001). In specific environments, different approaches are more or less effective. Despite several calls made by researchers (Mu et al., 2009; Bower and Khorakian, 2014), the previous research which has compiled risk factors did not examine the relationship between NPD project risks and above mentioned contingency factors. A contingency perspective in risks in NPD projects predicts the conditions under which the likelihood and potential negative impact of certain risk(s) will be higher or stronger than other risks. This study contributes to a deeper understanding of the extent to which these contingencies influence the emergence of NPD project risk. The findings confirm the hypothesis that that there are risks differences between radical and incremental projects. The thesis also brings to light the differences and the similarities between SMEs and large corporations in relation to risks in NPD projects. Finally, the thesis points to the differences and similarities between risks in different sectors. As a result, this study supports the claim that firms must tailor the NPD project risks to their environment (Ropponen and Lyytinen, 2000). In other words, there is no single universal list of risk factors that fits all NPD projects (Shenhar, 2001). By doing this, this research addresses the call to examine the fit among the context of NPD project and NPD project risks (Mu et al., 2009; Bower and Khorakian, 2014).

This study provides evidence that **agency theory** is a viable theory for understanding the risks associated to NPD project when different suppliers are involved at different phases of the NPD project. This thesis suggests that firms are often involved in global product development practices rather than local. i.e. their supply chain is located across the globe. This was confirmed from the data sample in this thesis where even small micro firms were adopting supply chain strategies in their NPD process. For example, in the case of Halwani cheese, the owner pointed towards the significance of supplier related risk as one of their ingredient supplier was based in a political uncertain Middle East country. Agency theory applies to the study o f risks arising when one party, the principal, delegates work to another party, the agent (Eisenhardt, 1989). In this research, the firms conducting NPD project serves as the principal and the suppliers (ingredient suppliers, suppliers involved in the design process and logistics providers etc) as the agent. From an agency theory perspective, principal utilizes various strategies to modify the behavior of agents in response to risk. This notion is confirmed by this thesis where firms conducting NPD projects use outcome based and behavioral based strategies when mitigating associated supply chain risk. An agency theory perspective in the context of managing supply chain risk argues that as risk becomes insignificant, outcome-based management efforts are appropriate (Eisenhardt 1989). This thesis confirms this notion of outcome based efforts, as mentioned by respondents in this thesis as evaluating suppliers performance based on risk performance and rewarding the suppliers by promising more business in the future. Another agency theory perspective is that when supply chain risk becomes a significant factor, principal need to adopt behavior-based management efforts that reduce the probability of those particular risks. This thesis confirmed this notion as well and the respondents when they were asked that how they mitigate supply chain risk mentioned several behavioral based risk mitigation strategies including developing suppliers, creating strategic alliances, and implementing information systems in response to manage risk. The dissertation contributes to theory development by organizing a detailed list of supply chain risk factors and supply chain risk management techniques NPD firms implement to reduce and avoid supply chain risk. Furthermore, the dissertation provides researchers with an alternative theoretical framework for studying the relationship between firms conducting NPD project and their suppliers built on agency theory.

Drawing on the normal accident theory and resource based theory, this thesis confirm the hypothesis that firm size moderates the emergence of NPD projects risks and both the likelihood of occurrence and potential negative impact of different NPD project risks are different for different firm size. The researchers, in general, on the basis of resource based view and normal accident theory, adopted different stances about which firm size is more vulnerable. For example those advocating normal accident theory, believed that that given the increasing trend of supplier involvement in NPD project and the continuous attempt to remain competitive in the market, NPD projects is a highly complex, interactive and tightly coupled systems. And because large firms are more often involved in NPD projects that are complex and associated with increasing degrees of outsourcing of value added activities than medium sized or smaller firms, they are more likely to face NPD project risks than their counterpart SMEs. Researchers adopting the resource based theory, in contrast, argued that SMEs face more challenges associated with the resource-constrained environments within which they often operate. This might be due to their restricted access to resources such as human resource, financial resources and technological and marketing capabilities (Jerrard et al., 2008; Kim and Vonortas, 2014; Kim and Vonortas, 2014; Millward and Lewis, 2005; Owens, 2007). Due to the mixed findings in the literature, this thesis therefore answers the call to further examine the association of NPD project risks with both SMEs and large size firms. The findings of the thesis support the general hypothesis that both large size and SMEs are different in terms of risk they are vulnerable to. The research further support the view of resource based theory and showed that SMEs, due to their limited access of resources, are more vulnerable to NPD project risks than large size firms. The findings of the thesis refute the view of normal accident theory which suggests that large size firms, due to their complex interactive system are more vulnerable to NPD project risks.

No studies have provided a comprehensive comparison between the perception of different stakeholders in relation to the various risk factors associated with NPD projects. This thesis contributed into NPD theory by providing new evidence that different stakeholders have different perceptions in relation to risks.

9.2 Implications for theory

The previous literature was lacking any attempt which could capture the complexity and multi-dimensionality of NPD project risk constructs. This study provides researchers with a better understanding of NPD project risk. Specifically, it provides theoretically derived definitions of different components of risk. Previously, researchers often tend to defined risks in NPD theory in a uni-dimensional manner. For example, the technological risk which is widely discussed in existing research has been conceptualized differently. Some researchers conceptualize the risk in terms of dynamism of technology, while others defined it in terms of internal technological capability. Thus, their operationalization of technological risk can in fact provide a limited and narrow view of technological risk. This research advances the theory by providing the holistic and comprehensive conceptualization of NPD project risks.

The proposed taxonomy of risks also maps the NPD literature on risks and aggregates and structures the risks in a parsimonious way. In this way, it not only provided a useful framework to organize and discuss the NPD risk theory but seems to be a promising candidate to serve as a reference model.

This research has provided a detailed operationalization of the NPD project risk constructs. It was based on a thorough examination of NPD project risks proposed in the literature as well as on interviews with practitioners, this thesis compiled and empirically validated constructs for different NPD project risks.

The indicators used to represent each risk factor were based on high loading factors and therefore are consistent and reliable indications. This provides a solid foundation for future work in this area. The existence of a validated and reliable measure of NPD project risk will enable numerous researchers to approach the study of risk from the same perspective. The resulting measure can guide future research efforts, such as enabling the identification of the risk management techniques that are most appropriate for a project’s particular set of risk factors.

The existence of a validated and reliable measure of NPD project risk is considerable addition to NPD theory as it will enable researchers to approach the study of NPD project risk from the same perspective.

9.3 Implications for Practice

NPD projects frequently fail due to a lack of understanding of NPD project risks. A possible mechanism to avoid failures is that the associated risks should be identified and mitigated during NPD project. This study has provided an NPD project risk classification which will enable management to become aware of possible risks to the successful completion of their NPD projects. The management can evaluate their NPD project based on technological, marketing, operations, supply chain, finance and environmental risks. These risk profiles will provide the management a useful framework to address the risks associated with their NPD projects.

The components of each risk can be used as early indicators of risks and management can more clearly identify the potential project problems based on these components. From there, they can devise effective risk management strategies for later projects.

Firms may benefit from using the results of this study to develop risk profiles for their NPD projects. Such a profile can serve as a tool for analyzing the NPD project riskiness, and the resulting insight can be used to manage the NPD projects better. For example, based on the riskiness of the projects, based on the project type i.e. incremental and radical, based on firm size and based on industry type, firms can classify their product portfolios into projects with high risks and projects with low risks.

9.4 Limitations

The risk is a complex and multi-dimensional construct. Despite the fact that in this research an extensive review of the literature (systematic review) was conducted to identify the list of potential risk factors through an inductive approach which was frequently used in the management literature by Armstrong et al. (2012), Pittaway and Cope (2007) and Pittaway et al. (2004), the research may not have captured every aspect of NPD project risk.

The data for this survey were collected from UK firms only. Therefore, the results might make sense for those firms which are based in countries with a similar political and geographical context.

In this dissertation, only one participant from each NPD project was selected to complete the survey. A more appropriate way would be to had multiple respondents from each NPD project who independently identify and assess risk in order to triangulate the results and permit the comparison of the perceptions which would have further strengthened this study.

In this dissertation, the data was collected in the form of management perceptual measures. Archival data could have improved the quality of the results. However, collecting archival data was hard due to confidentiality issues.

9.5 Future research

Keeping in mind the limitation of proposed taxonomy, further work is required to establish the completeness and refinement of proposed risk classification. A possible way of doing this is to investigate the risk phenomenon directly from the practitioners through focus group sessions, through archival data and open ended questions in surveys. Once the data is achieved, all the risk factors can be consolidated and a more abstract level taxonomy of risk can be generated with sub-dimensions and categories. The findings can then be synthesized with the existing literature.

The results of this research have established a tentative link between NPD project risks and its impact on NPD project, but there remains a need for a better understanding of the relationship between the two. There is a need for a rigorous study of examining the relationship between the proposed taxonomy and performance of NPD project. There are several indicators for assessing the performance. For example, cost, schedule, quality etc. The impact of each risk factor can be analyzed on each of the performance indicators of NPD project.

Also, I selected three contingency factors that had been identified in the existing research as possible influences on NPD project risks, but there are other factors that can affect the dimensions, For example, extent of supplier involvement, global versus local NPD operations and the type of NPD process used. These factors can be incorporated as a contingent variable and a more robust and profound risk profile can be developed.

The risk classification of NPD project risk developed in this study can also be used to uncover the actions which firm should take to reduce the severity of the risk factors' impact and to increase the probability of successful completion. As findings suggest that firms should look for particular strategies which should either reduce the probability of occurrence of risk and reduce its impact. Future research could be conducted in order to determine if it is possible to link a particular risk management method(s) with a specific set of risk factors or risk profile.

In this dissertation, only one participant from each NPD project was selected to complete the survey. As evident from the findings of this study, different NPD project participants would view risk differently. Therefore, differences in their view would provide greater insights into the significance and direction of their differences. Based on this, another area of research could involve comparing and contrasting the risk perceptions of different stakeholders for same project.

Another future research opportunity is to identify those risk factors that can only be perceived at the beginning or a priori rather than after a project has been completed. The study was designed in a way that it asked the respondents about the risk factors for those NPD projects that were completed. This research aspect is important as there might be the case that some of the NPD project risk factors might be easily identifiable throughout the NPD project while others may be difficult to perceive until near the end of a project and respondents might not able to recall them at the end.

Another possible extension would be to examine how the proposed risk taxonomy changes over time as the NPD project moves from one stage to another during its life cycle.

It would be interesting to examine also if the perceptions of different stakeholders such as top management or project managers converge or diverge during the course of a project.

The data for this survey were collected from firms based in the UK only. Therefore, the results hold only true for firms based in countries with a similar political, economic, and geographic setting. For example one of the reasons that environmental risk and its sub-components were not perceived high by respondents is possibly due to UK’s fairly stable political and economic situation. Therefore, a replication of this survey in other countries with presumably different risk profiles (e.g., USA, China, Brazil, Saudi Arabia, Egypt and other Gulf countries) would be a consequential next step.

10 References

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11 Appendices

11.1 Appendix 1

Risk as mentioned in Literature	NPD Stage	Reference	Underlying Factor	Abstract Level Title
Technological predictability	Fuzzy front end	Mu et al., (2009)	Technological Rapidity	Technical Risk
Technological capability skills	Design, Integration and production phase	Mu et al., (2009)	Technological capability risk	Technical Risk
Technical standards	After Sales	Mu et al., (2009)	Technological capability risk	Technical Risk
Technological unanalyzability	Planning and design	Nidumolu, (1995)	Technological Rapidity	Technical Risk
Technological unpredictability	Planning and Design Phase	Nidumolu, (1995)	Technological Rapidity	Technical Risk
Technical Performance risk	Unclear	(Browning et al., 2002)	Technological capability risk	Technical Risk
Product Technology	Design stag e	Keizer et al. 2002; Keizer and Halman 2007; Keizer et al., 2005, Keizer et al. 2009	Technological Rapidity	Technical Risk
Functional requirement	Design stage	Keizer et al. 2002; Keizer and Halman 2007; Keizer et al., 2005, Keizer et al. 2009	Technological capability risk	Technical Risk
Stability of product	Production and after sales	Keizer et al. 2002; Keizer and Halman 2007; Keizer et al., 2005, Keizer et al. 2009	Technological Rapidity	Technical Risk
Manufacturing Technology	Production and integration	Keizer et al. 2002; Keizer and Halman 2007; Keizer et al., 2005, Keizer et al. 2009	Technological capability risk	Technical Risk
Intellectual Property	Design phase	Keizer et al. 2002; Keizer and Halman 2007; Keizer et al., 2005,	Technological capability risk	Technical Risk

Risk as mentioned in Literature	NPD Stage	Reference	Underlying Factor	Abstract Level Title
		Keizer et al. 2009		
Unproven or complex technology	Concept development , Design phase	Segismundo and Miguel 2008	Technological Rapidity	Technical Risk
Dynamic technology	Design Phase, Production and Integration	Segismundo and Miguel 2008	Technological Rapidity	Technical Risk
Unrealistic goals	Production and integration	Segismundo and Miguel 2008	Planning Risk	Technical Risk
Hasty Planning	Planning Phase		Planning Risk	Technical Risk
Poor specifications	Planning and concept development	Wu and Wu, 2014	Technological capability risk	Technical Risk
Design issues	Design phase	Wu and Wu, 2014	Technological capability risk	Technical Risk
Leadership issues	All phases	Wu and Wu, 2014	Strategic Management Risk	Technical Risk
Communication and coordination	All phases	Wu and Wu, 2014	Control	Technical Risk
Life cycle	All phases	Wu and Wu, 2014	Control	Technical Risk
Technological uncertainty	Planning and concept development	Bstieler and Gross 2003	Technological Rapidity	Technical Risk
Instability of technology	Planning and concept development , Product design, Integration and production	Bstieler and Gross 2003	Technological Rapidity	Technical Risk
The intensity of R&D efforts	Design Phase, Planning and concept development, Integration and production	Bstieler and Gross 2003	Technological capability risk	Technical Risk
Technology complexity	Planning and concept development , Design Phase, Integration	Bstieler and Gross 2003	Technological Rapidity	Technical Risk

Risk as mentioned in Literature	NPD Stage	Reference	Underlying Factor	Abstract Level Title
	and developme nt			
Risk due to design tools	Design	Goodman, et al. 2007	Technological capability risk	Technical Risk
Platform Integration risk	Integration and Production	Goodman, et al. 2007	Technological capability risk	Technical Risk
Risk due to process flow tools and equipment	Integration and production	Goodman, et al. 2007	Technological capability risk	Technical Risk
Developers unable to make a product that satisfies the specifications	Not clear/gener al definitions	Smith, 1999	Technological capability risk	Technical Risk
Technical capability	Not clear/all phases	Szwejczewski,. et al. 2008	Technological capability risk	Technical Risk
Product Complexity	Integration and testing ; Product design	Stevens, 2014	Technological Rapidity	Technical Risk
technical difficulties	Design phase/Integ ration	Thamhain et al. 2007	Technological capability risk	Technical Risk
technology changes	Design Phase/Integ ration	Thamhain et al. 2007	Technological Rapidity	Technical Risk
intellectual property disputes	Design Phase/Integ ration	Thamhain et al. 2007	Technological capability risk	Technical Risk
Unproven technology	All phases	Kim and Vonortas, 2014	Technological Rapidity	Technical Risk
Longer development time	All phases	Kim and Vonortas, 2014	Technological capability risk	Technical Risk
Unexpected outcome	Post sale	Kim and Vonortas, 2014	Technological capability risk	Technical Risk
Technology obsolescent	Post production/ post sale	Kim and Vonortas, 2014	Technological Rapidity	Technical Risk
Infeasibility of material	Design	Tang et al. 2009	Technological Rapidity	Technical Risk
Incompatible development environment	All phases	Dey et al., 2007	Technological capability risk	Technical Risk
Inadequate design	Post sale	Dey et al., 2007	Technological capability risk	Technical Risk
problems in coding and unit test	Design Phase/Prod uction and integration	Dey et al., 2007	Technological capability risk	Technical Risk

Risk as mentioned in Literature	NPD Stage	Reference	Underlying Factor	Abstract Level Title
Project complexity	All phases	Huang and Han, 2008; Han and Huang, 2007	Technological Rapidity	Technical Risk
Design-related issues	Design Phase	Jerrard et al. 2009	Technological capability risk	Technical Risk
Component Parts	Integration and Production	Jerrard et al. 2009	Technological capability risk	Technical Risk
Intellectual Property	Design Phase	Jerrard et al. 2009	Technological capability risk	Technical Risk
Technical capability	Integration and production	Jerrard et al. 2009	Technological capability risk	Technical Risk
Technology obsolescence	Integration and production	Jerrard et al. 2009	Technological Rapidity	Technical Risk
Technical capability risks associated to software components	Integration and production	Li et al. 2008	Technological capability risk	Technical Risk
Component deviations	Design Phase	Munthe et al., 2014	Technological Rapidity	Technical Risk
Interface deviations	Integration and production	Munthe et al., 2014	Technological capability risk	Technical Risk
Concept deviations	Planning and concept developme nt	Munthe et al., 2014	Technological capability risk	Technical Risk
Scope deviations	Planning and concept developme nt/design phase	Munthe et al., 2014	Technological capability risk	Technical Risk
Technological change	All Phases	O'Connor and Rice, 2013	Technological Rapidity	Technical Risk
Major leap forward	All phases	O'Connor and Rice, 2013	Technological Rapidity	Technical Risk
Technical skills	Concept developme nt and planning phase	Stockstrom and Herstatt, 2008	Technological capability risk	Technical Risk
Lacking experience	Design	Stockstrom and Herstatt, 2008	Technological capability risk	Technical Risk
Surprised findings	Integration and production	Stockstrom and Herstatt, 2008	Technological Rapidity	Technical Risk
Lacking skills	Integration	Stockstrom and	Technological	Technical Risk

Risk as mentioned in Literature	NPD Stage	Reference	Underlying Factor	Abstract Level Title
	and Production	Herstatt, 2008	capability risk	
Technological feasibility	Concept development and planning , After sales	Unger and Eppinger, 2009; 2011	Technological Rapidity	Technical Risk
Legal liabilities	Design Phase, Production and Integration	Zsidisin and Smith, 2005	Technological capability risk	Technical Risk
Quality problems	Design Phase Integration and Production After Sales	Zsidisin and Smith, 2005	Technological capability risk	Technical Risk
Inability to handle product design changes	Design Phase Integration and Production After Sales	Zsidisin and Smith, 2005	Technological capability risk	Technical Risk
Product preposition	Concept development and Planning	Khan et al., 2008	Technological capability risk	Technical Risk
Quality Risk	After sales	Khan et al., 2008	Technological capability risk	Technical Risk
Loss of control of their own design	Planning and concept Design	Khan and Creazza, 2009	Technological capability risk	Technical Risk
Characteristics of products adding complexity	Design Phase Production and complexity After sales	Martinsuo et al. ,2014	Technological Rapidity	Technical Risk
new product features cause problems in the sourcing process	Design Phase Production and complexity After sales	Martinsuo et al. ,2014	Technological Rapidity	Technical Risk
Technical skills	All phases	Abetti and Stuart, 1988	Technological capability risk	Technical Risk
Functional risks	Al Phases	Abetti and Stuart, 1988	Technological capability risk	Technical Risk

Risk as mentioned in Literature	NPD Stage	Reference	Underlying Factor	Abstract Level Title
Technological newness	Planning, Desgn and integration	Jiang and Klein, 1999; Jiang and Klei,n 2000; Jiang et al. 2001	Technological Rapidity	Technical Risk
Lack of team's expertise with the task	Design, integration and developme nt	Jiang and Klein, 1999; Jiang and Klei,n 2000; Jiang et al. 2001	Technological capability risk	Technical Risk
Application complexity	Design, Integration and developme nt	Jiang and Klein, 1999; Jiang and Klei,n 2000; Jiang et al. 2001	Technological Rapidity	Technical Risk
Extent of changes brought		Jiang and Klein, 1999; Jiang and Klei,n 2000; Jiang et al. 2001	Technological Rapidity	Technical Risk
Quality Risk	All phases	Charoo and Ali, 2013	Technological capability risk	Technical Risk
Technological skills risk	Not specified	Wu et al., 2010	Technological capability risk	Technical Risk
Technological skills risk		Ahmadi and Wang, 1999	Technological capability risk	Technical Risk
Availability of Technological skills	Integration and developme nt, After sales	Larson and Kusiak, 1996	Technological capability risk	Technical Risk
Redesign risk	Design Phase Developme nt and integration	Larson and Kusiak, 1996	Technological capability risk	Technical Risk
R & D Risk	After sale	Lin and Zhou, 2011	Technological capability risk	Technical Risk
Technical skills	All Phases	Kayis et al., 2007	Technological capability risk	Technical Risk
Application Size		Barki et al. 2001	Technological capability risk	Technical Risk
Application Complexity	Technical Complexity	Barki et al. 2001	Technological Rapidity	Technical Risk
Technical skills	All Phases	Souder and Beethay 1991	Technological capability risk	Technical Risk

Risk as mentioned in Literature	**NPD Stage**	**Reference**	**Underlying Factor**	**Abstract Level Title**
Customer fear	Production phase	Mu et al., 2009	Customer Perceived Risk	Marketing Risk
Customer Requirement	Concept developme nt	Mu et al., 2009	Marketing Capability	Marketing Risk
Competition	Production stage	Mu et al., 2009	Competition Risk	Marketing Risk
Requirement instability	Fuzzy front end ; Integration and production	Nidumolu, 1995	Marketing Rapidly	Marketing Risk
Requirement diversity	Planning and Design Phase, Integration and production;	Nidumolu, 1995	Marketing Rapidly	Marketing Risk
Requirements Unanalyzability	Planning and Designing Phase	Nidumolu, 1995	Marketing Rapidly	Marketing Risk
Requirement instability	Fuzzy front end	Nidumolu, 1996	Marketing Rapidly	Marketing Risk
Requirement instability	Integration and production	Nidumolu, 1996	Marketing Rapidly	Marketing Risk
Requirement diversity	Planning and Design Phase	Nidumolu, 1996	Marketing Rapidly	Marketing Risk
Requirements Unanalyzabilit	Planning and Designing Phase	Nidumolu, 1996	Marketing Rapidly	Marketing Risk
Consumer Acceptance and Marketing	Planning and concept phase Design Phase	Keizer et al. 2002; Keizer and Halman 2007; Keizer et al., 2005, Keizer et al. 2009	Customer Perceived Risk	Marketing Risk

Risk as mentioned in Literature	NPD Stage	Reference	Underlying Factor	Abstract Level Title
Lack of satisfaction	Planning and concept phase Design Phase	Keizer et al. 2002; Keizer and Halman 2007; Keizer et al., 2005, Keizer et al. 2009	Customer Perceived Risk	Marketing Risk
In use advantages not obvious	Planning and concept phase Design Phase	Keizer et al. 2002; Keizer and Halman 2007; Keizer et al., 2005, Keizer et al. 2009	Customer Perceived Risk	Marketing Risk
Efficacy of advertising	Production and integration	Keizer et al. 2002; Keizer and Halman 2007; Keizer et al., 2005, Keizer et al. 2009	Marketing Capability Risk	Marketing Risk
Meeting needs of target consumers	Post sales	Keizer et al. 2002; Keizer and Halman 2007; Keizer et al., 2005, Keizer et al. 2009	Marketing Capability Risk	Marketing Risk
Lack of product specifications	Planning and concept Design Phase	Keizer et al. 2002; Keizer and Halman 2007; Keizer et al., 2005, Keizer et al. 2009	Marketing Capability Risk	Marketing Risk
Requirement changes	Planning and Concept phase	Keizer et al. 2002; Keizer and Halman 2007; Keizer et al., 2005, Keizer et al. 2009	Marketing Rapidity Risk	Marketing Risk
Competitors	Planning and Concept phase	Keizer et al. 2002; Keizer and Halman 2007; Keizer et al., 2005, Keizer et al. 2009	Competition Risk	Marketing Risk
Trade Customers risk	Post Sales	Keizer et al. 2002; Keizer and Halman 2007; Keizer et	Marketing Capability Risk	Marketing Risk

Risk as mentioned in Literature	NPD Stage	Reference	Underlying Factor	Abstract Level Title
		al., 2005, Keizer et al. 2009		
Public acceptance risk	Design and Concept development	Keizer et al. 2002; Keizer and Halman 2007; Keizer et al., 2005, Keizer et al. 2009	Customer Perceived Risk	Marketing Risk
Market Uncertainty risk	All Phases	Bstieler and Gross 2003	Marketing Rapidity Risk	Marketing Risk
Instability	All Phases	Bstieler and Gross 2003	Marketing Rapidity Risk	Marketing Risk
Degree of market orientation	All Phases	Bstieler and Gross 2003	Marketing Rapidity Risk	Marketing Risk
Complexity of market	Integration and production	Bstieler and Gross 2003	Marketing Rapidity Risk	Marketing Risk
Market skill	Post sales	Smith, 1999	Marketing capability	Marketing Risk
Market skills	All Phases	Szwejczewski,. et al. 2008	Marketing capability	Marketing Risk
Identifying customer needs	Concept development and Design Phase	Ogawa and Piller, 2006	Marketing capability	Marketing Risk
Product Uncertainty	Concept development and Design Phase	Stevens, 2014	Marketing capability	Marketing Risk
Market Uncertainty	Product design and integration and production (to be confirmed)	Stevens, 2014	Marketing capability	Marketing Risk
Market Complexity		Stevens, 2014	Marketing Rapidity Risk	Marketing Risk
Market Equivocality		Stevens, 2014	Customer perceived risk	Marketing Risk
Customer needs risk	product market	Kim and Vonortas, 2014	Market rapidity	Marketing Risk

Risk as mentioned in Literature	NPD Stage	Reference	Underlying Factor	Abstract Level Title
	acceptance, the potential actions of competitors, and general market conditions and evolution			
Demand side risk		Tang et al. 2009	Marketing Capability	Marketing Risk
Unavailable customer contact.		Dey et al., 2007	Marketing Capability	Marketing Risk
Scope Creep		Dey et al., 2007	Marketing Capability	Marketing Risk
User risk		Huang and Han, 2008; Han and Huang, 2007	Marketing Capability	Marketing Risk
Conflict between users,		Huang and Han, 2008; Han and Huang, 2007	Marketing Capability	Marketing Risk
Users with negative attitudes toward the project,		Huang and Han, 2008; Han and Huang, 2007	Customer perceived risk	Marketing Risk
Users not committed to the project		Huang and Han, 2008; Han and Huang, 2007	Customer perceived risk	Marketing Risk
Lack of cooperation from users		Huang and Han, 2008; Han and Huang, 2007	Customer perceived risk	Marketing Risk
Requirement risk		Huang and Han, 2008; Han and Huang, 2007	Marketing Capability	Marketing Risk
System requirements not adequately identified,		Huang and Han, 2008; Han and Huang, 2007	Marketing Capability	Marketing Risk
Unclear system requirements,		Huang and Han, 2008; Han and Huang, 2007	Marketing Capability	Marketing Risk
Incorrect system requirements		Huang and Han, 2008; Han and Huang, 2007	Marketing Capability	Marketing Risk

Risk as mentioned in Literature	NPD Stage	Reference	Underlying Factor	Abstract Level Title
incomplete knowledge of market environment		Ilevbare et al. 2014	Marketing Capability	Marketing Risk
the unpredictable manner in which the future external environment could develop		Ilevbare et al. 2014	Market Rapidity	Marketing Risk
Competition		Jerrard et al. 2009	Competition	Marketing Risk
Competition risk in terms of market reaction		Jerrard et al. 2009	Competition	Marketing Risk
False customer specification		O'Connor and Rice, 2013	Market Rapidity	Marketing Risk
Prototype failure		O'Connor and Rice, 2013	Technological Capability Risk	Technical Risk
Customer dissatisfaction		O'Connor and Rice, 2013	Customer Perceived Risk	Marketing Risk
Marketing capability skills		Unger and Eppinger, 2009; 2011	Marketing capability Risk	Marketing Risk
Changing project requirement		Thamhain et al. 2007	Market Rapidity	Marketing Risk
loss of market leadership		Khan et al., 2008	Competition	Marketing Risk
fails to retain or attract new customer footfall		Khan et al., 2008	Marketing capability Risk	Marketing Risk
poor perception causes further footfall decline		Khan et al., 2008	Customer Perceived Risk	Marketing Risk
fails to attract target customers		Khan et al., 2008	Marketing capability Risk	Marketing Risk
Copy our products & Sell more cheaply		Khan et al., 2008	Competition	Marketing Risk
not exploiting reach		Khan et al., 2008	Marketing Capability	Marketing Risk
strengthened competitors		Martinsuo et al. ,2014	Competition	Marketing Risk
lower customer demand than expected		Martinsuo et al. ,2014	Marketing Capability	Marketing Risk
Poor Marketing skills		Abetti and Stuart, 1988	Marketing Capability	Marketing Risk
Lack of user support		Jiang and Klein, 1999; Jiang and	Customer Perceived Risk	Marketing Risk

Risk as mentioned in Literature	NPD Stage	Reference	Underlying Factor	Abstract Level Title
		Klei,n 2000; Jiang et al. 2001		
Lack of user experience		Jiang and Klein, 1999; Jiang and Klei,n 2000; Jiang et al. 2001	Customer Perceived Risk	Marketing Risk
Requirements risk		Larson and Kusiak, 1996	Marketing Capability	Marketing Risk
Poor marketing issues		Larson and Kusiak, 1996	Marketing Capability	Marketing Risk
Market skills not available		Enkel et al 2005	Marketing Capability	Marketing Risk
Marketing Risk		Kayis et al., 2007	Marketing Capability	Marketing Risk
Marketing risk		Wu et al. 2010	Marketing Capability	Marketing Risk
Cooperation or action of competitors		Wu et al. 2010	Competition	Marketing Risk
Market risk		Souder and Beethay 1993	Marketing Capability	Marketing Risk
Organization risk	Fuzzy front end	Mu et al., 2009	Strategic management risk	Operations Risk
Project management and Organization risks	All Phases	Keizer et al. 2002; Keizer and Halman 2007; Keizer et al., 2005, Keizer et al. 2009	Control Risk	Operations Risk
Product Family and Brand Positioning	Planning and Concept developme nt	Keizer et al. 2002; Keizer and Halman 2007; Keizer et al., 2005, Keizer et al. 2009	Control Risk	Operations Risk
Screening and Appraisal	Release/Aft er sales	Keizer et al. 2002; Keizer and Halman 2007; Keizer et al., 2005, Keizer et al. 2009	Control Risk	Operations Risk
Organizational resource uncertainty	Planning and concept developme nt	Stevens, 2014	Resource Risk	Operations Risk
Process Complexity	Integration and Production	Stevens, 2014	Control Risk	Operations Risk

Risk as mentioned in Literature	NPD Stage	Reference	Underlying Factor	Abstract Level Title
Organizational resource complexity	Integration and Production	Stevens, 2014	Resource Risk	Operations Risk
Process Equivocality	Design Integration and Production	Stevens, 2014	Control Risk	Operations Risk
Organizational resource equivovality	Design Integration and Production	Stevens, 2014	Control Risk	Operations Risk
Lost or changing team members,	All Phases	Thamhain et al. 2007	Human Resource Risk	Operations Risk
Changing organisational priorities,	All Phases	Thamhain et al. 2007	Strategic Management Risk	Operations Risk
Conflict	All Phases	Thamhain et al. 2007	Control Risk	Operations Risk
changing management commitment	All Phases	Thamhain et al. 2007	Strategic Management Risk	Operations Risk
Schedule Risk	All Phases	Goodman et al., 2007	Planning Risk	Operations Risk
Operation Risk	All Phases	Kim and Vonortas, 2014	Human resource risk	Operations Risk
Labour relations risk	All Phases	Denning, 2013	Human resource risk	Operations Risk
Project management skills risk	All Phases	Denning, 2013	Human resource risk	Operations Risk
Risk of dis-engaged c-suite	All Phases	Denning, 2013	Strategic Management Risk	Operations Risk
Management Risk	All Phases	Tang et al., 2009	Human resource risk	Operations Risk
Loss/lack of resources	All Phases	Dey et al. 2007	Resource Risk	Operations Risk
Planning and control	All Phases	Huang and Han, 2008; Han and Huang, 2007	Planning Risk	Operations Risk
Project progress not monitored closely enough	All Phases	Huang and Han, 2008; Han and Huang, 2007	Control Risk	Operations Risk
, Inadequate estimation of required resources,	Concept planning	Huang and Han, 2008; Han and Huang, 2007	Resource Risk	Operations Risk

Risk as mentioned in Literature	**NPD Stage**	**Reference**	**Underlying Factor**	**Abstract Level Title**
Poor project planning,	All Phases	Huang and Han, 2008; Han and Huang, 2007	Planning Risk	Operations Risk
Project milestones not clearly defined,	Concept planning	Huang and Han, 2008; Han and Huang, 2007	Planning Risk	Operations Risk
Inexperienced project manager	All Phases	Huang and Han, 2008; Han and Huang, 2007	Human Resource Risk	Operations Risk
Ineffective communication	All Phases	Huang and Han, 2008; Han and Huang, 2007	Control Risk	Operations Risk
Inexperienced team members	All Phases	Huang and Han, 2008; Han and Huang, 2007	Human Resource Risk	Operations Risk
Inadequately trained development team members,	All Phases	Huang and Han, 2008; Han and Huang, 2007	Human Resource Risk	Operations Risk
Team members lack specialized skills required by the project)	All Phases	Huang and Han, 2008; Han and Huang, 2007	Human Resource Risk	Operations Risk
Organizational environment	All Phases	Huang and Han, 2008; Han and Huang, 2007	Strategic Management Risk	Operations Risk
Corporate politics with negative effect on the project	All Phases	{Huang, 2008 #114} Han and Huang,2007	Strategic Management Risk	Operations Risk
Unstableorganizational environment,	All Phases	Huang and Han, 2008; Han and Huang, 2007	Strategic Management Risk	Operations Risk
Organization undergoing restructuring during the project)	All Phases	Huang and Han, 2008; Han and Huang, 2007	Strategic Management Risk	Operations Risk
Premises risk	All Phases	Jerrard et al. 2009	Resource Risk	Operations Risk
HR / Organisational	All Phases	Jerrard et al. 2009	Human Resource Risk	Operations Risk
Coordination /Strategic	All Phases	Jerrard et al. 2009	Control Risk	Operations Risk

Risk as mentioned in Literature	NPD Stage	Reference	Underlying Factor	Abstract Level Title
Business Relationships	All Phases	Jerrard et al. 2009	Control Risk	Operations Risk
Organizational	All Phases	O'Connor et al. 2013	Control Risk	Operations Risk
Resource	All Phases	O'Connor et al. 2013	Resource	Operations Risk
Schedule risk –	. All Phases	Unger and Eppinger, 2009;Unger and Eppinger, 2011	Planning Risk	Operations Risk
Excessive costs	Planning, design, integration and developme nt	Zsidisin and Smith, 2005	Financial Unpredictability Risk	Finance Risk
Extended product development times	Design Phase Integration and production	Zsidisin and Smith, 2005	Control Risk	Operations Risk
Planning risk	All phases	Khan et al., 2008	Planning Risk	Operations Risk
People risk	All phases	Khan et al., 2008	Human Resource Risk	Operations Risk
Supplier cost savings:	All phases	Khan et al., 2008	Supply Chain Risk	Supply Chain Risk
Selling teams:	Integration and production	Khan et al., 2008	Human Resource Risk	Operations Risk
Price positioning	Integrtion and production	Khan et al., 2008	Financial Unpredictability Risk	Finance Risk
IT systems	All phases	Khan et al., 2008	Control Risk	Operations Risk
Space planning	All phases	Khan et al., 2008	Resource Risk	Operations Risk
capacity limitations and constraints for planning the production	Planning and concept	Khan and Creazza, 2009	Planning Risk	Operations Risk
Unexpected reaction to changes to the production schedules	Integration nand production	Khan and Creazza, 2009	Planning Risk	Operations Risk

Risk as mentioned in Literature	**NPD Stage**	**Reference**	**Underlying Factor**	**Abstract Level Title**
Production system's capability does not match demand	Integration and production	Khan and Creazza, 2009	Control Risk	Operations Risk
Continually changing organizational structures	All Phases	Martinsuo et al., 2014	Strategic Management Risk	Operations Risk
Difficulties to prioritize projects	Portfolio level	Martinsuo et al., 2014	Strategic Management Risk	Operations Risk
Development resource layoffs	Integration and developme nt	Martinsuo et al., 2014	Resource Risk	Operations Risk
Single projects taking more time than expected	Portfolio	Martinsuo et al., 2014	Control Risk	Operations Risk
,Changes in project scope during project execution,	Integration and developme nt	Martinsuo et al., 2014	Strategic Management Risk	Operations Risk
Waiting for an output from another project before the next project can be initiated.	Portfolio level	Martinsuo et al., 2014	Control Risk	Operations Risk
Lack of team's general expertise		Jiang and Klein, 1999; Jiang and Klei,n 2000; Jiang et al. 2001	Human resource Risk	Operations Risk
Lack of team's development expertise		Jiang and Klein, 1999; Jiang and Klei,n 2000; Jiang et al. 2001	Human resource Risk	Operations Risk
Resources insufficient		Jiang and Klein, 1999; Jiang and Klei,n 2000; Jiang et al. 2001	Resource Risk	Operations Risk
Lack of clarity of role definitions		Jiang and Klein, 1999; Jiang and Klei,n 2000; Jiang et al. 2001	Planning Risk	Operations Risk
Extent of changes brought		Jiang and Klein, 1999; Jiang and Klei,n 2000; Jiang et al. 2001	Control Risk	Operations Risk

Risk as mentioned in Literature	NPD Stage	Reference	Underlying Factor	Abstract Level Title
Intensity of conflicts		Jiang and Klein, 1999; Jiang and Klei,n 2000; Jiang et al. 2001	Control Risk	Operations Risk
Schedule risk	All Phases	Kayis et al., 2007	Planning Risk	Operations Risk
Communication risk		Kayis et al., 2007	Control Risk	Operations Risk
Location risk		Kayis et al., 2007	Resource Risk	Operations Risk
Schedule risk.	Integration and Production	Larson and Kusiak, 1996	Planning Risk	Operations Risk
Resource risk.	Design Integration and production	Larson and Kusiak, 1996	Resource Risk	Operations Risk
Production	After Sales	Lin and Zhou, 2011	Control Risk	Operations Risk
Planning risk	After Sales	Lin and Zhou, 2011	Planning Risk	Operations Risk
Internal Environment		Lin and Zhou, 2011	Strategic Management Risk	Operations Risk
Human resource risk		Wu et al., 2010	Human resource risk	Operations Risk
Strategy risk		Wu et al., 2010	Strategic Management Risk	Operations Risk
Risk of poor planning and communication		Wu et al., 2010	Control Risk	Operations Risk
Schedule risk		Wu et al., 2010	Planning Risk	Operations Risk
Expertise risk		Barki et al, 2001	Human Resource Risk	Operations Risk
Organizational Environment		Barki et al, 2001	Strategic Management Risk	Operations Risk
Schedule risk		Browning et al. 1999	Planning Risk	Operations Risk
Collaboration risk		Keizer et al. 2002; Keizer and Halman 2007; Keizer et al., 2005, Keizer et al.	Control Risk	Operations Risk

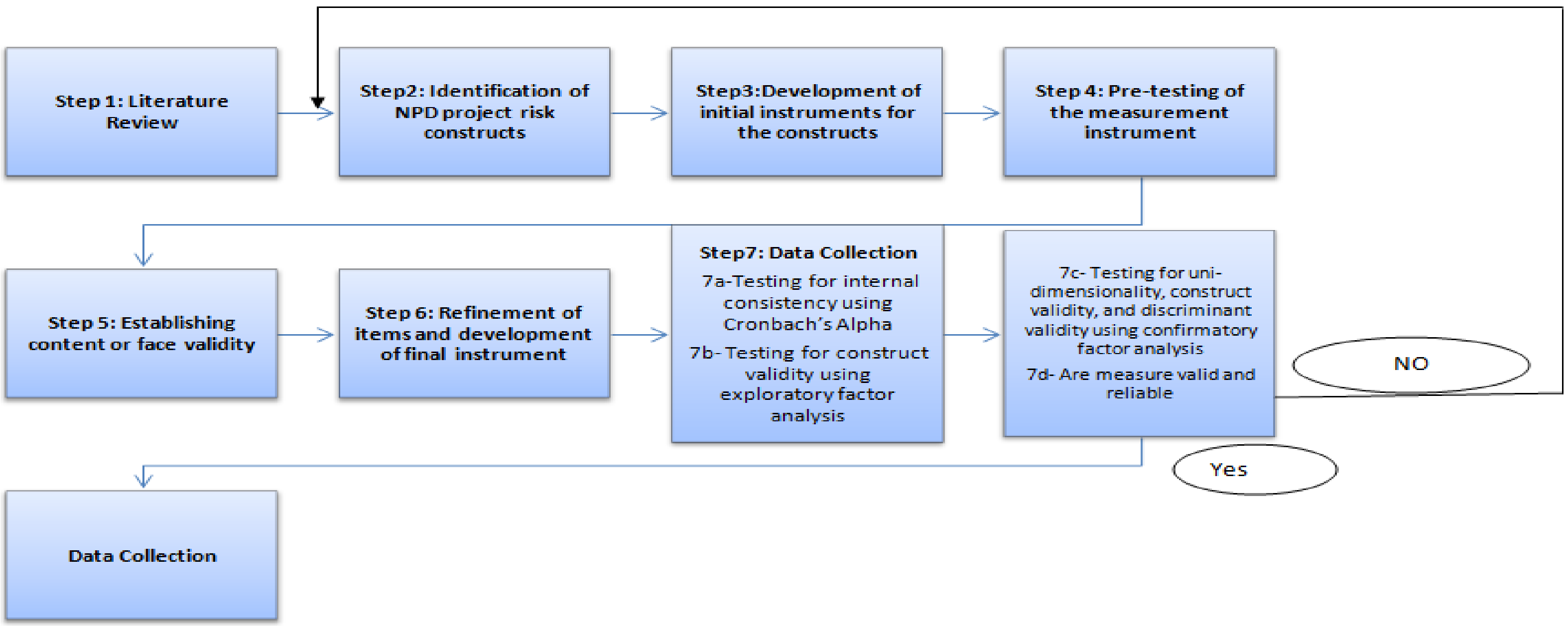
Risk as mentioned in Literature	NPD Stage	Reference	Underlying Factor	Abstract Level Title
		2009		
Supply chain and Sourcing	All Phases	Keizer et al. 2002; Keizer and Halman 2007; Keizer et al., 2005, Keizer et al. 2009	Supply Chain Risk	Supply Chain Risk
Quality risk	All Phases	Keizer et al. 2002; Keizer and Halman 2007; Keizer et al., 2005, Keizer et al. 2009	Control Risk	Operations Risk
Contracting risk	Planning and design	Keizer et al. 2002; Keizer and Halman 2007; Keizer et al., 2005, Keizer et al. 2009	Supply Chain Risk	Supply Chain Risk
Suppliers risk	Planning and design	Keizer et al. 2002; Keizer and Halman 2007; Keizer et al., 2005, Keizer et al. 2009	Supply Chain Risk	Supply Chain Risk
Collaboration risks	Any Phases	Wu and Wu, 2014	Supply Chain Risk	Supply Chain Risk
Relationship risk	Any phases	Thamhain, 2007	Supply Chain Risk	Supply Chain Risk
Coordination Risk	All Phases	Denning, 2013	Supply Chain Risk	Supply Chain Risk
Innovation Risk	Concept development and Design Phase	Denning, 2013	Technological Capability Risk	Technological Risk
Outsourcing risk	Concept development and Design Phase	Denning, 2013	Supply Chain Risk	Supply Chain Risk
Risk of tiered outsourcing	All Suppliers	Denning, 2013	Supply Chain Risk	Supply Chain Risk
Poorly designed contractual agreements with suppliers	Concept development and Design Phase	Denning, 2013	Supply Chain Risk	Supply Chain Risk
Off shoring risk	All Phases	Denning, 2013	Supply Chain Risk	Supply Chain Risk
Risk of communication	All Phases	Denning, 2013	Control Risk	Operations Risk

Risk as mentioned in Literature	**NPD Stage**	**Reference**	**Underlying Factor**	**Abstract Level Title**
by computers				
Supply Risk	All Phases	Tang et al. 2009	Supply Chain Risk	Supply Chain Risk
Process	All Phases	Tang et al. 2009	Control Risk	Operations Risk
Suppliers related risk	Planning and Concept developme nt	Jerrard et al., 2009	Supply Chain Risk	Supply Chain Risk
Supplier risk	Design Phase, Inegration and production	Jerrard et al., 2009	Supply Chain Risk	Supply Chain Risk
Supplier risk	All Phases	Jerrard et al., 2009	Supply Chain Risk	Supply chain Risk
Performance risk	All Phases	Lee and Johnson, 2010	Control Risk	Operations Risk
Relational risk	All Phases	Lee and Johnson, 2010	Supply Chain Risk	Supply Chain Risk
knowledge appropriation	Design Phase, Integration and production, after sales	Lee and Johnson, 2010	Control Risk	Operations Risk
Supplier capacity constraints	Integration and Production	Zsidisin and Smith, 2005	Supply Chain Risk	Supply Chain Risk
Supplier Organizational leadership Issues	All Phases	Zsidisin and Smith, 2005	Supply Chain Risk	Supply Chain Risk
Supply base	Design Phase, Integration and Production ,	Khan and Creazza, 2009	Supply Chain Risk	Supply Chain Risk
Poor availability	Design Phase, Integration and Production ,	Khan and Creazza, 2009	Supply Chain Risk	Supply Chain Risk

Risk as mentioned in Literature	NPD Stage	Reference	Underlying Factor	Abstract Level Title
Information risk	All Phases	Lin and Zhou, 2011	Supply Chain Risk	Supply Chain Risk
Supply related		Kayis et al, 2007	Supply Chain Risk	Supply Chain Risk
Commercial Viability risk	Planning and concept developme nt, product design phase	Keizer et al. 2002; Keizer and Halman 2007; Keizer et al., 2005, Keizer et al. 2009	Control Risk	Operations Risk
Financial Risk	Planning and Concept developme nt, After Sales	Wu and Wu (2014)	Lack of Funding Risk	Finance Risk
Poor funding	Planning and concept developme nt	Steven, 2014	Lack of Funding Risk	Finance Risk
Financial Risk	All Phases	Kim and Vonortas, 2014	Lack of Funding Risk	Finance Risk
Availability of funding	All Phases	Jerrard et al., 2009	Lack of Funding Risk	Finance Risk
Insufficient funds	. Concept developme nt After sales	Unger and Eppinger, 2009	Lack of Funding Risk	Finance Risk
Reduced funding for technology development in joint collaborations	Concept planning, Design, Integration and developme nt,	Martinsuo, 2014	Lack of Funding Risk	Finance Risk
Finance risk	Not specified	Wu et al., 2010	Financial Unpredictability	Finance Risk
Cost risk	Design integration and production	Larson and Kusiak, 1996	Financial Unpredictability	Finance Risk
Financial risk	All Phases	Kayis et al, 2007	Financial Unpredictability	Finance Risk
External risks	After sales	Keizer et al. 2002; Keizer and Halman 2007; Keizer et al., 2005,	Political Risk	Environmental Risk

Risk as mentioned in Literature	NPD Stage	Reference	Underlying Factor	Abstract Level Title
		Keizer et al. 2009		
Institutional/Regulatory risks	All Phases	Wu and Wu, 2014	Political Risk	Environmental Risk
Environmental quality problem,	All Phases	Thamhain et al. 2007	Political Risk	Environmental Risk
New regulatory requirement	All Phases	Thamhain et al. 2007	Political Risk	Environmental Risk
changing social economics conditions	All Phases	Thamhain et al. 2007	Social Risk	Environmental Risk
Global economy decline in 2008–2009	Not specified	Martinsuo et al, 2014	Macro-Economic Risk	Environmental Risk
Tightening emission regulations	Not specified	Martinsuo et al, 2014	Political Risk	Environmental Risk
The ongoing changes in legislation	All phases	Martinsuo et al, 2014	Political Risk	Environmental Risk
Environmental risk	After sales	Larson and Kusiak, 1996	Macro-Economic risk	Environmental Risk
Policy Risk	Not specified	Larson and Kusiak, 1996	Political Risk	Environmental Risk
Environment risk	All Phase	Kayis et al.,2007	Natural Risk	Environmental Risk
Environment risk	All Phase	Khan et al. 2008	Natural Risk	Environmental Risk
Environment risk	After sale	Lin and Zhou, 2011	Natural Risk	Environmental Risk
Regulatory Changes	Not specified	Wu et al. 2010	Political Risk	Environmental Risk
Environment, health and safety risk	All phases	Kohler and Som, 2014	Political Risk	Environmental Risk
Regulatory Changes		Wu et al., 2010	Political Risk	Environmental Risk

11.2 Appendix 2: Data Collection & Instrument Development Process



11.3 Appendix 3: Survey

Welcome to the Survey on Risks in New Product Development Projects (NPD)

The aim of this survey is to discover (i) what types of risks affect new product development (NPD) projects, (ii) how often, and (iii) how these risks are mitigated in practice.

Direct Benefit for Participants

1. Understand the extent to which your NPD projects are vulnerable to different types of risk.
2. Make better informed decisions on risk management practices following a comprehensive view of NPD project risks.
3. Justify these risk management decisions to management and colleagues.
4. Free and exclusive access to survey results.

Benefit for the Industry and Research

1. Understand the current state of the art regarding NPD project risks.
2. Create a bench-marking standard for NPD project risk management.
3. Understand the sources for NPD project risks.
4. Develop a research agenda for future activities that focuses on the most significant industry needs and gaps in knowledge.

Duration

Completion of the survey will take less than 10 minutes.

Confidentiality

1. All personally identifiable information, for example information that identifies you, your NPD project or organization, will be treated as confidential and will not be disclosed to other parties.
2. The results of this study will be used for scholarly purposes only and will be deleted at the end of the research project (December 2016).

3. Result of this survey will only be reported in an aggregated format so that no conclusion can be drawn regarding specific individuals, project or organizations.
4. Your participation in this research study is voluntary. You may choose not to participate. If you decide to participate in this research survey, you may withdraw at any time.

We appreciate your help by responding to the following questions.

During this survey, we will ask questions about risks in New Product Development projects. Risk is defined as "the effect of uncertainties on NPD project objectives".

When you answer the questions, we ask you to observe the following rules:

1. Please pick **ONE** NPD project to use as a reference when answering the questions.
2. Always use this one project as a reference for **ALL** questions.
3. Please choose a project with focus on development (not only production).
4. Please choose a project that was finished recently. If possible within the last 6 months.

If you are unable to answer a question, please leave the answer blank, and move to the next question.

Q 1: General Questions about the Company and NPD Project

Q1.1

Your name (optional):	
Your company's name (optional):	
Please indicate the size of your company in terms of number of employees:	
Please indicate the annual turnover of your company in GBP	
Development budget for NPD project was	
Which functional area best describes your role during this NPD project	

Q1.2: What industry sector does your firm operate in? (Select from Drop down list)

Q1.3: Please provide a brief description of your chosen NPD project

Q1.4: Please characterize your chosen NPD project (select one):

- o NPD project gave rise to a product that was a slight improvement on existing ones in market.
- o The NPD project created a completely new product line/offering OR it was a significant departure from the firm's existing product offerings
- o Not sure

RISKS IN NEW PRODUCT DEVELOPMENT PROJECT

The following questions will ask you to provide your judgement on risks associated with the following six areas.

1. Technology
2. Marketing
3. Operations
4. Supply chain
5. Finance
6. Environment

Technology Risk

Q2

Q2.1: How likely was it that the following aspects of technical risk affected your chosen NPD project? Please indicate (✓) the extent of your agreement with each statement. (1 = Extremely Unlikely; 2 = Unlikely; 3= Neither Unlikely nor Likely; 4= Likely; 5 = Extremely Likely).

Technology	Extremely Unlikely	Extremely Likely

The required technical competencies and processes such as production lines for developing the new product were available in our company.	1	2	3	4	5
The technical capabilities and skills for developing the new product were not available in our company.					

Q2.2: How important were the following aspects of technical risk for the chosen NPD project? Please indicate (✓) the extent of your agreement with each statement. (1 = Extremely Unimportant; 2 = Unimportant; 3= Neither Important Nor Unimportant; 4= Important; 5 = Extremely Important).

Technology	Extremely Unimportant				Extremely Important
The required technical competencies and processes such as production lines for developing the new product were available in our company.	1	2	3	4	5
The technical capabilities and skills for developing the new product were not available in our company.					

Q2.3: How did you mitigate the technological risk in your NPD project?

Marketing Risk

Q3

Q3.1: How likely was it that the following aspects of marketing risk affected your chosen NPD project? Please indicate (✓) the extent of your agreement with each statement. (1 = Extremely Unlikely; 2 = Unlikely; 3= Neither Unlikely nor likely; 4= Likely; 5 = Extremely Likely).

Marketing	Extremely Unlikely				Extremely Likely
Customer needs change quickly in an unexpected fashion making it hard to anticipate exact requirements	1	2	3	4	5
New product specifications did not meet customer demands and standards thus increasing customer doubt and uncertainty about the product.					
Our firm did not have adequate marketing capabilities or appropriate marketing strategies					
The firm's products were constantly under attack from low-cost substitutes					

Q3.2: How important were the following aspects of technical risk for the chosen NPD project? Please indicate (✓) the extent of your agreement with each statement. (1 = Extremely Unimportant; 2 = Unimportant; 3= Neither Important Nor Unimportant; 4= Important; 5 = Extremely Important).

Marketing	Extremely Unimportant				Extremely Important
Customer needs change quickly in an unexpected fashion making it hard to anticipate exact requirements	1	2	3	4	5
New product specifications did not meet customer demands and standards thus increasing customer doubt and uncertainty about the product.					
Our firm did not have adequate marketing capabilities or appropriate marketing strategies					
The firm's products were constantly under attack from low-cost substitutes					

Q3.3: How did you mitigate the marketing risk in your NPD project?

Operations Risk

Q4

Q4.1: How likely was it that the following aspects of operations risk affected your chosen NPD project? Please indicate (✓) the extent of your agreement with each statement. (1 = Extremely Unlikely; 2 = Unlikely; 3= Neither Unlikely nor likely; 4= Likely; 5 = Extremely Likely).

Operations	Extremely Unlikely				Extremely Likely
My firm did not have adequate engineering and production resources	1	2	3	4	5
Team members did not possess the specialized skills required for the NPD project					
Attention was not paid to project planning					
Project progress was not monitored closely					
Continuous top management support and commitment was lacking during the project					

Q4.2: How important were the following aspects of operations risk on your chosen NPD project? Please indicate (✓) the extent of your agreement with each statement. (1 = Extremely Unimportant; 2 = Unimportant; 3= Neither Important Nor Unimportant; 4= Important; 5 = Extremely Important).

Operations	Extremely Unimportant				Extremely Important
My firm did not have adequate engineering and production resources	1	2	3	4	5
Team members did not possess the specialized skills required for the NPD project					
Attention was not paid to project planning					

Project progress was not monitored closely					
Continuous top management support and commitment was lacking during the project					

Q4.3: How did you mitigate the operational risk in your NPD project?

Supply Chain Risk

Q5

Q5.1: How likely was it that the following aspect of supply chain risk affected your chosen NPD project? Please indicate (✓) the extent of your agreement with each statement. (1 = Extremely Unlikely; 2 = Unlikely; 3= Neither Unlikely nor likely; 4= Likely; 5 = Extremely Likely).

Supply Chain	Extremely Unlikely				Extremely Likely
Supplier did not deliver on time.	1	2	3	4	5

Q5.2: How important was the following aspect of supply chain risk on your chosen NPD project? Please indicate (✓) the extent of your agreement with each statement. (1 = Extremely Unimportant; 2 = Unimportant; 3= Neither Important Nor Unimportant; 4= Important; 5 = Extremely Important).

Supply Chain	Extremely Unimportant				Extremely Important
Supplier did not deliver on time.	1	2	3	4	5

Q5.3: How did you mitigate the supply chain risk in your NPD project?

Finance Risk

Q6.1: How likely was it that the following aspects of finance risk affected your chosen NPD project? Please indicate (✓) the extent of your agreement with each statement. (1 = Extremely Unlikely; 2 = Unlikely; 3= Neither Unlikely nor likely; 4= Likely; 5 = Extremely Likely).

Finance	Extremely Unlikely				Extremely Likely
The budget for the project was set without clearly defining the project scope and requirements.	1	2	3	4	5
My/our firm lacked stable funding resources for the project					

Q6.2: How important were the following aspects of finance risk on your chosen NPD project? Please indicate (✓) the extent of your agreement with each statement. (1 = Extremely Unimportant; 2 = Unimportant; 3= Neither Important Nor Unimportant; 4= Important; 5 = Extremely Important).

Finance	Extremely Unimportant				Extremely Important
The budget for the project was set without clearly defining the project scope and requirements.	1	2	3	4	5
My/our firm lacked stable funding resources for the project					

Q6.3: How did you mitigate the finance risk in your NPD project?

Environment Risk

Q7

Q7.1: How likely was it that the following aspects of environment risk affected your chosen NPD project? Please indicate (✓) the extent of your agreement with each statement. (1 = Extremely Unlikely; 2 = Unlikely; 3= Neither Unlikely nor likely; 4= Likely; 5 = Extremely Likely).

Environment	Extremely Unlikely				Extremely Likely
Political instability, war, civil unrest or other socio-political crises occurred during the project	1	2	3	4	5
Sudden changes in macro-economic environment (such as exchange rate fluctuations) occurred during the project					
There was a negative external reaction to the NPD project					
There was a natural disaster (e.g. earthquake, flooding, extreme climate, tsunami) during the NPD project					

Q7.2: How important were the following aspects of environment risk on your chosen NPD project? Please indicate (✓) the extent of your agreement with each statement. (1 = Extremely Unimportant; 2 = Unimportant; 3= Neither Important Nor Unimportant; 4= Important; 5 = Extremely Important).

Environment	Extremely Unimportant				Extremely important
Political instability, war, civil unrest or other socio-political crises occurred during the project	1	2	3	4	5
Sudden changes in macro-economic environment (such as exchange rate fluctuations) occurred during the project					
There was a negative external reaction to the					

NPD project					
There was a natural disaster (e.g. earthquake, flooding, extreme climate, tsunami) during the NPD project					

Q7.3: How did you mitigate the environment risk in your NPD project?

Q 8: Were there any other risk factors not mentioned above that affected your chosen NPD project?

- Yes (Please specify it)
- No

If No Is Selected, Then Skip To End of Question No.

Q9

Q9.1: How likely was it that () risk affected your chosen NPD project. Please indicate (✓) the extent of your agreement with each statement. (1 = Extremely Unlikely; 2 = Unlikely; 3= Neither Unlikely nor likely; 4= Likely; 5 = Extremely Likely).

	Extremely Unlikely				Extremely Likely
Risk (Name it)	1	2	3	4	5

Q9.2: How important was the effect of () on your chosen NPD project Please indicate (✓) the extent of your agreement with each statement. (1 = Extremely Unimportant; 2 =

Unimportant; 3= Neither Important Nor Unimportant; 4= Important; 5 = Extremely Important).

	Extremely Unimportant				Extremely Important
Risk (Name it)	1	2	3	4	5

Q9.3: How did you mitigate the (risk) in your NPD project?

Q 10: Would you like a copy of the results of this survey?

- ❍ Yes (Please provide your email address)
- ❍ No

Q11: May we contact you to clarify any of your answer?

- ❍ Yes (Please provide us your contact number)
- ❍ No

Thank you very much for your participation!

11.4 Appendix 4a: One Sample T-Test

Appendix 2-a: General description for each risk type and results for one sample t test (Likelihood of each risk type)

NPD Risk Types		General Descriptive Statistics			One Sample test (Criterion measure=3)					
		Mean	Mode	Std. Deviation	t	df	Sig.(2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Technological Risk	Probability: Tech. Rapidity	3.55	5	.084	6.571	262	.000	.551	.39	.72
	Probability: Tech. Capability	3.09	3	.082	1.065	262	.288	.087	-.07	.25
Marketing Risk	Probability: Marketing Rapidity	3.37	4	.084	4.360	262	.000	.365	.20	.53
	Probability: Customer Per. risk	3.09	2	.075	1.173	262	.242	.087	-.06	.23
	Probability: Market Capability	3.32	3	.079	4.047	262	.000	.319	.16	.47
	Probability: Competition	2.95	4	.088	-.519	262	.604	-.046	-.22	.13
Operational Risk	Probability: Resource	3.57	4	.083	6.856	262	.000	.567	.40	.73
	Probability: Human Resource	3.27	3	.070	3.855	262	.000	.270	.13	.41
	Probability: Planning	3.56	4	.066	8.547	262	.000	.563	.43	.69
	Probability: Control	3.76	4	.072	10.612	262	.000	.764	.62	.91
	Probability: Strategic Mgt.	3.96	4	.063	15.236	262	.000	.958	.83	1.08

Supply chain risk	Probability: Supply Chain	3.22	4	.086	2.533	262	.012	.217	.05	.39
Finance Risk	Probability: Fin. Unpredictability	2.43	2	.081	-7.022	262	.000	-.567	-.73	-.41
	Probability: Lack of Funding	3.45	4	.083	5.415	262	.000	.449	.29	.61
Environmental Risk	Probability: Political Risk	1.89	1	.070	-15.810	262	.000	-1.110	-1.25	-.97
	Probability: Macro-Economic	2.43	2	.081	-7.118	262	.000	-.574	-.73	-.42
	Probability: Social	2.30	2	.076	-9.159	262	.000	-.696	-.85	-.55
	Probability: Natural	1.86	1	.073	-15.693	262	.000	-1.144	-1.29	-1.00

11.5 Appendix 4-b: One Sample T-Test

Appendix 2-b: General description for each risk type and results for one sample t test (Impact of each risk type)

NPD Risk Types	General Descriptive Statistics			One Sample test (Criterion measure=3)					
	Mean	Mode	Std. Deviation	t	df	Sig.(2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Impact: Tech. Rapidity	3.20	4	.066	2.978	262	.003	.198	.07	.33
Impact: Tech. Capability	2.75	3	.085	-2.948	262	.003	-.251	-.42	-.08
Impact: Marketing Rapidity	2.83	3	.073	-2.287	262	.023	-.167	-.31	-.02
Impact: Customer Per. risk	2.86	2	.074	-1.900	262	.059	-.141	-.29	.01
Impact: Market Capability	2.83	2	.079	-2.209	262	.028	-.175	-.33	-.02
Impact :Competition	3.17	4	1.332	2.037	262	.04	0.167	0.01	0.33
Impact: Resource	3.18	4	1.174	2.521	262	.012	0.183	0.04	.33
Impact: Human Resource	2.70	2	.078	-3.804	262	.000	-.297	-.45	-.14
Impact: Planning	2.81	2	.077	-2.511	262	.013	-.194	-.35	-.04
Impact : Control	2.88	2	.077	-1.537	262	.126	-.118	-.27	.03
Impact: Strategic Mgt.	2.97	4	.081	-.425	262	.671	-.034	-.19	.12
Impact: Supply Chain	3.54	4	.072	7.498	262	.000	.540	.40	.68

	Impact: Fin. Unpredictability	2.80	2[a]	.079	-2.544	262	.012	-.202	-.36	-.05
	Impact: Lack of Funding	3.22	4	1.229	2.960	262	.003	0.224	.08	.37
	Impact: Political Risk	2.13	2	.077	-11.234	262	.000	-.867	-1.02	-.71
	Impact: Macro-Economic	2.44	2	.075	-7.531	262	.000	-.563	-.71	-.42
	Impact: Social	2.40	2	.078	-7.671	262	.000	-.597	-.75	-.44
	Impact: Natural	2.06	2	.079	-11.842	262	.000	-.935	-1.09	-.78

11.6 Appendix 5a: Binary logistic Regression models (NPD Project Risks and NPD Types)

Binary Logistics Regressions Models (Likelihood of risks only)

			B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
									Lower	Upper
Technological Risk	Radical	Prob Tech Rapidity	-.146	.129	1.278	1	.258	.864	.671	1.113
		Prob Tech Capability	-.398	.164	5.876	1	.015	.671	.486	.927
	Increment	Prob Tech Rapidity	.146	.129	1.278	1	.258	1.157	.898	1.490
		Prob Tech Capability	398	.164	5.876	1	.015	.671	.486	.927
Marketing Risk	Radical	Prob Marketing Rapidity	-.103	.175	.349	1	.555	.902	.640	1.271
		Prob Marketing CPR	-.314	.163	3.717	1	.054	.730	.531	1.005
		Prob Marketing Capability	.227	.131	2.990	1	.084	1.255	.970	1.623
		Prob Competition	-.167	.149	1.244	1	.265	.846	.631	1.135
	Increment	Prob Marketing Rapidity	.103	.175	.349	1	.555	1.109	.787	1.563
		Prob Marketing CPR	.314	.163	3.717	1	.054	1.369	.995	1.885
		Prob Marketing Capability	.398	.164	5.876	1	.015	1.489	1.079	2.056
		Prob Competition	.167	.149	1.244	1	.265	1.181	.881	1.584
Operations Risk	Radical	Prob Operation Resources	.319	.199	2.565	1	.109	1.376	.931	2.034
		Prob Operation HR	-.475	.183	6.727	1	.009	1.608	1.123	2.302
		Prob Operation Planning	.148	.201	.542	1	.461	1.159	.782	1.718
		Prob Operation Control	-.069	.205	.115	1	.734	.933	.624	1.394
		Prob Operation SM	-.165	.210	.095	1	.078	.937	.621	1.415

	Increment	Prob Operation Resources	-.319	.199	2.565	1	.109	.727	.492	1.074
		Prob Operation HR	.475	.183	6.727	1	.009	.622	.434	.890
		Prob Operation Planning	-.148	.201	.542	1	.461	.863	.582	1.278
		Prob Operation Control	.069	.205	.115	1	.734	1.072	.717	1.602
		Prob Operation SM	.165	.210	.095	1	.078	1.067	.707	1.611
Supply Chain	Radical	Prob Supply Chain	.438	.177	6.114	1	.013	1.550	1.095	2.194
	Increment	Prob Supply chain	-.438	.177	6.114	1	.013	.645	.456	.913
Finance Risk	Radical	Prob Finance Unpredictability	-.058	.174	.113	1	.737	.943	.671	1.326
		Prob Finance lack funding	.436	.176	6.156	1	.013	1.547	1.096	2.184
	Increment	Prob Finance Unpredictability	.058	.174	.113	1	.737	1.060	.754	1.490
		Prob Finance lack funding	-.436	.176	6.156	1	.013	.646	.458	.912
Environmental Risk	Radical	Prob Environment Political	.255	.212	1.449	1	.229	1.290	.852	1.953
		Prob Environment Macro	.139	.192	.523	1	.469	1.149	.788	1.676
		Prob Environent Social	-.262	.166	2.483	1	.069	1.300	.938	1.801
		Prob Environment Natural	-.044	.198	.049	1	.825	.957	.649	1.412
	Increment	Prob Environment Political	-.255	.212	1.449	1	.229	.775	.512	1.174
		Prob Environment Macro	-.139	.192	.523	1	.469	.870	.597	1.269
		Prob Environment Social	-.262	.166	2.483	1	.069	.769	.555	1.066
		Prob Environment Natural	.044	.198	.049	1	.825	1.045	.708	1.541

11.7 Appendix 5b: Binary logistic Regression models (NPD Project Risks and NPD Types)

Binary Logistics Regressions Models (Impacts of risks only)

			B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
									Lower	Upper
Technological Risk	Radical	Impact Tech Rapidity	.321	.176	3.316	1	.049	.725	.513	1.025
		Impact Tech. Capability	.655	.167	15.344	1	.000	1.926	1.387	2.673
	Increment	Impact Tech Rapidity	-.321	.176	3.316	1	.049	1.379	.976	1.947
		Impact Tech. Capability	-.655	.167	15.344	1	.000	.519	.374	.721
Marketing Risk	Radical	Impact Marketing Rapidity	-.477	.251	3.617	1	.047	.620	.379	1.015
		Impact Marketing CPR	-.405	.218	3.473	1	.062	1.500	.979	2.298
		Impact Marketing Capability	.092	.194	.226	1	.635	1.096	.750	1.602
		Impact Competition	-.298	.161	3.441	1	.034	.742	.542	1.017
	Increment	ImpactMarketingRapidity	.477	.251	3.617	1	.057	1.612	.986	2.637
		ImpactMarketingCPR	.405	.218	3.473	1	.047	.667	.435	1.021
		Impact Marketing Capability	-.092	.194	.226	1	.635	.912	.624	1.333
		Impact Competition	.298	.161	3.441	1	.034	1.347	.983	1.845
Operations Risk	Radical	Impact Operation Resources	-.259	.180	2.078	1	.149	.772	.543	1.098
		Impact Operations HR	-.127	.261	.235	1	.058	.881	.528	1.470
		Impact Operations Planning	.056	.303	.034	1	.853	1.058	.584	1.915
		Impact Operations Control	-.195	.290	.455	1	.500	.823	.466	1.451
		Impact Operations SM	.266	.155	2.957	1	.086	1.305	.963	1.768

	Increment	Impact Operation Resources	.259	.180	2.078	1	.149	1.296	.911	1.843
		Impact Operations HR	.127	.261	.235	1	.058	1.135	.680	1.893
		Impact Operations Planning	-.056	.303	.034	1	.853	.946	.522	1.712
		Impact Operations Control	.195	.290	.455	1	.500	1.216	.689	2.144
		Impact Operations SM	-.266	.155	2.957	1	.086	.766	.566	1.038
Supply Chain	Radical	Impact Supply Chain	-.422	.178	5.603	1	.018	.656	.462	.930
	Increment	Impact Supply chain	.422	.178	5.603	1	.018	1.525	1.075	2.163
Finance Risk	Radical	Impact Finance Unpredictability	-.466	.189	6.042	1	.014	.628	.433	.910
		Impact Finance Lack Funding	.054	.160	.115	1	.735	1.056	.771	1.446
	Increment	Impact Finance Unpredictability	.466	.189	6.042	1	.014	.628	.433	.910
		Impact Finance Lack Funding	-.054	.160	.115	1	.735	.947	.692	1.297
Environmental Risk	Radical	Impact Environment Political	.104	.230	.206	1	.650	1.110	.707	1.742
		Impact Environment Macro	-.498	.259	3.712	1	.054	.608	.366	1.009
		Impact Environment Social	-.643	.193	11.043	1	.079	1.902	1.302	2.778
		Impact Environment Natural	-.379	.215	3.090	1	.079	.685	.449	1.044
	Increment	Impact Environment Political	-.104	.230	.206	1	.650	.901	.574	1.414
		Impact Environment Macro	.498	.259	3.712	1	.054	1.646	.991	2.732
		Impact Environment Social	.643	.193	11.043	1	.079	.526	.360	.768
		Impact Environment Natural	.379	.215	3.090	1	.059	1.460	.957	2.228

11.8 Appendix 6 a: Binary logistic Regression models (NPD Project Risks and Firm Size)

Binary Logistics Regressions Models (Probability of risks only)

			B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
									Lower	Upper
Technological Risk	SMEs	Prob Tech Rapidity	-.141	.133	1.115	1	.291	.869	.669	1.128
		Prob Tech Capability	-.434	.142	9.331	1	.002	1.544	1.168	2.040
	Large	Prob Tech Rapidity	.141	.133	1.115	1	.291	1.151	.887	1.494
		Prob Tech Capability	.434	.142	9.331	1	.002	.648	.490	.856
Marketing Risk	SMEs	Prob Marketing Rapidity	-.085	.163	.273	1	.602	.918	.667	1.264
		Prob Marketing CPR	.119	.201	.349	1	.555	1.126	.759	1.670
		Prob Marketing Capability	-.185	.154	1.447	1	.029	1.203	.890	1.625
		Prob Competition	.138	.142	.941	1	.332	1.148	.869	1.516
	Large	Prob Marketing Rapidity	.085	.163	.273	1	.602	1.089	.791	1.499
		Prob Marketing CPR	-.119	.201	.349	1	.555	.888	.599	1.317
		Prob Marketing Capability	.185	.154	1.447	1	.029	.831	.615	1.123
		Prob Competition	-.138	.142	.941	1	.332	.871	.660	1.151
Operations Risk	SMEs	Prob Operation Resources	-.294	.162	3.303	1	.069	.745	.543	1.023
		Prob Operation HR	-.445	.179	6.177	1	.013	1.560	1.099	2.216
		Prob Operation Planning	.077	.196	.153	1	.695	1.080	.735	1.586
		Prob Operation Control	-.136	.193	.492	1	.483	.873	.598	1.275
		Prob Operation SM	.191	.209	.834	1	.077	1.210	.804	1.822

	Large	Prob Operation Resources	.294	.162	3.303	1	.069	1.342	.977	1.842
		Prob Operation HR	.445	.179	6.177	1	.013	.641	.451	.910
		Prob Operation Planning	-.077	.196	.153	1	.695	.926	.630	1.360
		Prob Operation Control	.136	.193	.492	1	.483	1.145	.784	1.673
		Prob Operation SM	-.191	.209	.834	1	.077	.826	.549	1.244
Supply Chain	SMEs	Prob Supply Chain	.739	.182	16.476	1	.000	.478	.334	.682
	Large	Prob Supply chain	-.739	.182	16.476	1	.000	2.094	1.466	2.992
Finance Risk	SMEs	Prob Finance Unpredictability	-.484	.177	7.483	1	.006	1.623	1.147	2.296
		Prob Finance lack funding	.230	.166	1.909	1	.167	1.258	.908	1.743
	Large	Prob Finance Unpredictability	.484	.177	7.483	1	.006	.616	.436	.872
		Prob Finance lack funding	-.230	.166	1.909	1	.167	.795	.574	1.101
Environmental Risk	SMEs	Prob Environment Political	.713	.222	10.306	1	.001	.490	.317	.758
		Prob Environment Macro	.039	.189	.042	1	.838	1.039	.718	1.505
		Prob Environent Social	.162	.160	1.022	1	.312	1.175	.859	1.608
		Prob Environment Natural	-.176	.203	.751	1	.386	.838	.563	1.249
	Large	Prob Environment Political	-.713	.222	10.306	1	.001	2.040	1.320	3.152
		Prob Environment Macro	-.039	.189	.042	1	.838	.962	.665	1.393
		Prob Environment Social	-.162	.160	1.022	1	.312	.851	.622	1.164
		Prob Environment Natural	.176	.203	.751	1	.386	1.193	.801	1.777

11.9 Appendix 6b: Binary logistic Regression models (NPD Project Risks and Firm Size)

Binary Logistics Regressions Models (Impacts of risks only)

			B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
									Lower	Upper
Technological Risk	SMEs	Impact Tech Rapidity	.278	.170	2.666	1	.103	1.320	.946	1.842
		Impact Tech. Capability	-.054	.144	.139	1	.030	.948	.715	1.257
	Large	Impact Tech Rapidity	-.278	.170	2.666	1	.103	.758	.543	1.057
		Impact Tech. Capability	.054	.144	.139	1	.030	1.055	.796	1.399
Marketing Risk	SMEs	Impact Marketing Rapidity	.272	.219	1.536	1	.215	1.312	.854	2.016
		Impact Marketing CPR	-.359	.203	3.132	1	.077	.698	.469	1.039
		Impact Marketing Capability	-.491	.192	6.555	1	.010	1.634	1.122	2.379
		Impact Competition	-.236	.150	2.489	1	.115	.790	.589	1.059
	Large	Impact Marketing Rapidity	-.272	.219	1.536	1	.215	.762	.496	1.171
		Impact Marketing CPR	.359	.203	3.132	1	.077	1.432	.962	2.132
		Impact Marketing Capability	.491	.192	6.555	1	.010	.612	.420	.891
		Impact Competition	.236	.150	2.489	1	.115	1.266	.944	1.698
Operations Risk	SMEs	Impact Operation Resources	-.059	.188	.097	1	.056	.943	.652	1.364
		Impact Operations HR	-.043	.250	.030	1	.042	.957	.586	1.564
		Impact Operations Planning	.079	.263	.090	1	.764	1.082	.646	1.813
		Impact Operations Control	-.181	.275	.432	1	.011	1.198	.699	2.054
		Impact Operations SM	.165	.153	1.163	1	.281	1.180	.874	1.593

	Large	Impact Operation Resources	.059	.188	.097	1	.056	1.060	.733	1.534
		Impact Operations HR	.043	.250	.030	1	.042	1.044	.639	1.706
		Impact Operations Planning	-.079	.263	.090	1	.764	.924	.551	1.548
		Impact Operations Control	.181	.275	.432	1	.011	.835	.487	1.431
		Impact Operations SM	-.165	.153	1.163	1	.281	.848	.628	1.145
Supply Chain	SMEs	Impact Supply Chain	.274	.172	2.546	1	.111	1.316	.939	1.843
	Large	Impact Supply chain	-.274	.172	2.546	1	.111	.760	.543	1.065
Finance Risk	SMEs	Impact Finance Unpredictability	-.067	.177	.144	1	.705	.935	.662	1.322
		Impact Finance Lack Funding	-.631	.168	14.094	1	.000	1.880	1.352	2.613
	Large	Impact Finance Unpredictability	.067	.177	.144	1	.705	1.069	.756	1.511
		Impact Finance Lack Funding	.631	.168	14.094	1	.000	.532	.383	.740
Environmental Risk	SMEs	Impact Environment Political	.053	.218	.050	1	.807	.948	.618	1.455
		Impact Environment Macro	.045	.249	.032	1	.857	1.046	.642	1.704
		Impact Environment Social	.032	.171	.034	1	.854	1.032	.738	1.443
		Impact Environment Natural	-.044	.214	.043	1	.836	.957	.630	1.454
	Large	Impact Environment Political	-.053	.218	.050	1	.807	1.055	.687	1.619
		Impact Environment Macro	-.045	.249	.032	1	.857	.956	.587	1.558
		Impact Environment Social	-.032	.171	.034	1	.854	.969	.693	1.355
		Impact Environment Natural	.044	.214	.043	1	.836	1.045	.688	1.588

11.10 Appendix 7: Analysis of Variance (NPD Project Risks and Industry Sectors)

Comparison of risk types according to industry types (Descriptive)									
		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Probability of Technological Rapidity Risk	FMCG	69	3.51	1.368	.165	3.18	3.84	1	5
	Software & Information System	36	3.81	1.390	.232	3.34	4.28	1	5
	Computers & Electronics	40	3.65	1.312	.207	3.23	4.07	1	5
	Textile & Apparel	22	3.50	1.472	.314	2.85	4.15	1	5
	Automotives & other means of Transportation	15	3.47	1.302	.336	2.75	4.19	1	5
	All Others	81	3.46	1.370	.152	3.15	3.76	1	5
	Total	263	3.55	1.361	.084	3.39	3.72	1	5
Probability of Technological Capability Risk new	FMCG	69	3.25	1.366	.164	2.92	3.57	1	5
	Software & Information System	36	2.94	1.264	.211	2.52	3.37	1	5
	Computers & Electronics	40	2.93	1.163	.184	2.55	3.30	1	5
	Textile & Apparel	22	3.36	1.399	.298	2.74	3.98	1	5
	Automotives & other means	15	2.73	1.223	.316	2.06	3.41	1	5

Comparison of risk types according to industry types (Descriptive)

	of Transportation								
	All Others	81	3.09	1.416	.157	2.77	3.40	0	5
	Total	263	3.09	1.332	.082	2.93	3.25	0	5
Impact of Technological Rapidity Risk	FMCG	69	3.35	1.082	.130	3.09	3.61	1	5
	Software & Information System	36	2.86	1.099	.183	2.49	3.23	0	4
	Computers & Electronics	40	3.28	1.219	.193	2.89	3.66	0	5
	Textile & Apparel	22	3.09	1.019	.217	2.64	3.54	1	4
	Automotives & other means of Transportation	15	3.40	.910	.235	2.90	3.90	2	5
	All Others	81	3.17	1.022	.114	2.95	3.40	1	5
	Total	263	3.20	1.077	.066	3.07	3.33	0	5
Impact of Technological Capability Risk	FMCG	69	2.70	1.488	.179	2.34	3.05	0	5
	Software & Information System	36	3.22	1.333	.222	2.77	3.67	1	5
	Computers & Electronics	40	2.60	1.392	.220	2.15	3.05	0	5
	Textile & Apparel	22	2.45	1.335	.285	1.86	3.05	1	5
	Automotives & other means of Transportation	15	2.67	1.234	.319	1.98	3.35	1	5
	All Others	81	2.75	1.328	.148	2.46	3.05	0	5
	Total	263	2.75	1.381	.085	2.58	2.92	0	5

Comparison of risk types according to industry types (Descriptive)									
Probability of Marketing Rapidity Risk	**FMCG**	**69**	**3.62**	**1.330**	**.160**	**3.30**	**3.94**	**1**	**5**
	Software & Information System	36	3.44	1.297	.216	3.01	3.88	1	5
	Computers & Electronics	**40**	**2.68**	**1.403**	**.222**	**2.23**	**3.12**	**1**	**5**
	Textile & Apparel	22	3.41	1.403	.299	2.79	4.03	1	5
	Automotives & other means of Transportation	15	3.07	1.486	.384	2.24	3.89	1	5
	All Others	81	3.49	1.266	.141	3.21	3.77	1	5
	Total	263	3.37	1.358	.084	3.20	3.53	1	5
Probability of Customer Perceived Risk	FMCG	69	2.93	1.217	.146	2.64	3.22	1	5
	Software & Information System	36	3.00	1.171	.195	2.60	3.40	1	5
	Computers & Electronics	40	3.00	1.219	.193	2.61	3.39	1	5
	Textile & Apparel	22	3.18	1.097	.234	2.70	3.67	1	5
	Automotives & other means of Transportation	15	2.73	1.163	.300	2.09	3.38	1	5
	All Others	81	3.35	1.237	.137	3.07	3.62	1	5
	Total	263	3.09	1.209	.075	2.94	3.23	1	5
Probability of Marketing Capability Risk	FMCG	69	3.26	1.302	.157	2.95	3.57	1	5
	Software & Information System	36	3.22	1.514	.252	2.71	3.73	0	5

Comparison of risk types according to industry types (Descriptive)

	Computers & Electronics	40	3.33	1.269	.201	2.92	3.73	1	5
	Textile & Apparel	22	3.09	1.342	.286	2.50	3.69	1	5
	Automotives & other means of Transportation	15	3.20	1.146	.296	2.57	3.83	1	5
	All Others	81	3.49	1.174	.130	3.23	3.75	1	5
	Total	263	3.32	1.280	.079	3.16	3.47	0	5
Probability of Competition Risk	**FMCG**	**69**	**3.38**	**1.456**	**.175**	**3.03**	**3.73**	**0**	**5**
	Software & Information System	36	2.64	1.222	.204	2.23	3.05	0	5
	Computers & Electronics	40	3.28	1.358	.215	2.84	3.71	0	5
	Textile & Apparel	22	2.86	1.424	.304	2.23	3.50	0	5
	Automotives & other means of Transportation	15	2.87	1.727	.446	1.91	3.82	0	5
	All Others	**81**	**2.62**	**1.374**	**.153**	**2.31**	**2.92**	**0**	**5**
	Total	263	2.95	1.427	.088	2.78	3.13	0	5
Impact of Marketing Rapidity Risk	FMCG	69	2.67	1.314	.158	2.35	2.98	0	5
	Software & Information System	36	3.50	1.028	.171	3.15	3.85	1	5
	Computers & Electronics	40	2.75	1.127	.178	2.39	3.11	0	5
	Textile & Apparel	22	2.18	.907	.193	1.78	2.58	1	4
	Automotives & other means	15	2.40	1.183	.306	1.74	3.06	0	4

Comparison of risk types according to industry types (Descriptive)

	of Transportation								
	All Others	81	2.98	1.095	.122	2.73	3.22	1	5
	Total	263	2.83	1.186	.073	2.69	2.98	0	5
Impact of Customer Perceived Risk	FMCG	69	2.64	1.248	.150	2.34	2.94	0	5
	Software & Information System	36	3.19	1.451	.242	2.70	3.69	0	5
	Computers & Electronics	40	3.03	1.025	.162	2.70	3.35	0	5
	Textile & Apparel	22	2.45	.912	.194	2.05	2.86	1	5
	Automotives & other means of Transportation	15	2.47	1.187	.307	1.81	3.12	0	4
	All Others	81	3.00	1.140	.127	2.75	3.25	1	5
	Total	263	2.86	1.201	.074	2.71	3.01	0	5
Impact of Marketing Capability Risk	**FMCG**	**69**	**2.58**	**1.253**	**.151**	**2.28**	**2.88**	**0**	**5**
	Software & Information System	**36**	**3.50**	**1.404**	**.234**	**3.02**	**3.98**	**1**	**5**
	Computers & Electronics	40	3.03	1.209	.191	2.64	3.41	0	5
	Textile & Apparel	22	2.27	1.241	.265	1.72	2.82	1	5
	Automotives & other means of Transportation	15	2.53	1.356	.350	1.78	3.28	0	4
	All Others	81	2.84	1.177	.131	2.58	3.10	1	5
	Total	263	2.83	1.284	.079	2.67	2.98	0	5

Comparison of risk types according to industry types (Descriptive)									
Impact of Competition Risk	**FMCG**	**69**	**2.88**	**1.451**	**.175**	**2.54**	**3.23**	**0**	**5**
	Software & Information System	**36**	**3.22**	**1.333**	**.222**	**2.77**	**3.67**	**0**	**5**
	Computers & Electronics	40	2.98	1.271	.201	2.57	3.38	0	5
	Textile & Apparel	22	2.64	1.465	.312	1.99	3.29	0	5
	Automotives & other means of Transportation	15	2.67	1.397	.361	1.89	3.44	0	5
	All Others	81	3.04	1.299	.144	2.75	3.32	0	5
	Total	263	2.96	1.357	.084	2.79	3.12	0	5
Probability of Resource Risk	FMCG	69	3.49	1.346	.162	3.17	3.82	0	5
	Software & Information System	36	3.83	1.108	.185	3.46	4.21	1	5
	Computers & Electronics	40	3.20	1.604	.254	2.69	3.71	0	5
	Textile & Apparel	22	3.86	1.320	.281	3.28	4.45	0	5
	Automotives & other means of Transportation	15	3.13	1.457	.376	2.33	3.94	1	5
	All Others	81	3.69	1.241	.138	3.42	3.97	1	5
	Total	263	3.57	1.340	.083	3.40	3.73	0	5
Probability of Human Resource Risk	FMCG	69	3.48	1.171	.141	3.20	3.76	1	5
	Software & Information System	36	3.31	1.037	.173	2.95	3.66	2	5

Comparison of risk types according to industry types (Descriptive)

	Computers & Electronics	40	3.08	1.047	.166	2.74	3.41	1	5
	Textile & Apparel	22	3.50	1.185	.253	2.97	4.03	1	5
	Automotives & other means of Transportation	15	2.80	1.146	.296	2.17	3.43	1	5
	All Others	81	3.20	1.156	.128	2.94	3.45	1	5
	Total	263	3.27	1.136	.070	3.13	3.41	1	5
Probability of Planning Risk	FMCG	69	3.46	1.065	.128	3.21	3.72	1	5
	Software & Information System	36	3.50	1.183	.197	3.10	3.90	1	5
	Computers & Electronics	40	3.33	1.289	.204	2.91	3.74	1	5
	Textile & Apparel	22	3.64	.902	.192	3.24	4.04	2	5
	Automotives & other means of Transportation	15	3.60	.986	.254	3.05	4.15	2	5
	All Others	81	3.77	.939	.104	3.56	3.97	1	5
	Total	263	3.56	1.068	.066	3.43	3.69	1	5
Probability of Control Risk	FMCG	69	3.68	1.356	.163	3.36	4.01	0	5
	Software & Information System	36	4.14	1.046	.174	3.78	4.49	1	5
	Computers & Electronics	40	3.35	1.252	.198	2.95	3.75	0	5
	Textile & Apparel	22	3.86	.774	.165	3.52	4.21	2	5
	Automotives & other means	15	3.73	1.163	.300	3.09	4.38	2	5

Comparison of risk types according to industry types (Descriptive)

	of Transportation								
	All Others	81	3.85	1.050	.117	3.62	4.08	0	5
	Total	263	3.76	1.168	.072	3.62	3.91	0	5
Probability of Strategic Management Risk	FMCG	69	4.01	1.022	.123	3.77	4.26	1	5
	Software & Information System	36	3.86	1.073	.179	3.50	4.22	1	5
	Computers & Electronics	40	3.70	.939	.148	3.40	4.00	2	5
	Textile & Apparel	22	4.05	.950	.203	3.62	4.47	2	5
	Automotives & other means of Transportation	15	3.87	1.246	.322	3.18	4.56	1	5
	All Others	81	4.07	1.010	.112	3.85	4.30	1	5
	Total	263	3.96	1.020	.063	3.83	4.08	1	5
Impact of Resource Risk	FMCG	69	3.07	1.298	.156	2.76	3.38	1	5
	Software & Information System	36	3.08	1.131	.188	2.70	3.47	1	5
	Computers & Electronics	40	3.13	1.159	.183	2.75	3.50	1	5
	Textile & Apparel	22	2.82	1.259	.268	2.26	3.38	1	5
	Automotives & other means of Transportation	15	3.07	1.100	.284	2.46	3.68	1	4
	All Others	81	3.12	1.208	.134	2.86	3.39	1	5
	Total	263	3.08	1.205	.074	2.93	3.22	1	5

Comparison of risk types according to industry types (Descriptive)

Impact of Human Resource Risk	FMCG	69	2.58	1.322	.159	2.26	2.90	0	5
	Software & Information System	36	3.08	1.273	.212	2.65	3.51	1	5
	Computers & Electronics	40	2.90	1.257	.199	2.50	3.30	0	5
	Textile & Apparel	22	2.32	1.287	.274	1.75	2.89	0	5
	Automotives & other means of Transportation	15	2.47	1.125	.291	1.84	3.09	1	4
	All Others	81	2.69	1.211	.135	2.42	2.96	0	5
	Total	263	2.70	1.264	.078	2.55	2.86	0	5
Impact of Planning Risk	FMCG	69	2.70	1.287	.155	2.39	3.00	0	5
	Software & Information System	36	3.19	1.451	.242	2.70	3.69	0	5
	Computers & Electronics	40	2.75	1.335	.211	2.32	3.18	0	5
	Textile & Apparel	22	2.55	1.057	.225	2.08	3.01	0	5
	Automotives & other means of Transportation	15	2.87	1.187	.307	2.21	3.52	1	5
	All Others	81	2.81	1.141	.127	2.56	3.07	0	5
	Total	263	2.81	1.253	.077	2.65	2.96	0	5
Impact of Control Risk	FMCG	69	2.77	1.250	.151	2.47	3.07	0	5
	Software & Information System	36	3.53	1.230	.205	3.11	3.94	1	5

Comparison of risk types according to industry types (Descriptive)

	Computers & Electronics	40	2.78	1.291	.204	2.36	3.19	0	5
	Textile & Apparel	22	2.68	1.171	.250	2.16	3.20	0	5
	Automotives & other means of Transportation	15	2.93	1.335	.345	2.19	3.67	1	5
	All Others	81	2.79	1.170	.130	2.53	3.05	0	5
	Total	263	2.88	1.244	.077	2.73	3.03	0	5
Impact of Strategic Management Risk	FMCG	69	3.06	1.259	.152	2.76	3.36	1	5
	Software & Information System	36	3.14	1.376	.229	2.67	3.60	1	5
	Computers & Electronics	40	2.98	1.209	.191	2.59	3.36	1	5
	Textile & Apparel	22	3.05	1.362	.290	2.44	3.65	1	5
	Automotives & other means of Transportation	15	3.00	1.414	.365	2.22	3.78	1	5
	All Others	81	2.78	1.342	.149	2.48	3.07	1	5
	Total	263	2.97	1.306	.081	2.81	3.12	1	5
Probability of Supply Chain Risk	FMCG	69	3.25	1.355	.163	2.92	3.57	0	5
	Software & Information System	**36**	**3.86**	**1.588**	**.265**	**3.32**	**4.40**	**0**	**5**
	Computers & Electronics	**40**	**2.85**	**1.388**	**.219**	**2.41**	**3.29**	**0**	**5**
	Textile & Apparel	22	3.27	1.279	.273	2.71	3.84	1	5
	Automotives & other means	15	2.73	1.163	.300	2.09	3.38	1	5

Comparison of risk types according to industry types (Descriptive)

	of Transportation								
	All Others	81	3.16	1.318	.146	2.87	3.45	0	5
	Total	263	3.22	1.388	.086	3.05	3.39	0	5
Impact of Supply Chain Risk	FMCG	69	3.61	1.215	.146	3.32	3.90	1	5
	Software & Information System	36	3.75	1.228	.205	3.33	4.17	0	5
	Computers & Electronics	40	3.53	.987	.156	3.21	3.84	1	5
	Textile & Apparel	22	3.36	1.049	.224	2.90	3.83	2	5
	Automotives & other means of Transportation	15	2.87	1.187	.307	2.21	3.52	1	4
	All Others	81	3.57	1.193	.133	3.30	3.83	0	5
	Total	263	3.54	1.168	.072	3.40	3.68	0	5
Probability of Financial Unpredictability Risk	FMCG	69	2.41	1.321	.159	2.09	2.72	0	5
	Software & Information System	**36**	**2.22**	**1.396**	**.233**	**1.75**	**2.69**	**0**	**5**
	Computers & Electronics	**40**	**3.08**	**1.228**	**.194**	**2.68**	**3.47**	**0**	**5**
	Textile & Apparel	22	2.14	1.207	.257	1.60	2.67	1	5
	Automotives & other means of Transportation	15	2.93	1.100	.284	2.32	3.54	1	4
	All Others	81	2.22	1.265	.141	1.94	2.50	0	5
	Total	263	2.43	1.308	.081	2.27	2.59	0	5

Comparison of risk types according to industry types (Descriptive)

Probability of Lack of Funding	FMCG	69	3.28	1.423	.171	2.93	3.62	0	5
	Software & Information System	36	3.67	1.549	.258	3.14	4.19	0	5
	Computers & Electronics	**40**	**2.88**	**1.181**	**.187**	**2.50**	**3.25**	**0**	**5**
	Textile & Apparel	22	3.82	1.181	.252	3.29	4.34	1	5
	Automotives & other means of Transportation	15	3.20	1.265	.327	2.50	3.90	1	5
	All Others	**81**	**3.73**	**1.215**	**.135**	**3.46**	**4.00**	**0**	**5**
	Total	263	3.45	1.344	.083	3.29	3.61	0	5
Impact of Financial Unpredictability Risk	FMCG	69	2.77	1.457	.175	2.42	3.12	0	5
	Software & Information System	36	2.94	1.492	.249	2.44	3.45	0	5
	Computers & Electronics	40	2.68	.997	.158	2.36	2.99	0	5
	Textile & Apparel	22	2.41	1.054	.225	1.94	2.88	1	5
	Automotives & other means of Transportation	15	2.87	1.302	.336	2.15	3.59	1	5
	All Others	81	2.91	1.217	.135	2.64	3.18	0	5
	Total	263	2.80	1.285	.079	2.64	2.95	0	5
Impact of Lack of Funding	FMCG	69	2.88	1.312	.158	2.57	3.20	0	5
	Software & Information System	36	3.19	1.283	.214	2.76	3.63	1	5

Comparison of risk types according to industry types (Descriptive)

	Computers & Electronics	40	2.95	1.218	.193	2.56	3.34	0	5
	Textile & Apparel	22	3.00	1.234	.263	2.45	3.55	1	5
	Automotives & other means of Transportation	15	3.07	1.100	.284	2.46	3.68	1	5
	All Others	81	3.22	1.265	.141	2.94	3.50	0	5
	Total	263	3.06	1.259	.078	2.91	3.21	0	5
Probability of Political Risk	FMCG	69	1.91	.996	.120	1.67	2.15	0	4
	Software & Information System	36	1.50	.775	.129	1.24	1.76	1	3
	Computers & Electronics	40	2.13	1.453	.230	1.66	2.59	0	5
	Textile & Apparel	22	2.00	.976	.208	1.57	2.43	1	5
	Automotives & other means of Transportation	15	1.80	1.265	.327	1.10	2.50	0	5
	All Others	81	1.91	1.217	.135	1.64	2.18	0	5
	Total	263	1.89	1.139	.070	1.75	2.03	0	5
Probability of Macro-Economic Risk	FMCG	69	2.25	1.181	.142	1.96	2.53	0	5
	Software & Information System	**36**	**1.92**	**.996**	**.166**	**1.58**	**2.25**	**1**	**5**
	Computers & Electronics	**40**	**2.90**	**1.499**	**.237**	**2.42**	**3.38**	**0**	**5**
	Textile & Apparel	22	2.82	1.259	.268	2.26	3.38	1	5
	Automotives & other means	15	2.27	1.486	.384	1.44	3.09	0	5

Comparison of risk types according to industry types (Descriptive)

	of Transportation								
	All Others	81	2.49	1.333	.148	2.20	2.79	0	5
	Total	263	2.43	1.308	.081	2.27	2.58	0	5
Probability of Social Risk	FMCG	69	2.20	1.279	.154	1.90	2.51	0	5
	Software & Information System	36	1.86	1.018	.170	1.52	2.21	0	5
	Computers & Electronics	40	2.40	1.257	.199	2.00	2.80	0	5
	Textile & Apparel	22	2.50	1.012	.216	2.05	2.95	1	5
	Automotives & other means of Transportation	15	2.60	1.056	.273	2.02	3.18	1	4
	All Others	81	2.43	1.322	.147	2.14	2.72	0	5
	Total	263	2.30	1.232	.076	2.15	2.45	0	5
Probability of Natural Risk	FMCG	69	2.03	1.175	.141	1.75	2.31	0	5
	Software & Information System	36	1.44	.843	.141	1.16	1.73	0	3
	Computers & Electronics	40	2.18	1.318	.208	1.75	2.60	0	5
	Textile & Apparel	22	2.23	1.378	.294	1.62	2.84	0	5
	Automotives & other means of Transportation	15	1.87	1.407	.363	1.09	2.65	0	5
	All Others	81	1.63	1.078	.120	1.39	1.87	0	5
	Total	263	1.86	1.183	.073	1.71	2.00	0	5

Comparison of risk types according to industry types (Descriptive)									
Impact of Political Risk	FMCG	69	2.04	1.254	.151	1.74	2.34	0	5
	Software & Information System	36	1.89	1.260	.210	1.46	2.32	0	5
	Computers & Electronics	40	2.33	1.439	.228	1.86	2.79	0	5
	Textile & Apparel	22	2.36	1.217	.259	1.82	2.90	0	5
	Automotives & other means of Transportation	15	2.20	1.265	.327	1.50	2.90	1	5
	All Others	81	2.15	1.163	.129	1.89	2.41	0	5
	Total	263	2.13	1.251	.077	1.98	2.29	0	5
Impact of Macro-Economic Risk	FMCG	69	2.29	1.202	.145	2.00	2.58	0	5
	Software & Information System	36	2.06	1.120	.187	1.68	2.43	1	5
	Computers & Electronics	40	2.63	1.125	.178	2.27	2.98	0	5
	Textile & Apparel	22	2.64	1.255	.268	2.08	3.19	0	5
	Automotives & other means of Transportation	15	2.47	1.302	.336	1.75	3.19	1	5
	All Others	81	2.58	1.254	.139	2.30	2.86	0	5
	Total	263	2.44	1.212	.075	2.29	2.58	0	5
Impact of Social Risk	FMCG	69	2.30	1.386	.167	1.97	2.64	0	5
	Software & Information System	36	2.47	1.464	.244	1.98	2.97	1	5

Comparison of risk types according to industry types (Descriptive)									
	Computers & Electronics	40	2.65	1.292	.204	2.24	3.06	0	5
	Textile & Apparel	22	2.05	1.046	.223	1.58	2.51	0	5
	Automotives & other means of Transportation	15	2.53	.640	.165	2.18	2.89	2	4
	All Others	81	2.41	1.181	.131	2.15	2.67	0	5
	Total	263	2.40	1.262	.078	2.25	2.56	0	5
Impact of Natural Risk	FMCG	69	2.10	1.341	.161	1.78	2.42	0	5
	Software & Information System	36	2.03	1.276	.213	1.60	2.46	0	5
	Computers & Electronics	**40**	**2.65**	**1.460**	**.231**	**2.18**	**3.12**	**0**	**5**
	Textile & Apparel	22	1.91	1.377	.294	1.30	2.52	0	5
	Automotives & other means of Transportation	15	2.13	1.187	.307	1.48	2.79	1	5
	All Others	**81**	**1.79**	**1.045**	**.116**	**1.56**	**2.02**	**0**	**5**
	Total	263	2.06	1.281	.079	1.91	2.22	0	5

11.11 Appendix 7b: Analysis of Variance (NPD Project Risks and Industry Sectors)

Test of Homogeneity of Variances: Comparison of risk types according to industry types (Test of Homogeneity of Variances)				
	Levene Statistic	df1	df2	Sig.
Probability of Technological Rapidity Risk	.588	5	257	.709
Probability of Technological Capability Risk new	1.173	5	257	.323
Impact of Technological Rapidity Risk	.448	5	257	.815
Impact of Technological Capability Risk	.669	5	257	.647
Probability of Marketing Rapidity Risk	.394	5	257	.853
Probability of Customer Perceived Risk	.559	5	257	.731
Probability of Marketing Capability Risk	.880	5	257	.495
Probability of Competition Risk	1.369	5	257	.236
Impact of Marketing Rapidity Risk	1.254	5	257	.284
Impact of Customer Perceived Risk	2.195	5	257	.055
Impact of Marketing	.779	5	257	.566

Test of Homogeneity of Variances: Comparison of risk types according to industry types (Test of Homogeneity of Variances)

Capability Risknew				
Impact of Competition Risk	.654	5	257	.659
Probability of Resource Risk	4.126	5	257	.007
Probability of Human Resource Risk	1.344	5	257	.246
Probability of Planning Risk	2.928	5	257	.054
Probability of Control Risk	3.526	5	257	.064
Probability of Strategic Management Risk	.429	5	257	.828
Impact of Resource Risk	.625	5	257	.681
Impact of Human Resource Risk	.318	5	257	.902
Impact of Planning Risk	1.571	5	257	.169
Impact of Control Risk	.303	5	257	.911
Impact of Strategic Management Risk	.412	5	257	.841
Probability of Supply Chain Risk	.626	5	257	.680
Impact of Supply Chain Risk	.628	5	257	.678

Test of Homogeneity of Variances: Comparison of risk types according to industry types (Test of Homogeneity of Variances)				
Probability of Financial Unpredictability Risk	.757	5	257	.581
Probability of Lack of Funding	2.478	5	257	.063
Impact of Financial Unpredictability Risk	2.451	5	257	.074
Impact of Lack of Funding	.807	5	257	.545
Probability of Political Risk	4.701	5	257	.094
Probability of Macro-Economic Risk	3.082	5	257	.080
Probability of Social Risk	1.644	5	257	.149
Probability of Natural Risk	1.979	5	257	.082
Impact of Political Risk	.788	5	257	.559
Impact of Macro-Economic Risk	.728	5	257	.603
Impact of Social Risk	2.995	5	257	.072
Impact of Natural Risk	2.334	5	257	.073

11.12 Appendix 7c: Analysis of Variance (NPD Project Risks and Industry Sectors)

ANOVA: Comparison of risk types according to industry type

		Sum of Squares	Df	Mean Square	F	Sig.
Probability of Technological Rapidity Risk	Between Groups	3.740	5	.748	.399	.849
	Within Groups	481.317	257	1.873		
	Total	485.057	262			
Probability of Technological Capability Risk new	Between Groups	7.094	5	1.419	.796	.553
	Within Groups	457.895	257	1.782		
	Total	464.989	262			
Impact of Technological Rapidity Risk	Between Groups	6.787	5	1.357	1.175	.322
	Within Groups	296.931	257	1.155		
	Total	303.719	262			
Impact of Technological Capability Risk	Between Groups	11.157	5	2.231	1.174	.322
	Within Groups	488.281	257	1.900		
	Total	499.437	262			
Probability of Marketing Rapidity Risk	**Between Groups**	**26.593**	**5**	**5.319**	**2.995**	**.012**
	Within Groups	**456.365**	**257**	**1.776**		
	Total	482.958	262			
Probability of Customer	Between Groups	9.824	5	1.965	1.353	.243

ANOVA: Comparison of risk types according to industry type						
Perceived Risk	Within Groups	373.165	257	1.452		
	Total	382.989	262			
Probability of Marketing Capability Risk	Between Groups	4.404	5	.881	.533	.751
	Within Groups	424.767	257	1.653		
	Total	429.171	262			
Probability of Competition Risk	**Between Groups**	**29.509**	**5**	**5.902**	**3.010**	**.012**
	Within Groups	**503.943**	**257**	**1.961**		
	Total	533.452	262			
Impact of Marketing Rapidity Risk	**Between Groups**	**31.982**	**5**	**6.396**	**4.883**	**.000**
	Within Groups	**336.657**	**257**	**1.310**		
	Total	**368.639**	**262**			
Impact of Customer Perceived Risk	**Between Groups**	**16.051**	**5**	**3.210**	**2.281**	**.047**
	Within Groups	**361.744**	**257**	**1.408**		
	Total	377.795	262			
Impact of Marketing Capability Risk	**Between Groups**	**30.157**	**5**	**6.031**	**3.858**	**.002**
	Within Groups	**401.797**	**257**	**1.563**		
	Total	431.954	262			
Impact of Competition Risk	Between Groups	6.957	5	1.391	.752	.585
	Within Groups	475.583	257	1.851		

ANOVA: Comparison of risk types according to industry type

	Total	482.540	262			
Probability of Resource Risk	Between Groups	14.331	5	2.866	1.614	.157
	Within Groups	456.255	257	1.775		
	Total	470.586	262			
Probability of Human Resource Risk	Between Groups	9.462	5	1.892	1.481	.196
	Within Groups	328.371	257	1.278		
	Total	337.833	262			
Probability of Planning Risk	Between Groups	6.546	5	1.309	1.152	.334
	Within Groups	292.169	257	1.137		
	Total	298.715	262			
Probability of Control Risk	Between Groups	13.247	5	2.649	1.978	.082
	Within Groups	344.138	257	1.339		
	Total	357.384	262			
Probability of Strategic Management Risk	Between Groups	4.605	5	.921	.883	.493
	Within Groups	267.934	257	1.043		
	Total	272.540	262			
Impact of Resource Risk	Between Groups	1.745	5	.349	.237	.946
	Within Groups	378.734	257	1.474		
	Total	380.479	262			

ANOVA: Comparison of risk types according to industry type						
Impact of Human Resource Risk	Between Groups	11.915	5	2.383	1.505	.189
	Within Groups	406.952	257	1.583		
	Total	418.867	262			
Impact of Planning Risk	Between Groups	7.953	5	1.591	1.014	.410
	Within Groups	403.158	257	1.569		
	Total	411.110	262			
Impact of Control Risk	**Between Groups**	**17.971**	**5**	**3.594**	**2.385**	**.039**
	Within Groups	**387.375**	**257**	**1.507**		
	Total	405.346	262			
Impact of Strategic Management Risk	Between Groups	4.689	5	.938	.545	.742
	Within Groups	442.003	257	1.720		
	Total	446.692	262			
Probability of Supply Chain Risk	**Between Groups**	**24.219**	**5**	**4.844**	**2.591**	**.026**
	Within Groups	**480.428**	**257**	**1.869**		
	Total	**504.646**	**262**			
Impact of Supply Chain Risk	Between Groups	9.470	5	1.894	1.399	.225
	Within Groups	347.861	257	1.354		
	Total	357.331	262			
Probability of Financial	**Between Groups**	**27.426**	**5**	**5.485**	**3.347**	**.006**

ANOVA: Comparison of risk types according to industry type						
Unpredictability Risk	**Within Groups**	**421.159**	**257**	**1.639**		
	Total	**448.586**	**262**			
Probability of Lack of Funding	**Between Groups**	**27.216**	**5**	**5.443**	**3.138**	**.009**
	Within Groups	**445.841**	**257**	**1.735**		
	Total	473.057	262			
Impact of Financial Unpredictability Risk	Between Groups	5.919	5	1.184	.714	.614
	Within Groups	426.400	257	1.659		
	Total	432.319	262			
Impact of Lack of Funding	Between Groups	5.482	5	1.096	.688	.633
	Within Groups	409.545	257	1.594		
	Total	415.027	262			
Probability of Political Risk	Between Groups	8.154	5	1.631	1.264	.280
	Within Groups	331.648	257	1.290		
	Total	339.802	262			
Probability of Macro-Economic Risk	**Between Groups**	**24.690**	**5**	**4.938**	**2.996**	**.012**
	Within Groups	**423.615**	**257**	**1.648**		
	Total	**448.304**	**262**			
Probability of Social Risk	Between Groups	11.624	5	2.325	1.548	.175
	Within Groups	386.042	257	1.502		

ANOVA: Comparison of risk types according to industry type						
	Total	397.665	262			
Probability of Natural Risk	**Between Groups**	**19.418**	**5**	**3.884**	**2.876**	**.015**
	Within Groups	**347.092**	**257**	**1.351**		
	Total	**366.510**	**262**			
Impact of Political Risk	Between Groups	5.429	5	1.086	.689	.632
	Within Groups	404.913	257	1.576		
	Total	410.342	262			
Impact of Macro-Economic Risk	Between Groups	10.695	5	2.139	1.470	.200
	Within Groups	374.019	257	1.455		
	Total	384.715	262			
Impact of Social Risk	Between Groups	6.353	5	1.271	.795	.554
	Within Groups	410.924	257	1.599		
	Total	417.278	262			
Impact of Natural Risk	**Between Groups**	**20.555**	**5**	4.111	2.581	.027
	Within Groups	**409.346**	**257**	1.593		
	Total	**429.901**	**262**			

11.13 Appendix 7d: Analysis of Variance (NPD Project Risks and Industry Sectors)

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

Tukey HSD

Dependent Variable	(I) Revised Industry 1	(J) REvised Industry 1	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Probability of Technological Rapidity Risk	FMCG	Software & Information System	-.298	.281	.897	-1.11	.51
		Computers & Electronics	-.143	.272	.995	-.92	.64
		Textile & Apparel	.007	.335	1.000	-.95	.97
		Automotives & other means of Transportation	.041	.390	1.000	-1.08	1.16
		All Others	.050	.224	1.000	-.59	.69
	Software & Information System	FMCG	.298	.281	.897	-.51	1.11
		Computers & Electronics	.156	.314	.996	-.75	1.06
		Textile & Apparel	.306	.370	.963	-.76	1.37

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons							
		Automotives & other means of Transportation	.339	.421	.966	-.87	1.55
		All Others	.349	.274	.800	-.44	1.14
	Computers & Electronics	FMCG	.143	.272	.995	-.64	.92
		Software & Information System	-.156	.314	.996	-1.06	.75
		Textile & Apparel	.150	.363	.998	-.89	1.19
		Automotives & other means of Transportation	.183	.414	.998	-1.01	1.37
		All Others	.193	.264	.978	-.57	.95
	Textile & Apparel	FMCG	-.007	.335	1.000	-.97	.95
		Software & Information System	-.306	.370	.963	-1.37	.76
		Computers & Electronics	-.150	.363	.998	-1.19	.89
		Automotives & other means of Transportation	.033	.458	1.000	-1.28	1.35
		All Others	.043	.329	1.000	-.90	.99
	Automotives & other means of Transportation	FMCG	-.041	.390	1.000	-1.16	1.08
		Software & Information System	-.339	.421	.966	-1.55	.87
		Computers & Electronics	-.183	.414	.998	-1.37	1.01
		Textile & Apparel	-.033	.458	1.000	-1.35	1.28

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		All Others	.010	.385	1.000	-1.09	1.11
	All Others	FMCG	-.050	.224	1.000	-.69	.59
		Software & Information System	-.349	.274	.800	-1.14	.44
		Computers & Electronics	-.193	.264	.978	-.95	.57
		Textile & Apparel	-.043	.329	1.000	-.99	.90
		Automotives & other means of Transportation	-.010	.385	1.000	-1.11	1.09
Probability of Technological Capability Risk new	FMCG	Software & Information System	.302	.274	.881	-.49	1.09
		Computers & Electronics	.321	.265	.831	-.44	1.08
		Textile & Apparel	-.117	.327	.999	-1.06	.82
		Automotives & other means of Transportation	.513	.380	.757	-.58	1.60
		All Others	.160	.219	.978	-.47	.79
	Software & Information System	FMCG	-.302	.274	.881	-1.09	.49
		Computers & Electronics	.019	.307	1.000	-.86	.90
		Textile & Apparel	-.419	.361	.855	-1.46	.62
		Automotives & other means of Transportation	.211	.410	.996	-.97	1.39
		All Others	-.142	.267	.995	-.91	.63

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

	Computers & Electronics	FMCG	-.321	.265	.831	-1.08	.44
		Software & Information System	-.019	.307	1.000	-.90	.86
		Textile & Apparel	-.439	.354	.818	-1.46	.58
		Automotives & other means of Transportation	.192	.404	.997	-.97	1.35
		All Others	-.161	.258	.989	-.90	.58
	Textile & Apparel	FMCG	.117	.327	.999	-.82	1.06
		Software & Information System	.419	.361	.855	-.62	1.46
		Computers & Electronics	.439	.354	.818	-.58	1.46
		Automotives & other means of Transportation	.630	.447	.721	-.65	1.91
		All Others	.277	.321	.955	-.64	1.20
	Automotives & other means of Transportation	FMCG	-.513	.380	.757	-1.60	.58
		Software & Information System	-.211	.410	.996	-1.39	.97
		Computers & Electronics	-.192	.404	.997	-1.35	.97
		Textile & Apparel	-.630	.447	.721	-1.91	.65
		All Others	-.353	.375	.935	-1.43	.72
	All Others	FMCG	-.160	.219	.978	-.79	.47

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons							
		Software & Information System	.142	.267	.995	-.63	.91
		Computers & Electronics	.161	.258	.989	-.58	.90
		Textile & Apparel	-.277	.321	.955	-1.20	.64
		Automotives & other means of Transportation	.353	.375	.935	-.72	1.43
Impact of Technological Rapidity Risk	FMCG	Software & Information System	.487	.221	.240	-.15	1.12
		Computers & Electronics	.073	.214	.999	-.54	.69
		Textile & Apparel	.257	.263	.925	-.50	1.01
		Automotives & other means of Transportation	-.052	.306	1.000	-.93	.83
		All Others	.175	.176	.920	-.33	.68
	Software & Information System	FMCG	-.487	.221	.240	-1.12	.15
		Computers & Electronics	-.414	.247	.549	-1.12	.30
		Textile & Apparel	-.230	.291	.969	-1.07	.61
		Automotives & other means of Transportation	-.539	.330	.579	-1.49	.41
		All Others	-.312	.215	.698	-.93	.31
	Computers & Electronics	FMCG	-.073	.214	.999	-.69	.54
		Software & Information System	.414	.247	.549	-.30	1.12

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		Textile & Apparel	.184	.285	.987	-.64	1.00
		Automotives & other means of Transportation	-.125	.325	.999	-1.06	.81
		All Others	.102	.208	.996	-.49	.70
	Textile & Apparel	FMCG	-.257	.263	.925	-1.01	.50
		Software & Information System	.230	.291	.969	-.61	1.07
		Computers & Electronics	-.184	.285	.987	-1.00	.64
		Automotives & other means of Transportation	-.309	.360	.956	-1.34	.72
		All Others	-.082	.258	1.000	-.82	.66
	Automotives & other means of Transportation	FMCG	.052	.306	1.000	-.83	.93
		Software & Information System	.539	.330	.579	-.41	1.49
		Computers & Electronics	.125	.325	.999	-.81	1.06
		Textile & Apparel	.309	.360	.956	-.72	1.34
		All Others	.227	.302	.975	-.64	1.09
	All Others	FMCG	-.175	.176	.920	-.68	.33
		Software & Information System	.312	.215	.698	-.31	.93
		Computers & Electronics	-.102	.208	.996	-.70	.49

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		Textile & Apparel	.082	.258	1.000	-.66	.82
		Automotives & other means of Transportation	-.227	.302	.975	-1.09	.64
Impact of Technological Capability Risk	FMCG	Software & Information System	-.527	.283	.431	-1.34	.29
		Computers & Electronics	.096	.274	.999	-.69	.88
		Textile & Apparel	.241	.337	.980	-.73	1.21
		Automotives & other means of Transportation	.029	.393	1.000	-1.10	1.16
		All Others	-.057	.226	1.000	-.71	.59
	Software & Information System	FMCG	.527	.283	.431	-.29	1.34
		Computers & Electronics	.622	.317	.365	-.29	1.53
		Textile & Apparel	.768	.373	.313	-.30	1.84
		Automotives & other means of Transportation	.556	.424	.779	-.66	1.77
		All Others	.469	.276	.534	-.32	1.26
	Computers & Electronics	FMCG	-.096	.274	.999	-.88	.69
		Software & Information System	-.622	.317	.365	-1.53	.29
		Textile & Apparel	.145	.366	.999	-.91	1.20
		Automotives & other means of Transportation	-.067	.417	1.000	-1.26	1.13

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		All Others	-.153	.266	.993	-.92	.61
	Textile & Apparel	FMCG	-.241	.337	.980	-1.21	.73
		Software & Information System	-.768	.373	.313	-1.84	.30
		Computers & Electronics	-.145	.366	.999	-1.20	.91
		Automotives & other means of Transportation	-.212	.462	.997	-1.54	1.11
		All Others	-.299	.331	.946	-1.25	.65
	Automotives & other means of Transportation	FMCG	-.029	.393	1.000	-1.16	1.10
		Software & Information System	-.556	.424	.779	-1.77	.66
		Computers & Electronics	.067	.417	1.000	-1.13	1.26
		Textile & Apparel	.212	.462	.997	-1.11	1.54
		All Others	-.086	.387	1.000	-1.20	1.03
	All Others	FMCG	.057	.226	1.000	-.59	.71
		Software & Information System	-.469	.276	.534	-1.26	.32
		Computers & Electronics	.153	.266	.993	-.61	.92
		Textile & Apparel	.299	.331	.946	-.65	1.25
		Automotives & other means of Transportation	.086	.387	1.000	-1.03	1.20

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons							
Probability of Marketing Rapidity Risk	FMCG	Software & Information System	.179	.274	.987	-.61	.97
		Computers & Electronics	**.948***	**.265**	**.005**	**.19**	1.71
		Textile & Apparel	.214	.326	.986	-.72	1.15
		Automotives & other means of Transportation	.557	.380	.686	-.53	1.65
		All Others	.129	.218	.991	-.50	.76
	Software & Information System	FMCG	-.179	.274	.987	-.97	.61
		Computers & Electronics	.769	.306	.124	-.11	1.65
		Textile & Apparel	.035	.361	1.000	-1.00	1.07
		Automotives & other means of Transportation	.378	.410	.940	-.80	1.55
		All Others	-.049	.267	1.000	-.82	.72
	Computers & Electronics	FMCG	-.948*	.265	.005	-1.71	-.19
		Software & Information System	-.769	.306	.124	-1.65	.11
		Textile & Apparel	-.734	.354	.303	-1.75	.28
		Automotives & other means of Transportation	-.392	.403	.927	-1.55	.77
		All Others	-.819*	.258	.020	-1.56	-.08
	Textile & Apparel	FMCG	-.214	.326	.986	-1.15	.72

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		Software & Information System	-.035	.361	1.000	-1.07	1.00
		Computers & Electronics	.734	.354	.303	-.28	1.75
		Automotives & other means of Transportation	.342	.446	.973	-.94	1.62
		All Others	-.085	.320	1.000	-1.00	.84
	Automotives & other means of Transportation	FMCG	-.557	.380	.686	-1.65	.53
		Software & Information System	-.378	.410	.940	-1.55	.80
		Computers & Electronics	.392	.403	.927	-.77	1.55
		Textile & Apparel	-.342	.446	.973	-1.62	.94
		All Others	-.427	.375	.864	-1.50	.65
	All Others	FMCG	-.129	.218	.991	-.76	.50
		Software & Information System	.049	.267	1.000	-.72	.82
		Computers & Electronics	.819*	.258	.020	.08	1.56
		Textile & Apparel	.085	.320	1.000	-.84	1.00
		Automotives & other means of Transportation	.427	.375	.864	-.65	1.50
Probability of Customer Perceived Risk	FMCG	Software & Information System	-.072	.248	1.000	-.78	.64
		Computers & Electronics	-.072	.239	1.000	-.76	.62

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons							
		Textile & Apparel	-.254	.295	.955	-1.10	.59
		Automotives & other means of Transportation	.194	.343	.993	-.79	1.18
		All Others	-.418	.197	.281	-.98	.15
	Software & Information System	FMCG	.072	.248	1.000	-.64	.78
		Computers & Electronics	.000	.277	1.000	-.79	.79
		Textile & Apparel	-.182	.326	.994	-1.12	.75
		Automotives & other means of Transportation	.267	.370	.979	-.80	1.33
		All Others	-.346	.241	.707	-1.04	.35
	Computers & Electronics	FMCG	.072	.239	1.000	-.62	.76
		Software & Information System	.000	.277	1.000	-.79	.79
		Textile & Apparel	-.182	.320	.993	-1.10	.74
		Automotives & other means of Transportation	.267	.365	.978	-.78	1.31
		All Others	-.346	.233	.675	-1.01	.32
	Textile & Apparel	FMCG	.254	.295	.955	-.59	1.10
		Software & Information System	.182	.326	.994	-.75	1.12
		Computers & Electronics	.182	.320	.993	-.74	1.10

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		Automotives & other means of Transportation	.448	.403	.876	-.71	1.61
		All Others	-.164	.290	.993	-1.00	.67
	Automotives & other means of Transportation	FMCG	-.194	.343	.993	-1.18	.79
		Software & Information System	-.267	.370	.979	-1.33	.80
		Computers & Electronics	-.267	.365	.978	-1.31	.78
		Textile & Apparel	-.448	.403	.876	-1.61	.71
		All Others	-.612	.339	.462	-1.58	.36
	All Others	FMCG	.418	.197	.281	-.15	.98
		Software & Information System	.346	.241	.707	-.35	1.04
		Computers & Electronics	.346	.233	.675	-.32	1.01
		Textile & Apparel	.164	.290	.993	-.67	1.00
		Automotives & other means of Transportation	.612	.339	.462	-.36	1.58
Probability of Marketing Capability Risk	FMCG	Software & Information System	.039	.264	1.000	-.72	.80
		Computers & Electronics	-.064	.255	1.000	-.80	.67
		Textile & Apparel	.170	.315	.994	-.73	1.07
		Automotives & other means of Transportation	.061	.366	1.000	-.99	1.11

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		All Others	-.233	.211	.879	-.84	.37
	Software & Information System	FMCG	-.039	.264	1.000	-.80	.72
		Computers & Electronics	-.103	.295	.999	-.95	.75
		Textile & Apparel	.131	.348	.999	-.87	1.13
		Automotives & other means of Transportation	.022	.395	1.000	-1.11	1.16
		All Others	-.272	.258	.899	-1.01	.47
	Computers & Electronics	FMCG	.064	.255	1.000	-.67	.80
		Software & Information System	.103	.295	.999	-.75	.95
		Textile & Apparel	.234	.341	.983	-.75	1.21
		Automotives & other means of Transportation	.125	.389	1.000	-.99	1.24
		All Others	-.169	.248	.984	-.88	.54
	Textile & Apparel	FMCG	-.170	.315	.994	-1.07	.73
		Software & Information System	-.131	.348	.999	-1.13	.87
		Computers & Electronics	-.234	.341	.983	-1.21	.75
		Automotives & other means of Transportation	-.109	.430	1.000	-1.35	1.13
		All Others	-.403	.309	.783	-1.29	.48

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

	Automotives & other means of Transportation	FMCG	-.061	.366	1.000	-1.11	.99
		Software & Information System	-.022	.395	1.000	-1.16	1.11
		Computers & Electronics	-.125	.389	1.000	-1.24	.99
		Textile & Apparel	.109	.430	1.000	-1.13	1.35
		All Others	-.294	.361	.965	-1.33	.74
	All Others	FMCG	.233	.211	.879	-.37	.84
		Software & Information System	.272	.258	.899	-.47	1.01
		Computers & Electronics	.169	.248	.984	-.54	.88
		Textile & Apparel	.403	.309	.783	-.48	1.29
		Automotives & other means of Transportation	.294	.361	.965	-.74	1.33
Probability of Competition Risk	FMCG	Software & Information System	.738	.288	.110	-.09	1.56
		Computers & Electronics	.102	.278	.999	-.70	.90
		Textile & Apparel	.513	.343	.667	-.47	1.50
		Automotives & other means of Transportation	.510	.399	.796	-.64	1.66
		All Others	**.760***	**.229**	**.013**	**.10**	1.42
	Software & Information	FMCG	-.738	.288	.110	-1.56	.09

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

	System	Computers & Electronics	-.636	.322	.358	-1.56	.29
		Textile & Apparel	-.225	.379	.991	-1.31	.86
		Automotives & other means of Transportation	-.228	.430	.995	-1.46	1.01
		All Others	.022	.280	1.000	-.78	.83
	Computers & Electronics	FMCG	-.102	.278	.999	-.90	.70
		Software & Information System	.636	.322	.358	-.29	1.56
		Textile & Apparel	.411	.372	.878	-.66	1.48
		Automotives & other means of Transportation	.408	.424	.929	-.81	1.63
		All Others	.658	.271	.150	-.12	1.43
	Textile & Apparel	FMCG	-.513	.343	.667	-1.50	.47
		Software & Information System	.225	.379	.991	-.86	1.31
		Computers & Electronics	-.411	.372	.878	-1.48	.66
		Automotives & other means of Transportation	-.003	.469	1.000	-1.35	1.34
		All Others	.246	.337	.978	-.72	1.21
	Automotives & other means of Transportation	FMCG	-.510	.399	.796	-1.66	.64
		Software & Information System	.228	.430	.995	-1.01	1.46

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons							
		Computers & Electronics	-.408	.424	.929	-1.63	.81
		Textile & Apparel	.003	.469	1.000	-1.34	1.35
		All Others	.249	.394	.988	-.88	1.38
	All Others	FMCG	-.760*	.229	.013	-1.42	-.10
		Software & Information System	-.022	.280	1.000	-.83	.78
		Computers & Electronics	-.658	.271	.150	-1.43	.12
		Textile & Apparel	-.246	.337	.978	-1.21	.72
		Automotives & other means of Transportation	-.249	.394	.988	-1.38	.88
Impact of Marketing Rapidity Risk	FMCG	Software & Information System	-.833*	.235	.006	-1.51	-.16
		Computers & Electronics	-.083	.227	.999	-.74	.57
		Textile & Apparel	.485	.280	.513	-.32	1.29
		Automotives & other means of Transportation	.267	.326	.964	-.67	1.20
		All Others	-.309	.188	.569	-.85	.23
	Software & Information System	FMCG	.833*	.235	.006	.16	1.51
		Computers & Electronics	.750	.263	.053	.00	1.50
		Textile & Apparel	1.318*	.310	.000	.43	2.21
		Automotives & other means	1.100*	.352	.024	.09	2.11

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		of Transportation					
		All Others	.525	.229	.202	-.13	1.18
	Computers & Electronics	FMCG	.083	.227	.999	-.57	.74
		Software & Information System	-.750	.263	.053	-1.50	.00
		Textile & Apparel	.568	.304	.423	-.30	1.44
		Automotives & other means of Transportation	.350	.347	.914	-.64	1.34
		All Others	-.225	.221	.911	-.86	.41
	Textile & Apparel	FMCG	-.485	.280	.513	-1.29	.32
		Software & Information System	-1.318*	.310	.000	-2.21	-.43
		Computers & Electronics	-.568	.304	.423	-1.44	.30
		Automotives & other means of Transportation	-.218	.383	.993	-1.32	.88
		All Others	-.793*	.275	.048	-1.58	.00
	Automotives & other means of Transportation	FMCG	-.267	.326	.964	-1.20	.67
		Software & Information System	-1.100*	.352	.024	-2.11	-.09
		Computers & Electronics	-.350	.347	.914	-1.34	.64
		Textile & Apparel	.218	.383	.993	-.88	1.32
		All Others	-.575	.322	.475	-1.50	.35

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

	All Others	FMCG	.309	.188	.569	-.23	.85
		Software & Information System	-.525	.229	.202	-1.18	.13
		Computers & Electronics	.225	.221	.911	-.41	.86
		Textile & Apparel	.793*	.275	.048	.00	1.58
		Automotives & other means of Transportation	.575	.322	.475	-.35	1.50
Impact of Customer Perceived Risk	FMCG	Software & Information System	-.557	.244	.205	-1.26	.14
		Computers & Electronics	-.387	.236	.571	-1.06	.29
		Textile & Apparel	.183	.290	.989	-.65	1.02
		Automotives & other means of Transportation	.171	.338	.996	-.80	1.14
		All Others	-.362	.194	.427	-.92	.20
	Software & Information System	FMCG	.557	.244	.205	-.14	1.26
		Computers & Electronics	.169	.273	.989	-.61	.95
		Textile & Apparel	.740	.321	.196	-.18	1.66
		Automotives & other means of Transportation	.728	.365	.347	-.32	1.77
		All Others	.194	.238	.964	-.49	.88
	Computers & Electronics	FMCG	.387	.236	.571	-.29	1.06

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		Software & Information System	-.169	.273	.989	-.95	.61
		Textile & Apparel	.570	.315	.460	-.33	1.47
		Automotives & other means of Transportation	.558	.359	.629	-.47	1.59
		All Others	.025	.229	1.000	-.63	.68
	Textile & Apparel	FMCG	-.183	.290	.989	-1.02	.65
		Software & Information System	-.740	.321	.196	-1.66	.18
		Computers & Electronics	-.570	.315	.460	-1.47	.33
		Automotives & other means of Transportation	-.012	.397	1.000	-1.15	1.13
		All Others	-.545	.285	.397	-1.36	.27
	Automotives & other means of Transportation	FMCG	-.171	.338	.996	-1.14	.80
		Software & Information System	-.728	.365	.347	-1.77	.32
		Computers & Electronics	-.558	.359	.629	-1.59	.47
		Textile & Apparel	.012	.397	1.000	-1.13	1.15
		All Others	-.533	.333	.600	-1.49	.42
	All Others	FMCG	.362	.194	.427	-.20	.92
		Software & Information System	-.194	.238	.964	-.88	.49

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons							
		Computers & Electronics	-.025	.229	1.000	-.68	.63
		Textile & Apparel	.545	.285	.397	-.27	1.36
		Automotives & other means of Transportation	.533	.333	.600	-.42	1.49
Impact of Marketing Capability Risk	FMCG	Software & Information System	-.920*	.257	.005	-1.66	-.18
		Computers & Electronics	-.445	.248	.473	-1.16	.27
		Textile & Apparel	.307	.306	.917	-.57	1.19
		Automotives & other means of Transportation	.046	.356	1.000	-.98	1.07
		All Others	-.260	.205	.802	-.85	.33
	Software & Information System	**FMCG**	**.920***	**.257**	**.005**	**.18**	1.66
		Computers & Electronics	.475	.287	.564	-.35	1.30
		Textile & Apparel	1.227*	.338	.005	.26	2.20
		Automotives & other means of Transportation	.967	.384	.123	-.14	2.07
		All Others	.660	.250	.092	-.06	1.38
	Computers & Electronics	FMCG	.445	.248	.473	-.27	1.16
		Software & Information System	-.475	.287	.564	-1.30	.35
		Textile & Apparel	.752	.332	.212	-.20	1.71

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		Automotives & other means of Transportation	.492	.379	.786	-.60	1.58
		All Others	.185	.242	.973	-.51	.88
	Textile & Apparel	FMCG	-.307	.306	.917	-1.19	.57
		Software & Information System	-1.227*	.338	.005	-2.20	-.26
		Computers & Electronics	-.752	.332	.212	-1.71	.20
		Automotives & other means of Transportation	-.261	.419	.989	-1.46	.94
		All Others	-.567	.301	.413	-1.43	.30
	Automotives & other means of Transportation	FMCG	-.046	.356	1.000	-1.07	.98
		Software & Information System	-.967	.384	.123	-2.07	.14
		Computers & Electronics	-.492	.379	.786	-1.58	.60
		Textile & Apparel	.261	.419	.989	-.94	1.46
		All Others	-.306	.351	.953	-1.32	.70
	All Others	FMCG	.260	.205	.802	-.33	.85
		Software & Information System	-.660	.250	.092	-1.38	.06
		Computers & Electronics	-.185	.242	.973	-.88	.51
		Textile & Apparel	.567	.301	.413	-.30	1.43

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		Automotives & other means of Transportation	.306	.351	.953	-.70	1.32
Impact of Competition Risk	FMCG	Software & Information System	-.338	.280	.832	-1.14	.46
		Computers & Electronics	-.091	.270	.999	-.87	.69
		Textile & Apparel	.248	.333	.976	-.71	1.20
		Automotives & other means of Transportation	.217	.388	.993	-.90	1.33
		All Others	-.153	.223	.983	-.79	.49
	Software & Information System	FMCG	.338	.280	.832	-.46	1.14
		Computers & Electronics	.247	.313	.969	-.65	1.14
		Textile & Apparel	.586	.368	.605	-.47	1.64
		Automotives & other means of Transportation	.556	.418	.769	-.64	1.76
		All Others	.185	.272	.984	-.60	.97
	Computers & Electronics	FMCG	.091	.270	.999	-.69	.87
		Software & Information System	-.247	.313	.969	-1.14	.65
		Textile & Apparel	.339	.361	.936	-.70	1.38
		Automotives & other means of Transportation	.308	.412	.976	-.87	1.49
		All Others	-.062	.263	1.000	-.82	.69

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

	Textile & Apparel	FMCG	-.248	.333	.976	-1.20	.71
		Software & Information System	-.586	.368	.605	-1.64	.47
		Computers & Electronics	-.339	.361	.936	-1.38	.70
		Automotives & other means of Transportation	-.030	.456	1.000	-1.34	1.28
		All Others	-.401	.327	.824	-1.34	.54
	Automotives & other means of Transportation	FMCG	-.217	.388	.993	-1.33	.90
		Software & Information System	-.556	.418	.769	-1.76	.64
		Computers & Electronics	-.308	.412	.976	-1.49	.87
		Textile & Apparel	.030	.456	1.000	-1.28	1.34
		All Others	-.370	.382	.927	-1.47	.73
	All Others	FMCG	.153	.223	.983	-.49	.79
		Software & Information System	-.185	.272	.984	-.97	.60
		Computers & Electronics	.062	.263	1.000	-.69	.82
		Textile & Apparel	.401	.327	.824	-.54	1.34
		Automotives & other means of Transportation	.370	.382	.927	-.73	1.47
Probability of Resource Risk	FMCG	Software & Information System	-.341	.274	.815	-1.13	.45

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		Computers & Electronics	.293	.265	.879	-.47	1.05
		Textile & Apparel	-.371	.326	.866	-1.31	.57
		Automotives & other means of Transportation	.359	.380	.934	-.73	1.45
		All Others	-.199	.218	.944	-.83	.43
	Software & Information System	FMCG	.341	.274	.815	-.45	1.13
		Computers & Electronics	.633	.306	.307	-.25	1.51
		Textile & Apparel	-.030	.361	1.000	-1.07	1.01
		Automotives & other means of Transportation	.700	.409	.527	-.48	1.88
		All Others	.142	.267	.995	-.62	.91
	Computers & Electronics	FMCG	-.293	.265	.879	-1.05	.47
		Software & Information System	-.633	.306	.307	-1.51	.25
		Textile & Apparel	-.664	.354	.419	-1.68	.35
		Automotives & other means of Transportation	.067	.403	1.000	-1.09	1.22
		All Others	-.491	.257	.399	-1.23	.25
	Textile & Apparel	FMCG	.371	.326	.866	-.57	1.31
		Software & Information System	.030	.361	1.000	-1.01	1.07

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons							
		Computers & Electronics	.664	.354	.419	-.35	1.68
		Automotives & other means of Transportation	.730	.446	.575	-.55	2.01
		All Others	.172	.320	.995	-.75	1.09
	Automotives & other means of Transportation	FMCG	-.359	.380	.934	-1.45	.73
		Software & Information System	-.700	.409	.527	-1.88	.48
		Computers & Electronics	-.067	.403	1.000	-1.22	1.09
		Textile & Apparel	-.730	.446	.575	-2.01	.55
		All Others	-.558	.375	.671	-1.63	.52
	All Others	FMCG	.199	.218	.944	-.43	.83
		Software & Information System	-.142	.267	.995	-.91	.62
		Computers & Electronics	.491	.257	.399	-.25	1.23
		Textile & Apparel	-.172	.320	.995	-1.09	.75
		Automotives & other means of Transportation	.558	.375	.671	-.52	1.63
Probability of Human Resource Risk	FMCG	Software & Information System	.173	.232	.976	-.49	.84
		Computers & Electronics	.403	.225	.471	-.24	1.05
		Textile & Apparel	-.022	.277	1.000	-.82	.77

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons							
		Automotives & other means of Transportation	.678	.322	.287	-.25	1.60
		All Others	.281	.185	.654	-.25	.81
	Software & Information System	FMCG	-.173	.232	.976	-.84	.49
		Computers & Electronics	.231	.260	.949	-.52	.98
		Textile & Apparel	-.194	.306	.988	-1.07	.68
		Automotives & other means of Transportation	.506	.347	.693	-.49	1.50
		All Others	.108	.226	.997	-.54	.76
	Computers & Electronics	FMCG	-.403	.225	.471	-1.05	.24
		Software & Information System	-.231	.260	.949	-.98	.52
		Textile & Apparel	-.425	.300	.717	-1.29	.44
		Automotives & other means of Transportation	.275	.342	.967	-.71	1.26
		All Others	-.123	.218	.993	-.75	.50
	Textile & Apparel	FMCG	.022	.277	1.000	-.77	.82
		Software & Information System	.194	.306	.988	-.68	1.07
		Computers & Electronics	.425	.300	.717	-.44	1.29
		Automotives & other means of Transportation	.700	.378	.436	-.39	1.79

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		All Others	.302	.272	.876	-.48	1.08
	Automotives & other means of Transportation	FMCG	-.678	.322	.287	-1.60	.25
		Software & Information System	-.506	.347	.693	-1.50	.49
		Computers & Electronics	-.275	.342	.967	-1.26	.71
		Textile & Apparel	-.700	.378	.436	-1.79	.39
		All Others	-.398	.318	.811	-1.31	.51
	All Others	FMCG	-.281	.185	.654	-.81	.25
		Software & Information System	-.108	.226	.997	-.76	.54
		Computers & Electronics	.123	.218	.993	-.50	.75
		Textile & Apparel	-.302	.272	.876	-1.08	.48
		Automotives & other means of Transportation	.398	.318	.811	-.51	1.31
Probability of Planning Risk	FMCG	Software & Information System	-.036	.219	1.000	-.67	.59
		Computers & Electronics	.139	.212	.987	-.47	.75
		Textile & Apparel	-.173	.261	.986	-.92	.58
		Automotives & other means of Transportation	-.136	.304	.998	-1.01	.74
		All Others	-.302	.175	.515	-.80	.20

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

	Software & Information System	FMCG	.036	.219	1.000	-.59	.67
		Computers & Electronics	.175	.245	.980	-.53	.88
		Textile & Apparel	-.136	.289	.997	-.96	.69
		Automotives & other means of Transportation	-.100	.328	1.000	-1.04	.84
		All Others	-.265	.214	.815	-.88	.35
	Computers & Electronics	FMCG	-.139	.212	.987	-.75	.47
		Software & Information System	-.175	.245	.980	-.88	.53
		Textile & Apparel	-.311	.283	.881	-1.12	.50
		Automotives & other means of Transportation	-.275	.323	.957	-1.20	.65
		All Others	-.440	.206	.271	-1.03	.15
	Textile & Apparel	FMCG	.173	.261	.986	-.58	.92
		Software & Information System	.136	.289	.997	-.69	.96
		Computers & Electronics	.311	.283	.881	-.50	1.12
		Automotives & other means of Transportation	.036	.357	1.000	-.99	1.06
		All Others	-.129	.256	.996	-.87	.61
	Automotives & other means	FMCG	.136	.304	.998	-.74	1.01

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

	of Transportation	Software & Information System	.100	.328	1.000	-.84	1.04
		Computers & Electronics	.275	.323	.957	-.65	1.20
		Textile & Apparel	-.036	.357	1.000	-1.06	.99
		All Others	-.165	.300	.994	-1.03	.70
	All Others	FMCG	.302	.175	.515	-.20	.80
		Software & Information System	.265	.214	.815	-.35	.88
		Computers & Electronics	.440	.206	.271	-.15	1.03
		Textile & Apparel	.129	.256	.996	-.61	.87
		Automotives & other means of Transportation	.165	.300	.994	-.70	1.03
Probability of Control Risk	FMCG	Software & Information System	-.458	.238	.390	-1.14	.23
		Computers & Electronics	.331	.230	.702	-.33	.99
		Textile & Apparel	-.182	.283	.988	-1.00	.63
		Automotives & other means of Transportation	-.052	.330	1.000	-1.00	.89
		All Others	-.171	.190	.946	-.72	.37
	Software & Information System	FMCG	.458	.238	.390	-.23	1.14
		Computers & Electronics	.789*	.266	.038	.03	1.55

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		Textile & Apparel	.275	.313	.951	-.62	1.17
		Automotives & other means of Transportation	.406	.356	.864	-.62	1.43
		All Others	.287	.232	.818	-.38	.95
	Computers & Electronics	FMCG	-.331	.230	.702	-.99	.33
		Software & Information System	-.789*	.266	.038	-1.55	-.03
		Textile & Apparel	-.514	.307	.551	-1.40	.37
		Automotives & other means of Transportation	-.383	.350	.883	-1.39	.62
		All Others	-.502	.224	.221	-1.14	.14
	Textile & Apparel	FMCG	.182	.283	.988	-.63	1.00
		Software & Information System	-.275	.313	.951	-1.17	.62
		Computers & Electronics	.514	.307	.551	-.37	1.40
		Automotives & other means of Transportation	.130	.387	.999	-.98	1.24
		All Others	.012	.278	1.000	-.79	.81
	Automotives & other means of Transportation	FMCG	.052	.330	1.000	-.89	1.00
		Software & Information System	-.406	.356	.864	-1.43	.62
		Computers & Electronics	.383	.350	.883	-.62	1.39

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		Textile & Apparel	-.130	.387	.999	-1.24	.98
		All Others	-.119	.325	.999	-1.05	.82
	All Others	FMCG	.171	.190	.946	-.37	.72
		Software & Information System	-.287	.232	.818	-.95	.38
		Computers & Electronics	.502	.224	.221	-.14	1.14
		Textile & Apparel	-.012	.278	1.000	-.81	.79
		Automotives & other means of Transportation	.119	.325	.999	-.82	1.05
Probability of Strategic Management Risk	FMCG	Software & Information System	.153	.210	.978	-.45	.76
		Computers & Electronics	.314	.203	.632	-.27	.90
		Textile & Apparel	-.031	.250	1.000	-.75	.69
		Automotives & other means of Transportation	.148	.291	.996	-.69	.98
		All Others	-.060	.167	.999	-.54	.42
	Software & Information System	FMCG	-.153	.210	.978	-.76	.45
		Computers & Electronics	.161	.235	.983	-.51	.83
		Textile & Apparel	-.184	.276	.985	-.98	.61
		Automotives & other means of Transportation	-.006	.314	1.000	-.91	.90

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		All Others	-.213	.205	.904	-.80	.37
	Computers & Electronics	FMCG	-.314	.203	.632	-.90	.27
		Software & Information System	-.161	.235	.983	-.83	.51
		Textile & Apparel	-.345	.271	.799	-1.12	.43
		Automotives & other means of Transportation	-.167	.309	.995	-1.05	.72
		All Others	-.374	.197	.407	-.94	.19
	Textile & Apparel	FMCG	.031	.250	1.000	-.69	.75
		Software & Information System	.184	.276	.985	-.61	.98
		Computers & Electronics	.345	.271	.799	-.43	1.12
		Automotives & other means of Transportation	.179	.342	.995	-.80	1.16
		All Others	-.029	.245	1.000	-.73	.68
	Automotives & other means of Transportation	FMCG	-.148	.291	.996	-.98	.69
		Software & Information System	.006	.314	1.000	-.90	.91
		Computers & Electronics	.167	.309	.995	-.72	1.05
		Textile & Apparel	-.179	.342	.995	-1.16	.80
		All Others	-.207	.287	.979	-1.03	.62

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

	All Others	FMCG	.060	.167	.999	-.42	.54
		Software & Information System	.213	.205	.904	-.37	.80
		Computers & Electronics	.374	.197	.407	-.19	.94
		Textile & Apparel	.029	.245	1.000	-.68	.73
		Automotives & other means of Transportation	.207	.287	.979	-.62	1.03
Impact of Resource Risk	FMCG	Software & Information System	-.011	.250	1.000	-.73	.71
		Computers & Electronics	-.053	.241	1.000	-.75	.64
		Textile & Apparel	.254	.297	.956	-.60	1.11
		Automotives & other means of Transportation	.006	.346	1.000	-.99	1.00
		All Others	-.051	.199	1.000	-.62	.52
	Software & Information System	FMCG	.011	.250	1.000	-.71	.73
		Computers & Electronics	-.042	.279	1.000	-.84	.76
		Textile & Apparel	.265	.329	.966	-.68	1.21
		Automotives & other means of Transportation	.017	.373	1.000	-1.05	1.09
		All Others	-.040	.243	1.000	-.74	.66
	Computers & Electronics	FMCG	.053	.241	1.000	-.64	.75

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		Software & Information System	.042	.279	1.000	-.76	.84
		Textile & Apparel	.307	.322	.932	-.62	1.23
		Automotives & other means of Transportation	.058	.368	1.000	-1.00	1.11
		All Others	.002	.235	1.000	-.67	.68
	Textile & Apparel	FMCG	-.254	.297	.956	-1.11	.60
		Software & Information System	-.265	.329	.966	-1.21	.68
		Computers & Electronics	-.307	.322	.932	-1.23	.62
		Automotives & other means of Transportation	-.248	.406	.990	-1.42	.92
		All Others	-.305	.292	.902	-1.14	.53
	Automotives & other means of Transportation	FMCG	-.006	.346	1.000	-1.00	.99
		Software & Information System	-.017	.373	1.000	-1.09	1.05
		Computers & Electronics	-.058	.368	1.000	-1.11	1.00
		Textile & Apparel	.248	.406	.990	-.92	1.42
		All Others	-.057	.341	1.000	-1.04	.92
	All Others	FMCG	.051	.199	1.000	-.52	.62
		Software & Information System	.040	.243	1.000	-.66	.74

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		Computers & Electronics	-.002	.235	1.000	-.68	.67
		Textile & Apparel	.305	.292	.902	-.53	1.14
		Automotives & other means of Transportation	.057	.341	1.000	-.92	1.04
Impact of Human Resource Risk	FMCG	Software & Information System	-.504	.259	.376	-1.25	.24
		Computers & Electronics	-.320	.250	.795	-1.04	.40
		Textile & Apparel	.262	.308	.958	-.62	1.15
		Automotives & other means of Transportation	.113	.358	1.000	-.92	1.14
		All Others	-.112	.206	.994	-.70	.48
	Software & Information System	FMCG	.504	.259	.376	-.24	1.25
		Computers & Electronics	.183	.289	.988	-.65	1.01
		Textile & Apparel	.765	.341	.220	-.21	1.74
		Automotives & other means of Transportation	.617	.387	.603	-.49	1.73
		All Others	.392	.252	.629	-.33	1.12
	Computers & Electronics	FMCG	.320	.250	.795	-.40	1.04
		Software & Information System	-.183	.289	.988	-1.01	.65
		Textile & Apparel	.582	.334	.505	-.38	1.54

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		Automotives & other means of Transportation	.433	.381	.865	-.66	1.53
		All Others	.209	.243	.956	-.49	.91
	Textile & Apparel	FMCG	-.262	.308	.958	-1.15	.62
		Software & Information System	-.765	.341	.220	-1.74	.21
		Computers & Electronics	-.582	.334	.505	-1.54	.38
		Automotives & other means of Transportation	-.148	.421	.999	-1.36	1.06
		All Others	-.373	.303	.820	-1.24	.50
	Automotives & other means of Transportation	FMCG	-.113	.358	1.000	-1.14	.92
		Software & Information System	-.617	.387	.603	-1.73	.49
		Computers & Electronics	-.433	.381	.865	-1.53	.66
		Textile & Apparel	.148	.421	.999	-1.06	1.36
		All Others	-.225	.354	.988	-1.24	.79
	All Others	FMCG	.112	.206	.994	-.48	.70
		Software & Information System	-.392	.252	.629	-1.12	.33
		Computers & Electronics	-.209	.243	.956	-.91	.49
		Textile & Apparel	.373	.303	.820	-.50	1.24

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons							
		Automotives & other means of Transportation	.225	.354	.988	-.79	1.24
Impact of Planning Risk	FMCG	Software & Information System	-.499	.258	.382	-1.24	.24
		Computers & Electronics	-.054	.249	1.000	-.77	.66
		Textile & Apparel	.150	.307	.996	-.73	1.03
		Automotives & other means of Transportation	-.171	.357	.997	-1.20	.85
		All Others	-.119	.205	.992	-.71	.47
	Software & Information System	FMCG	.499	.258	.382	-.24	1.24
		Computers & Electronics	.444	.288	.636	-.38	1.27
		Textile & Apparel	.649	.339	.395	-.32	1.62
		Automotives & other means of Transportation	.328	.385	.957	-.78	1.43
		All Others	.380	.251	.656	-.34	1.10
	Computers & Electronics	FMCG	.054	.249	1.000	-.66	.77
		Software & Information System	-.444	.288	.636	-1.27	.38
		Textile & Apparel	.205	.332	.990	-.75	1.16
		Automotives & other means of Transportation	-.117	.379	1.000	-1.21	.97
		All Others	-.065	.242	1.000	-.76	.63

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

	Textile & Apparel	FMCG	-.150	.307	.996	-1.03	.73
		Software & Information System	-.649	.339	.395	-1.62	.32
		Computers & Electronics	-.205	.332	.990	-1.16	.75
		Automotives & other means of Transportation	-.321	.419	.973	-1.53	.88
		All Others	-.269	.301	.948	-1.13	.60
	Automotives & other means of Transportation	FMCG	.171	.357	.997	-.85	1.20
		Software & Information System	-.328	.385	.957	-1.43	.78
		Computers & Electronics	.117	.379	1.000	-.97	1.21
		Textile & Apparel	.321	.419	.973	-.88	1.53
		All Others	.052	.352	1.000	-.96	1.06
	All Others	FMCG	.119	.205	.992	-.47	.71
		Software & Information System	-.380	.251	.656	-1.10	.34
		Computers & Electronics	.065	.242	1.000	-.63	.76
		Textile & Apparel	.269	.301	.948	-.60	1.13
		Automotives & other means of Transportation	-.052	.352	1.000	-1.06	.96
Impact of Control Risk	FMCG	Software & Information System	-.760*	.252	.034	-1.48	-.03

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		Computers & Electronics	-.007	.244	1.000	-.71	.69
		Textile & Apparel	.086	.301	1.000	-.78	.95
		Automotives & other means of Transportation	-.165	.350	.997	-1.17	.84
		All Others	-.022	.201	1.000	-.60	.56
	Software & Information System	**FMCG**	**.760***	**.252**	**.034**	**.03**	1.48
		Computers & Electronics	.753	.282	.085	-.06	1.56
		Textile & Apparel	.846	.332	.115	-.11	1.80
		Automotives & other means of Transportation	.594	.377	.615	-.49	1.68
		All Others	.738*	.246	.035	.03	1.44
	Computers & Electronics	FMCG	.007	.244	1.000	-.69	.71
		Software & Information System	-.753	.282	.085	-1.56	.06
		Textile & Apparel	.093	.326	1.000	-.84	1.03
		Automotives & other means of Transportation	-.158	.372	.998	-1.23	.91
		All Others	-.015	.237	1.000	-.70	.67
	Textile & Apparel	FMCG	-.086	.301	1.000	-.95	.78
		Software & Information System	-.846	.332	.115	-1.80	.11

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		Computers & Electronics	-.093	.326	1.000	-1.03	.84
		Automotives & other means of Transportation	-.252	.411	.990	-1.43	.93
		All Others	-.108	.295	.999	-.96	.74
	Automotives & other means of Transportation	FMCG	.165	.350	.997	-.84	1.17
		Software & Information System	-.594	.377	.615	-1.68	.49
		Computers & Electronics	.158	.372	.998	-.91	1.23
		Textile & Apparel	.252	.411	.990	-.93	1.43
		All Others	.143	.345	.998	-.85	1.13
	All Others	FMCG	.022	.201	1.000	-.56	.60
		Software & Information System	-.738*	.246	.035	-1.44	-.03
		Computers & Electronics	.015	.237	1.000	-.67	.70
		Textile & Apparel	.108	.295	.999	-.74	.96
		Automotives & other means of Transportation	-.143	.345	.998	-1.13	.85
Impact of Strategic Management Risk	FMCG	Software & Information System	-.081	.270	1.000	-.86	.69
		Computers & Electronics	.083	.261	1.000	-.67	.83
		Textile & Apparel	.013	.321	1.000	-.91	.93

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		Automotives & other means of Transportation	.058	.374	1.000	-1.01	1.13
		All Others	.280	.215	.783	-.34	.90
	Software & Information System	FMCG	.081	.270	1.000	-.69	.86
		Computers & Electronics	.164	.301	.994	-.70	1.03
		Textile & Apparel	.093	.355	1.000	-.93	1.11
		Automotives & other means of Transportation	.139	.403	.999	-1.02	1.30
		All Others	.361	.263	.742	-.39	1.12
	Computers & Electronics	FMCG	-.083	.261	1.000	-.83	.67
		Software & Information System	-.164	.301	.994	-1.03	.70
		Textile & Apparel	-.070	.348	1.000	-1.07	.93
		Automotives & other means of Transportation	-.025	.397	1.000	-1.17	1.12
		All Others	.197	.253	.971	-.53	.92
	Textile & Apparel	FMCG	-.013	.321	1.000	-.93	.91
		Software & Information System	-.093	.355	1.000	-1.11	.93
		Computers & Electronics	.070	.348	1.000	-.93	1.07
		Automotives & other means of Transportation	.045	.439	1.000	-1.22	1.31

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons							
		All Others	.268	.315	.958	-.64	1.17
	Automotives & other means of Transportation	FMCG	-.058	.374	1.000	-1.13	1.01
		Software & Information System	-.139	.403	.999	-1.30	1.02
		Computers & Electronics	.025	.397	1.000	-1.12	1.17
		Textile & Apparel	-.045	.439	1.000	-1.31	1.22
		All Others	.222	.369	.991	-.84	1.28
	All Others	FMCG	-.280	.215	.783	-.90	.34
		Software & Information System	-.361	.263	.742	-1.12	.39
		Computers & Electronics	-.197	.253	.971	-.92	.53
		Textile & Apparel	-.268	.315	.958	-1.17	.64
		Automotives & other means of Transportation	-.222	.369	.991	-1.28	.84
Probability of Supply Chain Risk	FMCG	Software & Information System	-.615	.281	.247	-1.42	.19
		Computers & Electronics	.396	.272	.691	-.38	1.18
		Textile & Apparel	-.026	.335	1.000	-.99	.93
		Automotives & other means of Transportation	.513	.390	.775	-.61	1.63
		All Others	.086	.224	.999	-.56	.73

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

	Software & Information System	FMCG	.615	.281	.247	-.19	1.42
		Computers & Electronics	**1.011***	**.314**	**.018**	**.11**	1.91
		Textile & Apparel	.588	.370	.606	-.47	1.65
		Automotives & other means of Transportation	1.128	.420	.082	-.08	2.33
		All Others	.701	.274	.112	-.09	1.49
	Computers & Electronics	FMCG	-.396	.272	.691	-1.18	.38
		Software & Information System	-1.011*	.314	.018	-1.91	-.11
		Textile & Apparel	-.423	.363	.853	-1.46	.62
		Automotives & other means of Transportation	.117	.414	1.000	-1.07	1.31
		All Others	-.310	.264	.848	-1.07	.45
	Textile & Apparel	FMCG	.026	.335	1.000	-.93	.99
		Software & Information System	-.588	.370	.606	-1.65	.47
		Computers & Electronics	.423	.363	.853	-.62	1.46
		Automotives & other means of Transportation	.539	.458	.847	-.78	1.85
		All Others	.112	.329	.999	-.83	1.06
	Automotives & other means	FMCG	-.513	.390	.775	-1.63	.61

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

	of Transportation	Software & Information System	-1.128	.420	.082	-2.33	.08
		Computers & Electronics	-.117	.414	1.000	-1.31	1.07
		Textile & Apparel	-.539	.458	.847	-1.85	.78
		All Others	-.427	.384	.876	-1.53	.68
	All Others	FMCG	-.086	.224	.999	-.73	.56
		Software & Information System	-.701	.274	.112	-1.49	.09
		Computers & Electronics	.310	.264	.848	-.45	1.07
		Textile & Apparel	-.112	.329	.999	-1.06	.83
		Automotives & other means of Transportation	.427	.384	.876	-.68	1.53
Impact of Supply Chain Risk	FMCG	Software & Information System	-.141	.239	.992	-.83	.55
		Computers & Electronics	.084	.231	.999	-.58	.75
		Textile & Apparel	.245	.285	.955	-.57	1.06
		Automotives & other means of Transportation	.742	.331	.224	-.21	1.69
		All Others	.041	.191	1.000	-.51	.59
	Software & Information System	FMCG	.141	.239	.992	-.55	.83
		Computers & Electronics	.225	.267	.959	-.54	.99

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		Textile & Apparel	.386	.315	.823	-.52	1.29
		Automotives & other means of Transportation	.883	.358	.137	-.14	1.91
		All Others	.182	.233	.970	-.49	.85
	Computers & Electronics	FMCG	-.084	.231	.999	-.75	.58
		Software & Information System	-.225	.267	.959	-.99	.54
		Textile & Apparel	.161	.309	.995	-.73	1.05
		Automotives & other means of Transportation	.658	.352	.424	-.35	1.67
		All Others	-.043	.225	1.000	-.69	.60
	Textile & Apparel	FMCG	-.245	.285	.955	-1.06	.57
		Software & Information System	-.386	.315	.823	-1.29	.52
		Computers & Electronics	-.161	.309	.995	-1.05	.73
		Automotives & other means of Transportation	.497	.390	.798	-.62	1.62
		All Others	-.204	.280	.978	-1.01	.60
	Automotives & other means of Transportation	FMCG	-.742	.331	.224	-1.69	.21
		Software & Information System	-.883	.358	.137	-1.91	.14
		Computers & Electronics	-.658	.352	.424	-1.67	.35

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		Textile & Apparel	-.497	.390	.798	-1.62	.62
		All Others	-.701	.327	.268	-1.64	.24
	All Others	FMCG	-.041	.191	1.000	-.59	.51
		Software & Information System	-.182	.233	.970	-.85	.49
		Computers & Electronics	.043	.225	1.000	-.60	.69
		Textile & Apparel	.204	.280	.978	-.60	1.01
		Automotives & other means of Transportation	.701	.327	.268	-.24	1.64
Probability of Financial Unpredictability Risk	FMCG	Software & Information System	.184	.263	.982	-.57	.94
		Computers & Electronics	-.669	.254	.094	-1.40	.06
		Textile & Apparel	.269	.313	.956	-.63	1.17
		Automotives & other means of Transportation	-.528	.365	.698	-1.57	.52
		All Others	.184	.210	.952	-.42	.79
	Software & Information System	FMCG	-.184	.263	.982	-.94	.57
		Computers & Electronics	-.853*	.294	.046	-1.70	-.01
		Textile & Apparel	.086	.346	1.000	-.91	1.08
		Automotives & other means of Transportation	-.711	.393	.463	-1.84	.42

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		All Others	.000	.256	1.000	-.74	.74
	Computers & Electronics	FMCG	.669	.254	.094	-.06	1.40
		Software & Information System	**.853***	**.294**	**.046**	**.01**	1.70
		Textile & Apparel	.939	.340	.067	-.04	1.91
		Automotives & other means of Transportation	.142	.388	.999	-.97	1.25
		All Others	.853*	.247	.009	.14	1.56
	Textile & Apparel	FMCG	-.269	.313	.956	-1.17	.63
		Software & Information System	-.086	.346	1.000	-1.08	.91
		Computers & Electronics	-.939	.340	.067	-1.91	.04
		Automotives & other means of Transportation	-.797	.429	.430	-2.03	.43
		All Others	-.086	.308	1.000	-.97	.80
	Automotives & other means of Transportation	FMCG	.528	.365	.698	-.52	1.57
		Software & Information System	.711	.393	.463	-.42	1.84
		Computers & Electronics	-.142	.388	.999	-1.25	.97
		Textile & Apparel	.797	.429	.430	-.43	2.03
		All Others	.711	.360	.359	-.32	1.74

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

	All Others	FMCG	-.184	.210	.952	-.79	.42
		Software & Information System	.000	.256	1.000	-.74	.74
		Computers & Electronics	-.853*	.247	.009	-1.56	-.14
		Textile & Apparel	.086	.308	1.000	-.80	.97
		Automotives & other means of Transportation	-.711	.360	.359	-1.74	.32
Probability of Lack of Funding	FMCG	Software & Information System	-.391	.271	.699	-1.17	.39
		Computers & Electronics	.400	.262	.645	-.35	1.15
		Textile & Apparel	-.543	.322	.544	-1.47	.38
		Automotives & other means of Transportation	.075	.375	1.000	-1.00	1.15
		All Others	-.453	.216	.291	-1.07	.17
	Software & Information System	FMCG	.391	.271	.699	-.39	1.17
		Computers & Electronics	.792	.303	.097	-.08	1.66
		Textile & Apparel	-.152	.356	.998	-1.17	.87
		Automotives & other means of Transportation	.467	.405	.858	-.70	1.63
		All Others	-.062	.264	1.000	-.82	.70
	Computers & Electronics	FMCG	-.400	.262	.645	-1.15	.35

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		Software & Information System	-.792	.303	.097	-1.66	.08
		Textile & Apparel	-.943	.350	.079	-1.95	.06
		Automotives & other means of Transportation	-.325	.399	.965	-1.47	.82
		All Others	-.853*	.255	.012	-1.58	-.12
	Textile & Apparel	FMCG	.543	.322	.544	-.38	1.47
		Software & Information System	.152	.356	.998	-.87	1.17
		Computers & Electronics	.943	.350	.079	-.06	1.95
		Automotives & other means of Transportation	.618	.441	.726	-.65	1.88
		All Others	.090	.317	1.000	-.82	1.00
	Automotives & other means of Transportation	FMCG	-.075	.375	1.000	-1.15	1.00
		Software & Information System	-.467	.405	.858	-1.63	.70
		Computers & Electronics	.325	.399	.965	-.82	1.47
		Textile & Apparel	-.618	.441	.726	-1.88	.65
		All Others	-.528	.370	.710	-1.59	.53
	All Others	FMCG	.453	.216	.291	-.17	1.07
		Software & Information System	.062	.264	1.000	-.70	.82

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		Computers & Electronics	**.853***	**.255**	**.012**	**.12**	**1.58**
		Textile & Apparel	-.090	.317	1.000	-1.00	.82
		Automotives & other means of Transportation	.528	.370	.710	-.53	1.59
Impact of Financial Unpredictability Risk	FMCG	Software & Information System	-.176	.265	.985	-.94	.58
		Computers & Electronics	.093	.256	.999	-.64	.83
		Textile & Apparel	.359	.315	.865	-.55	1.26
		Automotives & other means of Transportation	-.099	.367	1.000	-1.15	.96
		All Others	-.145	.211	.983	-.75	.46
	Software & Information System	FMCG	.176	.265	.985	-.58	.94
		Computers & Electronics	.269	.296	.944	-.58	1.12
		Textile & Apparel	.535	.349	.641	-.47	1.54
		Automotives & other means of Transportation	.078	.396	1.000	-1.06	1.21
		All Others	.031	.258	1.000	-.71	.77
	Computers & Electronics	FMCG	-.093	.256	.999	-.83	.64
		Software & Information System	-.269	.296	.944	-1.12	.58
		Textile & Apparel	.266	.342	.971	-.72	1.25

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		Automotives & other means of Transportation	-.192	.390	.996	-1.31	.93
		All Others	-.239	.249	.930	-.95	.48
	Textile & Apparel	FMCG	-.359	.315	.865	-1.26	.55
		Software & Information System	-.535	.349	.641	-1.54	.47
		Computers & Electronics	-.266	.342	.971	-1.25	.72
		Automotives & other means of Transportation	-.458	.431	.896	-1.70	.78
		All Others	-.504	.310	.580	-1.39	.38
	Automotives & other means of Transportation	FMCG	.099	.367	1.000	-.96	1.15
		Software & Information System	-.078	.396	1.000	-1.21	1.06
		Computers & Electronics	.192	.390	.996	-.93	1.31
		Textile & Apparel	.458	.431	.896	-.78	1.70
		All Others	-.047	.362	1.000	-1.09	.99
	All Others	FMCG	.145	.211	.983	-.46	.75
		Software & Information System	-.031	.258	1.000	-.77	.71
		Computers & Electronics	.239	.249	.930	-.48	.95
		Textile & Apparel	.504	.310	.580	-.38	1.39

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons							
		Automotives & other means of Transportation	.047	.362	1.000	-.99	1.09
Impact of Lack of Funding	FMCG	Software & Information System	-.310	.260	.839	-1.06	.43
		Computers & Electronics	-.066	.251	1.000	-.79	.65
		Textile & Apparel	-.116	.309	.999	-1.00	.77
		Automotives & other means of Transportation	-.183	.360	.996	-1.22	.85
		All Others	-.338	.207	.576	-.93	.26
	Software & Information System	FMCG	.310	.260	.839	-.43	1.06
		Computers & Electronics	.244	.290	.959	-.59	1.08
		Textile & Apparel	.194	.342	.993	-.79	1.18
		Automotives & other means of Transportation	.128	.388	.999	-.99	1.24
		All Others	-.028	.253	1.000	-.75	.70
	Computers & Electronics	FMCG	.066	.251	1.000	-.65	.79
		Software & Information System	-.244	.290	.959	-1.08	.59
		Textile & Apparel	-.050	.335	1.000	-1.01	.91
		Automotives & other means of Transportation	-.117	.382	1.000	-1.21	.98
		All Others	-.272	.244	.875	-.97	.43

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

	Textile & Apparel	FMCG	.116	.309	.999	-.77	1.00
		Software & Information System	-.194	.342	.993	-1.18	.79
		Computers & Electronics	.050	.335	1.000	-.91	1.01
		Automotives & other means of Transportation	-.067	.423	1.000	-1.28	1.15
		All Others	-.222	.303	.978	-1.09	.65
	Automotives & other means of Transportation	FMCG	.183	.360	.996	-.85	1.22
		Software & Information System	-.128	.388	.999	-1.24	.99
		Computers & Electronics	.117	.382	1.000	-.98	1.21
		Textile & Apparel	.067	.423	1.000	-1.15	1.28
		All Others	-.156	.355	.998	-1.17	.86
	All Others	FMCG	.338	.207	.576	-.26	.93
		Software & Information System	.028	.253	1.000	-.70	.75
		Computers & Electronics	.272	.244	.875	-.43	.97
		Textile & Apparel	.222	.303	.978	-.65	1.09
		Automotives & other means of Transportation	.156	.355	.998	-.86	1.17
Probability of Political Risk	FMCG	Software & Information System	.413	.234	.488	-.26	1.08

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons							
		Computers & Electronics	-.212	.226	.936	-.86	.44
		Textile & Apparel	-.087	.278	1.000	-.89	.71
		Automotives & other means of Transportation	.113	.324	.999	-.82	1.04
		All Others	-.001	.186	1.000	-.53	.53
	Software & Information System	FMCG	-.413	.234	.488	-1.08	.26
		Computers & Electronics	-.625	.261	.162	-1.37	.12
		Textile & Apparel	-.500	.307	.582	-1.38	.38
		Automotives & other means of Transportation	-.300	.349	.956	-1.30	.70
		All Others	-.414	.228	.456	-1.07	.24
	Computers & Electronics	FMCG	.212	.226	.936	-.44	.86
		Software & Information System	.625	.261	.162	-.12	1.37
		Textile & Apparel	.125	.302	.998	-.74	.99
		Automotives & other means of Transportation	.325	.344	.934	-.66	1.31
		All Others	.211	.220	.929	-.42	.84
	Textile & Apparel	FMCG	.087	.278	1.000	-.71	.89
		Software & Information System	.500	.307	.582	-.38	1.38

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		Computers & Electronics	-.125	.302	.998	-.99	.74
		Automotives & other means of Transportation	.200	.380	.995	-.89	1.29
		All Others	.086	.273	1.000	-.70	.87
	Automotives & other means of Transportation	FMCG	-.113	.324	.999	-1.04	.82
		Software & Information System	.300	.349	.956	-.70	1.30
		Computers & Electronics	-.325	.344	.934	-1.31	.66
		Textile & Apparel	-.200	.380	.995	-1.29	.89
		All Others	-.114	.319	.999	-1.03	.80
	All Others	FMCG	.001	.186	1.000	-.53	.53
		Software & Information System	.414	.228	.456	-.24	1.07
		Computers & Electronics	-.211	.220	.929	-.84	.42
		Textile & Apparel	-.086	.273	1.000	-.87	.70
		Automotives & other means of Transportation	.114	.319	.999	-.80	1.03
Probability of Macro-Economic Risk	FMCG	Software & Information System	.330	.264	.812	-.43	1.09
		Computers & Electronics	-.654	.255	.111	-1.39	.08
		Textile & Apparel	-.572	.314	.455	-1.47	.33

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		Automotives & other means of Transportation	-.020	.366	1.000	-1.07	1.03
		All Others	-.247	.210	.848	-.85	.36
	Software & Information System	FMCG	-.330	.264	.812	-1.09	.43
		Computers & Electronics	-.983*	.295	.012	-1.83	-.14
		Textile & Apparel	-.902	.347	.102	-1.90	.10
		Automotives & other means of Transportation	-.350	.395	.949	-1.48	.78
		All Others	-.577	.257	.221	-1.32	.16
	Computers & Electronics	FMCG	.654	.255	.111	-.08	1.39
		Software & Information System	**.983***	**.295**	**.012**	**.14**	1.83
		Textile & Apparel	.082	.341	1.000	-.90	1.06
		Automotives & other means of Transportation	.633	.389	.580	-.48	1.75
		All Others	.406	.248	.575	-.31	1.12
	Textile & Apparel	FMCG	.572	.314	.455	-.33	1.47
		Software & Information System	.902	.347	.102	-.10	1.90
		Computers & Electronics	-.082	.341	1.000	-1.06	.90
		Automotives & other means of Transportation	.552	.430	.794	-.68	1.79

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons							
		All Others	.324	.309	.900	-.56	1.21
	Automotives & other means of Transportation	FMCG	.020	.366	1.000	-1.03	1.07
		Software & Information System	.350	.395	.949	-.78	1.48
		Computers & Electronics	-.633	.389	.580	-1.75	.48
		Textile & Apparel	-.552	.430	.794	-1.79	.68
		All Others	-.227	.361	.989	-1.26	.81
	All Others	FMCG	.247	.210	.848	-.36	.85
		Software & Information System	.577	.257	.221	-.16	1.32
		Computers & Electronics	-.406	.248	.575	-1.12	.31
		Textile & Apparel	-.324	.309	.900	-1.21	.56
		Automotives & other means of Transportation	.227	.361	.989	-.81	1.26
Probability of Social Risk	FMCG	Software & Information System	.342	.252	.753	-.38	1.07
		Computers & Electronics	-.197	.244	.966	-.90	.50
		Textile & Apparel	-.297	.300	.921	-1.16	.56
		Automotives & other means of Transportation	-.397	.349	.865	-1.40	.61
		All Others	-.229	.201	.864	-.81	.35

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons							
	Software & Information System	FMCG	-.342	.252	.753	-1.07	.38
		Computers & Electronics	-.539	.282	.396	-1.35	.27
		Textile & Apparel	-.639	.332	.388	-1.59	.31
		Automotives & other means of Transportation	-.739	.377	.367	-1.82	.34
		All Others	-.571	.245	.188	-1.28	.13
	Computers & Electronics	FMCG	.197	.244	.966	-.50	.90
		Software & Information System	.539	.282	.396	-.27	1.35
		Textile & Apparel	-.100	.325	1.000	-1.03	.83
		Automotives & other means of Transportation	-.200	.371	.995	-1.27	.87
		All Others	-.032	.237	1.000	-.71	.65
	Textile & Apparel	FMCG	.297	.300	.921	-.56	1.16
		Software & Information System	.639	.332	.388	-.31	1.59
		Computers & Electronics	.100	.325	1.000	-.83	1.03
		Automotives & other means of Transportation	-.100	.410	1.000	-1.28	1.08
		All Others	.068	.295	1.000	-.78	.91
	Automotives & other means	FMCG	.397	.349	.865	-.61	1.40

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

	of Transportation	Software & Information System	.739	.377	.367	-.34	1.82
		Computers & Electronics	.200	.371	.995	-.87	1.27
		Textile & Apparel	.100	.410	1.000	-1.08	1.28
		All Others	.168	.345	.997	-.82	1.16
	All Others	FMCG	.229	.201	.864	-.35	.81
		Software & Information System	.571	.245	.188	-.13	1.28
		Computers & Electronics	.032	.237	1.000	-.65	.71
		Textile & Apparel	-.068	.295	1.000	-.91	.78
		Automotives & other means of Transportation	-.168	.345	.997	-1.16	.82
Probability of Natural Risk	FMCG	Software & Information System	.585	.239	.144	-.10	1.27
		Computers & Electronics	-.146	.231	.989	-.81	.52
		Textile & Apparel	-.198	.285	.982	-1.02	.62
		Automotives & other means of Transportation	.162	.331	.996	-.79	1.11
		All Others	.399	.190	.292	-.15	.95
	Software & Information System	FMCG	-.585	.239	.144	-1.27	.10
		Computers & Electronics	-.731	.267	.072	-1.50	.04

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		Textile & Apparel	-.783	.314	.131	-1.69	.12
		Automotives & other means of Transportation	-.422	.357	.845	-1.45	.60
		All Others	-.185	.233	.968	-.85	.48
	Computers & Electronics	FMCG	.146	.231	.989	-.52	.81
		Software & Information System	.731	.267	.072	-.04	1.50
		Textile & Apparel	-.052	.308	1.000	-.94	.83
		Automotives & other means of Transportation	.308	.352	.952	-.70	1.32
		All Others	.545	.225	.150	-.10	1.19
	Textile & Apparel	FMCG	.198	.285	.982	-.62	1.02
		Software & Information System	.783	.314	.131	-.12	1.69
		Computers & Electronics	.052	.308	1.000	-.83	.94
		Automotives & other means of Transportation	.361	.389	.939	-.76	1.48
		All Others	.598	.279	.271	-.20	1.40
	Automotives & other means of Transportation	FMCG	-.162	.331	.996	-1.11	.79
		Software & Information System	.422	.357	.845	-.60	1.45
		Computers & Electronics	-.308	.352	.952	-1.32	.70

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		Textile & Apparel	-.361	.389	.939	-1.48	.76
		All Others	.237	.327	.979	-.70	1.18
	All Others	FMCG	-.399	.190	.292	-.95	.15
		Software & Information System	.185	.233	.968	-.48	.85
		Computers & Electronics	-.545	.225	.150	-1.19	.10
		Textile & Apparel	-.598	.279	.271	-1.40	.20
		Automotives & other means of Transportation	-.237	.327	.979	-1.18	.70
Impact of Political Risk	FMCG	Software & Information System	.155	.258	.991	-.59	.90
		Computers & Electronics	-.282	.249	.869	-1.00	.43
		Textile & Apparel	-.320	.307	.903	-1.20	.56
		Automotives & other means of Transportation	-.157	.358	.998	-1.18	.87
		All Others	-.105	.206	.996	-.70	.49
	Software & Information System	FMCG	-.155	.258	.991	-.90	.59
		Computers & Electronics	-.436	.288	.657	-1.26	.39
		Textile & Apparel	-.475	.340	.728	-1.45	.50
		Automotives & other means of Transportation	-.311	.386	.966	-1.42	.80

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons							
		All Others	-.259	.251	.907	-.98	.46
	Computers & Electronics	FMCG	.282	.249	.869	-.43	1.00
		Software & Information System	.436	.288	.657	-.39	1.26
		Textile & Apparel	-.039	.333	1.000	-1.00	.92
		Automotives & other means of Transportation	.125	.380	.999	-.97	1.22
		All Others	.177	.243	.978	-.52	.87
	Textile & Apparel	FMCG	.320	.307	.903	-.56	1.20
		Software & Information System	.475	.340	.728	-.50	1.45
		Computers & Electronics	.039	.333	1.000	-.92	1.00
		Automotives & other means of Transportation	.164	.420	.999	-1.04	1.37
		All Others	.215	.302	.980	-.65	1.08
	Automotives & other means of Transportation	FMCG	.157	.358	.998	-.87	1.18
		Software & Information System	.311	.386	.966	-.80	1.42
		Computers & Electronics	-.125	.380	.999	-1.22	.97
		Textile & Apparel	-.164	.420	.999	-1.37	1.04
		All Others	.052	.353	1.000	-.96	1.06

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

	All Others	FMCG	.105	.206	.996	-.49	.70
		Software & Information System	.259	.251	.907	-.46	.98
		Computers & Electronics	-.177	.243	.978	-.87	.52
		Textile & Apparel	-.215	.302	.980	-1.08	.65
		Automotives & other means of Transportation	-.052	.353	1.000	-1.06	.96
Impact of Macro-Economic Risk	FMCG	Software & Information System	.234	.248	.934	-.48	.95
		Computers & Electronics	-.335	.240	.728	-1.02	.35
		Textile & Apparel	-.347	.295	.849	-1.19	.50
		Automotives & other means of Transportation	-.177	.344	.996	-1.16	.81
		All Others	-.290	.198	.684	-.86	.28
	Software & Information System	FMCG	-.234	.248	.934	-.95	.48
		Computers & Electronics	-.569	.277	.315	-1.37	.23
		Textile & Apparel	-.581	.326	.481	-1.52	.36
		Automotives & other means of Transportation	-.411	.371	.877	-1.48	.65
		All Others	-.525	.242	.255	-1.22	.17
	Computers & Electronics	FMCG	.335	.240	.728	-.35	1.02

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		Software & Information System	.569	.277	.315	-.23	1.37
		Textile & Apparel	-.011	.320	1.000	-.93	.91
		Automotives & other means of Transportation	.158	.365	.998	-.89	1.21
		All Others	.045	.233	1.000	-.62	.71
	Textile & Apparel	FMCG	.347	.295	.849	-.50	1.19
		Software & Information System	.581	.326	.481	-.36	1.52
		Computers & Electronics	.011	.320	1.000	-.91	.93
		Automotives & other means of Transportation	.170	.404	.998	-.99	1.33
		All Others	.056	.290	1.000	-.78	.89
	Automotives & other means of Transportation	FMCG	.177	.344	.996	-.81	1.16
		Software & Information System	.411	.371	.877	-.65	1.48
		Computers & Electronics	-.158	.365	.998	-1.21	.89
		Textile & Apparel	-.170	.404	.998	-1.33	.99
		All Others	-.114	.339	.999	-1.09	.86
	All Others	FMCG	.290	.198	.684	-.28	.86
		Software & Information System	.525	.242	.255	-.17	1.22

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons							
		Computers & Electronics	-.045	.233	1.000	-.71	.62
		Textile & Apparel	-.056	.290	1.000	-.89	.78
		Automotives & other means of Transportation	.114	.339	.999	-.86	1.09
Impact of Social Risk	FMCG	Software & Information System	-.168	.260	.987	-.91	.58
		Computers & Electronics	-.346	.251	.742	-1.07	.38
		Textile & Apparel	.259	.310	.960	-.63	1.15
		Automotives & other means of Transportation	-.229	.360	.988	-1.26	.81
		All Others	-.103	.207	.996	-.70	.49
	Software & Information System	FMCG	.168	.260	.987	-.58	.91
		Computers & Electronics	-.178	.290	.990	-1.01	.66
		Textile & Apparel	.427	.342	.813	-.56	1.41
		Automotives & other means of Transportation	-.061	.389	1.000	-1.18	1.05
		All Others	.065	.253	1.000	-.66	.79
	Computers & Electronics	FMCG	.346	.251	.742	-.38	1.07
		Software & Information System	.178	.290	.990	-.66	1.01
		Textile & Apparel	.605	.336	.467	-.36	1.57

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons							
		Automotives & other means of Transportation	.117	.383	1.000	-.98	1.22
		All Others	.243	.244	.920	-.46	.94
	Textile & Apparel	FMCG	-.259	.310	.960	-1.15	.63
		Software & Information System	-.427	.342	.813	-1.41	.56
		Computers & Electronics	-.605	.336	.467	-1.57	.36
		Automotives & other means of Transportation	-.488	.423	.859	-1.70	.73
		All Others	-.362	.304	.841	-1.23	.51
	Automotives & other means of Transportation	FMCG	.229	.360	.988	-.81	1.26
		Software & Information System	.061	.389	1.000	-1.05	1.18
		Computers & Electronics	-.117	.383	1.000	-1.22	.98
		Textile & Apparel	.488	.423	.859	-.73	1.70
		All Others	.126	.355	.999	-.89	1.15
	All Others	FMCG	.103	.207	.996	-.49	.70
		Software & Information System	-.065	.253	1.000	-.79	.66
		Computers & Electronics	-.243	.244	.920	-.94	.46
		Textile & Apparel	.362	.304	.841	-.51	1.23

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons

		Automotives & other means of Transportation	-.126	.355	.999	-1.15	.89
Impact of Natural Risk	FMCG	Software & Information System	.074	.259	1.000	-.67	.82
		Computers & Electronics	-.549	.251	.247	-1.27	.17
		Textile & Apparel	.192	.309	.989	-.69	1.08
		Automotives & other means of Transportation	-.032	.360	1.000	-1.06	1.00
		All Others	.311	.207	.661	-.28	.90
	Software & Information System	FMCG	-.074	.259	1.000	-.82	.67
		Computers & Electronics	-.622	.290	.267	-1.45	.21
		Textile & Apparel	.119	.342	.999	-.86	1.10
		Automotives & other means of Transportation	-.106	.388	1.000	-1.22	1.01
		All Others	.238	.253	.936	-.49	.96
	Computers & Electronics	FMCG	.549	.251	.247	-.17	1.27
		Software & Information System	.622	.290	.267	-.21	1.45
		Textile & Apparel	.741	.335	.236	-.22	1.70
		Automotives & other means of Transportation	.517	.382	.755	-.58	1.61
		All Others	**.860***	**.244**	**.007**	**.16**	1.56

Comparison of risk types according to industry types (Post-Hoc test) Multiple Comparisons							
	Textile & Apparel	FMCG	-.192	.309	.989	-1.08	.69
		Software & Information System	-.119	.342	.999	-1.10	.86
		Computers & Electronics	-.741	.335	.236	-1.70	.22
		Automotives & other means of Transportation	-.224	.423	.995	-1.44	.99
		All Others	.119	.303	.999	-.75	.99
	Automotives & other means of Transportation	FMCG	.032	.360	1.000	-1.00	1.06
		Software & Information System	.106	.388	1.000	-1.01	1.22
		Computers & Electronics	-.517	.382	.755	-1.61	.58
		Textile & Apparel	.224	.423	.995	-.99	1.44
		All Others	.343	.355	.928	-.68	1.36
	All Others	FMCG	-.311	.207	.661	-.90	.28
		Software & Information System	-.238	.253	.936	-.96	.49
		Computers & Electronics	-.860*	.244	.007	-1.56	-.16
		Textile & Apparel	-.119	.303	.999	-.99	.75
		Automotives & other means of Transportation	-.343	.355	.928	-1.36	.68

*. The mean difference is significant at the 0.05 level.

11.14 Appendix 8a: Analysis of Variance (Comparison of Risk Perceptions)

Comparisons of Perceptions about NPD project risks from R&D versus others (group Statistics)

Group Statistics

	Functions comparison R&D versus others	N	Mean	Std. Deviation	Std. Error Mean
Probability of Technological Rapidity Risk	**R&D (technology development, product design)**	**98**	**4.16**	**1.081**	**.109**
	Others	165	3.17	1.378	.107
Probability of Technological Capability Risk new	R&D (technology development, product design)	98	2.59	1.283	.130
	Others	**165**	**3.31**	**1.295**	**.101**
Impact of Technological Rapidity Risk	**R&D (technology development, product design)**	**98**	**3.44**	**.996**	**.101**
	Others	165	3.10	1.055	.082
Impact of Technological Capability Risk	R&D (technology development, product design)	98	2.85	1.495	.151
	Others	165	2.69	1.310	.102
Probability of Marketing Rapidity Risk	**R&D (technology development, product design)**	**98**	**3.94**	**1.242**	**.125**
	Others	165	3.27	1.284	.100
Probability of Customer Perceived Risk	R&D (technology development, product design)	98	3.03	1.222	.123
	Others	165	3.12	1.204	.094

Comparisons of Perceptions about NPD project risks from R&D versus others (group Statistics)					
Probability of Marketing Capability Risk	R&D (technology development, product design)	98	2.77	1.361	.137
	Others	**165**	**3.58**	**1.153**	**.090**
Probability of Competition Risk	R&D (technology development, product design)	98	2.53	1.325	.134
	Others	**165**	**3.30**	**1.412**	**.110**
Impact of Marketing Rapidity Risk	R&D (technology development, product design)	98	2.96	1.121	.113
	Others	165	2.76	1.221	.095
Impact of Customer Perceived Risk	R&D (technology development, product design)	98	2.97	1.197	.121
	Others	165	2.79	1.202	.094
Impact of Marketing Capability Risknew	R&D (technology development, product design)	98	2.81	1.265	.128
	Others	165	2.84	1.299	.101
Impact of Competition Risk	R&D (technology development, product design)	98	2.85	1.387	.140
	Others	165	3.02	1.339	.104
Probability of Resource Risk	R&D (technology development, product design)	98	3.51	1.310	.132
	Others	165	3.60	1.361	.106
Probability of Human Resource Risk	R&D (technology development, product	98	3.22	1.145	.116

Comparisons of Perceptions about NPD project risks from R&D versus others (group Statistics)					
	design)				
	Others	165	3.30	1.133	.088
Probability of Planning Risk	R&D (technology development, product design)	98	3.41	1.092	.110
	Others	**165**	**3.65**	**1.046**	**.081**
Probability of Control Risk	R&D (technology development, product design)	98	3.72	1.283	.130
	Others	165	3.79	1.098	.085
Probability of Strategic Management Risk	R&D (technology development, product design)	98	3.96	1.015	.102
	Others	165	3.96	1.026	.080
Impact of Resource Risk	R&D (technology development, product design)	98	2.97	1.188	.120
	Others	165	3.14	1.214	.095
Impact of Human Resource Risk	R&D (technology development, product design)	98	2.68	1.289	.130
	Others	165	2.72	1.253	.098
Impact of Planning Risk	R&D (technology development, product design)	98	2.73	1.240	.125
	Others	165	2.85	1.262	.098
Impact of Control Risk	R&D (technology development, product design)	98	2.93	1.142	.115

Comparisons of Perceptions about NPD project risks from R&D versus others (group Statistics)					
	Others	165	2.85	1.303	.101
Impact of Strategic Management Risk	R&D (technology development, product design)	98	3.02	1.227	.124
	Others	165	2.93	1.353	.105
Probability of Supply Chain Risk	R&D (technology development, product design)	98	2.87	1.462	.148
	Others	**165**	**3.38**	**1.318**	**.103**
Impact of Supply Chain Risk	R&D (technology development, product design)	98	3.66	1.102	.111
	Others	165	3.47	1.202	.094
Probability of Financial unpredictability	R&D (technology development, product design)	98	2.69	1.327	.134
	Others	165	2.28	1.276	.099
Probability of Lack of Funding	R&D (technology development, product design)	98	2.96	1.392	.141
	Others	**165**	**3.74**	**1.229**	**.096**
Impact of Financial Unpredictability Risk	R&D (technology development, product design)	98	2.72	1.299	.131
	Others	165	2.84	1.278	.100
Impact of Lack of Funding	R&D (technology development, product design)	98	2.95	1.255	.127
	Others	165	3.13	1.260	.098

Comparisons of Perceptions about NPD project risks from R&D versus others (group Statistics)					
Probability of Political Risk	R&D (technology development, product design)	98	1.98	1.201	.121
	Others	165	1.84	1.100	.086
Probability of Macro-Economic Risk	R&D (technology development, product design)	98	2.41	1.307	.132
	Others	165	2.44	1.313	.102
Probability of Social Risk	R&D (technology development, product design)	98	2.39	1.240	.125
	Others	165	2.25	1.228	.096
Probability of Natural Risk	R&D (technology development, product design)	98	1.98	1.292	.131
	Others	165	1.78	1.110	.086
Impact of Political Risk	R&D (technology development, product design)	98	2.14	1.276	.129
	Others	165	2.13	1.240	.097
Impact of Macro-Economic Risk	R&D (technology development, product design)	98	2.46	1.211	.122
	Others	165	2.42	1.216	.095
Impact of Social Risk	R&D (technology development, product design)	98	2.47	1.318	.133
	Others	165	2.36	1.230	.096
Impact of Natural Risk	**R&D (technology development, product**	**98**	**2.26**	**1.311**	**.132**

Comparisons of Perceptions about NPD project risks from R&D versus others (group Statistics)					
	design)				
	Others	165	1.95	1.253	.098

11.15 Appendix 8b: Analysis of Variance (Comparison of Risk Perception)

(Levene' Test for Equality of Variances t-test for Equality of Means)

Comparisons of Perceptions about NPD project risks from R&D versus others

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Probability of Technological Rapidity Risk	Equal variances assumed	24.367	**.000**	6.108	261	.000	.994	.163	.673	1.314
	Equal variances not assumed			**6.491**	**241.468**	**.000**	**.994**	**.153**	**.692**	**1.295**
Probability of Technological Capability Risk new	Equal variances assumed	**.145**	**.704**	**-4.357**	**261**	**.000**	**-.717**	**.165**	**-1.041**	**-.393**
	Equal variances not assumed			-4.368	205.479	.000	-.717	.164	-1.041	-.393
Impact of Technological Rapidity Risk	Equal variances assumed	**.177**	**.674**	**2.594**	**261**	**.010**	**.342**	**.132**	**.082**	**.601**
	Equal variances not assumed			2.633	213.364	.009	.342	.130	.086	.598
Impact of Technological Capability Risk	Equal variances assumed	2.842	.093	.886	261	.377	.156	.176	-.191	.503
	Equal variances not assumed			.856	183.098	.393	.156	.182	-.203	.515

Comparisons of Perceptions about NPD project risks from R&D versus others

Probability of Marketing Rapidity Risk	Equal variances assumed	5.094	.025	4.155	261	.000	.672	.162	.354	.991
	Equal variances not assumed			**4.190**	**209.306**	**.000**	**.672**	**.160**	**.356**	**.988**
Probability of Customer Perceived Risk	Equal variances assumed	.029	.864	-.587	261	.558	-.091	.154	-.395	.213
	Equal variances not assumed			-.585	201.396	.560	-.091	.155	-.396	.215
Probability of Marketing Capability Risk	Equal variances assumed	3.853	.051	-5.186	261	.000	-.817	.157	-1.127	-.507
	Equal variances not assumed			**-4.973**	**178.243**	**.000**	**-.817**	**.164**	**-1.140**	**-.493**
Probability of Competition Risk	Equal variances assumed	**.097**	**.756**	**-4.388**	**261**	**.000**	**-.772**	**.176**	**-1.119**	**-.426**
	Equal variances not assumed			-4.459	214.228	.000	-.772	.173	-1.114	-.431
Impact of Marketing Rapidity Risk	Equal variances assumed	4.161	.042	1.335	261	.183	.202	.151	-.096	.499
	Equal variances not assumed			1.364	217.850	.174	.202	.148	-.090	.493
Impact of Customer Perceived Risk	Equal variances assumed	1.433	.232	1.146	261	.253	.175	.153	-.126	.477
	Equal variances not assumed			1.148	204.639	.252	.175	.153	-.126	.477
Impact of Marketing Capability Risknew	Equal variances assumed	.408	.523	-.184	261	.854	-.030	.164	-.353	.293

Comparisons of Perceptions about NPD project risks from R&D versus others

	Equal variances not assumed			-.186	208.143	.853	-.030	.163	-.352	.291
Impact of Competition Risk	Equal variances assumed	.702	.403	-1.025	261	.307	-.177	.173	-.518	.163
	Equal variances not assumed			-1.015	198.111	.311	-.177	.175	-.522	.167
Probability of Resource Risk	Equal variances assumed	.151	.698	-.525	261	.600	-.090	.171	-.427	.247
	Equal variances not assumed			-.530	210.089	.597	-.090	.170	-.424	.244
Probability of Human Resource Risk	Equal variances assumed	.027	.869	-.500	261	.618	-.072	.145	-.358	.213
	Equal variances not assumed			-.498	202.223	.619	-.072	.145	-.359	.214
Probability of Planning Risk	Equal variances assumed	**1.010**	**.316**	**-1.817**	**261**	**.070**	**-.246**	**.136**	**-.513**	**.021**
	Equal variances not assumed			-1.797	196.877	.074	-.246	.137	-.517	.024
Probability of Control Risk	Equal variances assumed	2.825	.094	-.425	261	.671	-.063	.149	-.357	.230
	Equal variances not assumed			-.408	179.637	.683	-.063	.155	-.370	.243
Probability of Strategic Management Risk	Equal variances assumed	.018	.893	.012	261	.990	.002	.130	-.255	.258
	Equal variances not assumed			.012	205.768	.990	.002	.130	-.255	.258
Impact of Resource Risk	Equal variances	.742	.390	-1.107	261	.269	-.170	.154	-.473	.132

Comparisons of Perceptions about NPD project risks from R&D versus others

	assumed									
	Equal variances not assumed			-1.113	207.466	.267	-.170	.153	-.471	.131
Impact of Human Resource Risk	Equal variances assumed	.003	.955	-.195	261	.846	-.031	.162	-.350	.287
	Equal variances not assumed			-.193	199.329	.847	-.031	.163	-.352	.289
Impact of Planning Risk	Equal variances assumed	.021	.884	-.712	261	.477	-.114	.160	-.429	.201
	Equal variances not assumed			-.715	206.805	.476	-.114	.159	-.428	.200
Impact of Control Risk	Equal variances assumed	5.268	.023	.466	261	.642	.074	.159	-.239	.387
	Equal variances not assumed			.482	225.342	.630	.074	.154	-.229	.377
Impact of Strategic Management Risk	Equal variances assumed	4.005	.046	.522	261	.602	.087	.167	-.241	.415
	Equal variances not assumed			.535	219.925	.593	.087	.163	-.233	.408
Probability of Supply Chain Risk	Equal variances assumed	**4.589**	**.033**	**-2.904**	**261**	**.004**	**-.508**	**.175**	**-.853**	**-.164**
	Equal variances not assumed			-2.828	187.388	.005	-.508	.180	-.863	-.154
Impact of Supply Chain Risk	Equal variances assumed	1.275	.260	1.322	261	.187	.197	.149	-.096	.489
	Equal variances not assumed			1.351	218.084	.178	.197	.145	-.090	.483

Comparisons of Perceptions about NPD project risks from R&D versus others										
Probability of Financial unpredictability	Equal variances assumed	**2.400**	**.123**	**2.513**	**261**	**.013**	**.415**	**.165**	**.090**	**.740**
	Equal variances not assumed			2.488	197.596	.014	.415	.167	.086	.744
Probability of Lack of Funding	Equal variances assumed	**5.246**	**.023**	**-4.735**	**261**	**.000**	**-.780**	**.165**	**-1.105**	**-.456**
	Equal variances not assumed			-4.588	184.323	.000	-.780	.170	-1.116	-.445
Impact of Financial Unpredictability Risk	Equal variances assumed	.237	.627	-.719	261	.473	-.118	.164	-.441	.205
	Equal variances not assumed			-.716	201.319	.475	-.118	.165	-.443	.207
Impact of Lack of Funding	Equal variances assumed	.053	.818	-1.111	261	.267	-.178	.160	-.494	.138
	Equal variances not assumed			-1.112	204.553	.267	-.178	.160	-.494	.138
Probability of Political Risk	Equal variances assumed	.676	.412	.986	261	.325	.143	.145	-.143	.429
	Equal variances not assumed			.964	189.892	.336	.143	.149	-.150	.436
Probability of Macro-Economic Risk	Equal variances assumed	.003	.954	-.169	261	.866	-.028	.167	-.357	.301
	Equal variances not assumed			-.169	204.617	.866	-.028	.167	-.357	.301
Probability of Social Risk	Equal variances assumed	.127	.722	.847	261	.398	.133	.157	-.176	.443
	Equal variances			.845	202.251	.399	.133	.158	-.178	.444

Comparisons of Perceptions about NPD project risks from R&D versus others

	not assumed									
Probability of Natural Risk	Equal variances assumed	2.517	.114	1.313	261	.190	.198	.151	-.099	.494
	Equal variances not assumed			1.263	180.217	.208	.198	.157	-.111	.507
Impact of Political Risk	Equal variances assumed	.091	.763	.097	261	.922	.016	.160	-.299	.330
	Equal variances not assumed			.097	199.271	.923	.016	.161	-.302	.333
Impact of Macro-Economic Risk	Equal variances assumed	.068	.794	.226	261	.822	.035	.155	-.270	.340
	Equal variances not assumed			.226	204.457	.822	.035	.155	-.270	.340
Impact of Social Risk	Equal variances assumed	.770	.381	.656	261	.512	.106	.161	-.212	.423
	Equal variances not assumed			.645	192.859	.520	.106	.164	-.218	.429
Impact of Natural Risk	Equal variances assumed	**1.522**	**.218**	**1.867**	**261**	**.063**	**.304**	**.163**	**-.017**	**.624**
	Equal variances not assumed			1.846	196.667	.066	.304	.164	-.021	.628

11.16 Appendix 8c: Analysis of Variance (Comparison of Risk Perception)

Group Statistics: Comparisons of Perceptions about NPD project risks from Top management versus others (Group Statistics)

	Functions comparison Top management versus	N	Mean	Std. Deviation	Std. Error Mean
Probability of Technological Rapidity Risk	**Senior Management (CEO, MD, General Manager, VP,BOD)**	**45**	**3.84**	**1.413**	**.211**
	Others	218	3.48	1.345	.091
Probability of Technological Capability Risk	**Senior Management (CEO, MD, General Manager, VP,BOD)**	**45**	**3.47**	**1.254**	**.187**
	Others	218	2.95	1.336	.091
Impact of Technological Rapidity Risk	Senior Management (CEO, MD, General Manager, VP,BOD)	45	3.27	.889	.133
	Others	218	3.22	1.075	.073
Impact of Technological Capability Risk	Senior Management (CEO, MD, General Manager, VP,BOD)	45	2.11	1.283	.191
	Others	**218**	**2.88**	**1.366**	**.093**
Probability of Marketing Rapidity Risk	Senior Management (CEO, MD, General Manager, VP,BOD)	45	3.31	1.345	.201
	Others	218	3.56	1.298	.088
Probability of Customer Perceived Risk	Senior Management (CEO, MD, General Manager, VP,BOD)	45	3.24	1.090	.163

Group Statistics: Comparisons of Perceptions about NPD project risks from Top management versus others (Group Statistics)					
	Others	218	3.06	1.232	.083
Probability of Marketing Capability Risk	Senior Management (CEO, MD, General Manager, VP,BOD)	45	3.56	1.099	.164
	Others	218	3.22	1.326	.090
Probability of Competition Risk	Senior Management (CEO, MD, General Manager, VP,BOD)	45	2.80	1.471	.219
	Others	218	3.06	1.418	.096
Impact of Marketing Rapidity Risk	Senior Management (CEO, MD, General Manager, VP,BOD)	45	2.60	1.232	.184
	Others	218	2.88	1.174	.079
Impact of Customer Perceived Risk	Senior Management (CEO, MD, General Manager, VP,BOD)	45	2.67	1.206	.180
	Others	218	2.90	1.199	.081
Impact of Marketing Capability Risk	Senior Management (CEO, MD, General Manager, VP,BOD)	45	2.53	1.440	.215
	Others	**218**	**2.89**	**1.245**	**.084**
Impact of Competition Risk	Senior Management (CEO, MD, General Manager, VP,BOD)	45	3.22	1.363	.203
	Others	218	2.90	1.353	.092
Probability of Resource Risk	Senior Management (CEO, MD, General Manager, VP,BOD)	45	3.38	1.386	.207
	Others	218	3.61	1.330	.090
Probability of Human Resource Risk	Senior Management (CEO, MD, General Manager, VP,BOD)	45	3.47	1.140	.170
	Others	218	3.23	1.133	.077
Probability of Planning Risk	Senior Management (CEO, MD, General Manager, VP,BOD)	45	3.64	1.131	.169
	Others	218	3.55	1.056	.072

Group Statistics: Comparisons of Perceptions about NPD project risks from Top management versus others (Group Statistics)					
Probability of Control Risk	Senior Management (CEO, MD, General Manager, VP,BOD)	45	3.73	1.232	.184
	Others	218	3.77	1.157	.078
Probability of Strategic Management Risk	Senior Management (CEO, MD, General Manager, VP,BOD)	45	3.89	1.172	.175
	Others	218	3.97	.988	.067
Impact of Resource Risk	Senior Management (CEO, MD, General Manager, VP,BOD)	45	2.76	1.300	.194
	Others	**218**	**3.14**	**1.177**	**.080**
Impact of Human Resource Risk	Senior Management (CEO, MD, General Manager, VP,BOD)	45	2.16	1.224	.182
	Others	**218**	**2.82**	**1.246**	**.084**
Impact of Planning Risk	Senior Management (CEO, MD, General Manager, VP,BOD)	45	2.47	1.217	.181
	Others	**218**	**2.88**	**1.251**	**.085**
Impact of Control Risk	Senior Management (CEO, MD, General Manager, VP,BOD)	45	2.47	1.272	.190
	Others	**218**	**2.97**	**1.223**	**.083**
Impact of Strategic Management Risk	Senior Management (CEO, MD, General Manager, VP,BOD)	45	2.82	1.370	.204
	Others	218	3.00	1.293	.088
Probability of Supply Chain Risk	Senior Management (CEO, MD, General Manager, VP,BOD)	45	3.36	1.540	.230
	Others	218	3.15	1.361	.092
Impact of Supply Chain Risk	Senior Management (CEO, MD, General Manager, VP,BOD)	45	3.31	1.203	.179
	Others	218	3.59	1.158	.078
Probability of Financial unpredictability	**Senior Management (CEO, MD, General Manager, VP,BOD)**	**45**	**3.16**	**1.678**	**.250**

Group Statistics: Comparisons of Perceptions about NPD project risks from Top management versus others (Group Statistics)					
	Others	218	2.34	1.201	.081
Probability of Lack of Funding	Senior Management (CEO, MD, General Manager, VP,BOD)	45	2.64	1.479	.221
	Others	**218**	**3.54**	**1.288**	**.087**
Impact of Financial Unpredictability Risk	Senior Management (CEO, MD, General Manager, VP,BOD)	45	2.53	1.375	.205
	Others	218	2.85	1.261	.085
Impact of Lack of Funding	Senior Management (CEO, MD, General Manager, VP,BOD)	45	2.93	1.286	.192
	Others	218	3.09	1.254	.085
Probability of Political Risk	**Senior Management (CEO, MD, General Manager, VP,BOD)**	**45**	**2.24**	**1.171**	**.175**
	Others	218	1.82	1.121	.076
Probability of Macro-Economic Risk	Senior Management (CEO, MD, General Manager, VP,BOD)	45	2.67	1.279	.191
	Others	218	2.38	1.311	.089
Probability of Social Risk	Senior Management (CEO, MD, General Manager, VP,BOD)	45	2.22	1.241	.185
	Others	218	2.32	1.232	.083
Probability of Natural Risk	Senior Management (CEO, MD, General Manager, VP,BOD)	45	1.93	1.136	.169
	Others	218	1.84	1.194	.081
Impact of Political Risk	Senior Management (CEO, MD, General Manager, VP,BOD)	45	2.18	1.336	.199
	Others	218	2.12	1.236	.084
Impact of Macro-Economic Risk	**Senior Management (CEO, MD, General Manager, VP,BOD)**	**45**	**3.44**	**1.374**	**.205**
	Others	218	2.28	1.104	.075

Group Statistics: Comparisons of Perceptions about NPD project risks from Top management versus others (Group Statistics)					
Impact of Social Risk	Senior Management (CEO, MD, General Manager, VP,BOD)	45	2.22	1.146	.171
	Others	218	2.44	1.284	.087
Impact of Natural Risk	Senior Management (CEO, MD, General Manager, VP,BOD)	45	1.91	1.294	.193
	Others	218	2.10	1.279	.087

11.17 Appendix 8d: Analysis of Variance (Comparison of Risk Perception)

(Levene' Test for Equality of Variances t-test for Equality of Means)

Comparisons of Perceptions about NPD project risks from Top management versus others										
Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Probability of Technological Rapidity Risk	Equal variances assumed	**.121**	**.728**	**1.654**	**261**	**.099**	**.367**	**.222**	**-.070**	**.805**
	Equal variances not assumed			1.600	61.540	.115	.367	.230	-.092	.826
Probability of	Equal	.000	.983	2.366	261	.019	.513	.217	.086	.939

Comparisons of Perceptions about NPD project risks from Top management versus others

Technological Capability Risk	variances assumed									
	Equal variances not assumed			**2.468**	**66.306**	**.016**	**.513**	**.208**	**.098**	**.927**
Impact of Technological Rapidity Risk	Equal variances assumed	2.984	.085	.298	261	.766	.051	.171	-.286	.388
	Equal variances not assumed			.338	73.206	.737	.051	.151	-.250	.353
Impact of Technological Capability Risk	Equal variances assumed	**.602**	**.438**	**-3.476**	**261**	**.001**	**-.770**	**.221**	**-1.206**	**-.334**
	Equal variances not assumed			-3.622	66.259	.001	-.770	.212	-1.194	-.345
Probability of Marketing Rapidity Risk	Equal variances assumed	.114	.736	-1.162	261	.246	-.249	.214	-.670	.173
	Equal variances not assumed			-1.135	62.074	.261	-.249	.219	-.686	.189
Probability of Customer Perceived Risk	Equal variances assumed	1.375	.242	.957	261	.340	.189	.198	-.200	.579
	Equal variances not			1.037	69.269	.304	.189	.183	-.175	.554

Comparisons of Perceptions about NPD project risks from Top management versus others										
	assumed									
Probability of Marketing Capability Risk	Equal variances assumed	5.015	.026	1.587	261	.114	.335	.211	-.081	.751
	Equal variances not assumed			1.796	73.089	.077	.335	.187	-.037	.708
Probability of Competition Risk	Equal variances assumed	.000	.995	-1.111	261	.267	-.260	.234	-.720	.200
	Equal variances not assumed			-1.085	62.033	.282	-.260	.239	-.738	.219
Impact of Marketing Rapidity Risk	Equal variances assumed	.494	.483	-1.448	261	.149	-.281	.194	-.662	.101
	Equal variances not assumed			-1.403	61.586	.166	-.281	.200	-.681	.119
Impact of Customer Perceived Risk	Equal variances assumed	.053	.818	-1.183	261	.238	-.232	.196	-.619	.154
	Equal variances not assumed			-1.178	63.239	.243	-.232	.197	-.627	.162
Impact of Marketing Capability Risk	Equal variances assumed	**3.381**	**.067**	**-1.680**	**261**	**.094**	**-.352**	**.210**	**-.765**	**.061**

Comparisons of Perceptions about NPD project risks from Top management versus others										
	Equal variances not assumed			-1.527	58.341	.132	-.352	.231	-.813	.110
Impact of Competition Risk	Equal variances assumed	.225	.636	1.436	261	.152	.319	.222	-.118	.755
	Equal variances not assumed			1.429	63.167	.158	.319	.223	-.127	.764
Probability of Resource Risk	Equal variances assumed	.194	.660	-1.038	261	.300	-.228	.219	-.660	.204
	Equal variances not assumed			-1.010	61.862	.316	-.228	.225	-.678	.223
Probability of Human Resource Risk	Equal variances assumed	.508	.477	1.278	261	.202	.237	.186	-.128	.603
	Equal variances not assumed			1.273	63.231	.208	.237	.186	-.135	.610
Probability of Planning Risk	Equal variances assumed	.350	.555	.563	261	.574	.099	.175	-.246	.443
	Equal variances not assumed			.538	60.856	.592	.099	.183	-.268	.465
Probability of Control	Equal	.152	.697	-.195	261	.846	-.037	.192	-.415	.340

Comparisons of Perceptions about NPD project risks from Top management versus others

Risk	variances assumed									
	Equal variances not assumed			-.187	61.067	.852	-.037	.200	-.437	.362
Probability of Strategic Management Risk	Equal variances assumed	3.084	.080	-.500	261	.618	-.084	.167	-.413	.246
	Equal variances not assumed			-.447	57.604	.657	-.084	.187	-.458	.291
Impact of Resource Risk	Equal variances assumed	**3.622**	**.058**	**-1.970**	**261**	**.050**	**-.387**	**.196**	**-.773**	**.000**
	Equal variances not assumed			-1.846	59.813	.070	-.387	.209	-.806	.032
Impact of Human Resource Risk	Equal variances assumed	**.454**	**.501**	**-3.250**	**261**	**.001**	**-.661**	**.203**	**-1.061**	**-.261**
	Equal variances not assumed			-3.288	64.229	.002	-.661	.201	-1.062	-.259
Impact of Planning Risk	Equal variances assumed	**.247**	**.620**	**-2.008**	**261**	**.046**	**-.409**	**.204**	**-.811**	**-.008**
	Equal variances not			-2.045	64.656	.045	-.409	.200	-.809	-.009

Comparisons of Perceptions about NPD project risks from Top management versus others										
	assumed									
Impact of Control Risk	Equal variances assumed	**.499**	**.481**	**-2.485**	**261**	**.014**	**-.501**	**.202**	**-.898**	**-.104**
	Equal variances not assumed			-2.422	61.947	.018	-.501	.207	-.915	-.088
Impact of Strategic Management Risk	Equal variances assumed	2.103	.148	-.810	261	.419	-.173	.214	-.594	.248
	Equal variances not assumed			-.779	61.260	.439	-.173	.222	-.617	.271
Probability of Supply Chain Risk	Equal variances assumed	1.642	.201	.895	261	.371	.204	.228	-.245	.653
	Equal variances not assumed			.825	59.028	.412	.204	.247	-.291	.699
Impact of Supply Chain Risk	Equal variances assumed	.090	.764	-1.447	261	.149	-.276	.191	-.652	.100
	Equal variances not assumed			-1.411	61.982	.163	-.276	.196	-.667	.115
Probability of Financial unpredictability	Equal variances assumed	20.543	.000	3.853	261	.000	.816	.212	.399	1.233

Comparisons of Perceptions about NPD project risks from Top management versus others										
	Equal variances not assumed			**3.102**	**53.670**	**.003**	**.816**	**.263**	**.289**	**1.344**
Probability of Lack of Funding	Equal variances assumed	4.966	.027	-4.142	261	.000	-.897	.217	-1.323	-.470
	Equal variances not assumed			**-3.781**	**58.559**	**.000**	**-.897**	**.237**	**-1.372**	**-.422**
Impact of Financial Unpredictability Risk	Equal variances assumed	.593	.442	-1.525	261	.129	-.320	.210	-.733	.093
	Equal variances not assumed			-1.440	60.246	.155	-.320	.222	-.764	.124
Impact of Lack of Funding	Equal variances assumed	.002	.968	-.746	261	.456	-.154	.206	-.560	.252
	Equal variances not assumed			-.733	62.477	.466	-.154	.210	-.573	.265
Probability of Political Risk	Equal variances assumed	.001	.978	2.314	261	.021	.428	.185	.064	.792
	Equal variances not assumed			**2.248**	**61.779**	**.028**	**.428**	**.190**	**.047**	**.808**
Probability of Macro-	Equal	.065	.799	1.359	261	.175	.291	.214	-.131	.712

Comparisons of Perceptions about NPD project risks from Top management versus others										
Economic Risk	variances assumed									
	Equal variances not assumed			1.381	64.544	.172	.291	.210	-.130	.711
Probability of Social Risk	Equal variances assumed	.481	.489	-.489	261	.625	-.099	.202	-.497	.299
	Equal variances not assumed			-.487	63.199	.628	-.099	.203	-.504	.307
Probability of Natural Risk	Equal variances assumed	3.170	.076	.484	261	.629	.094	.194	-.288	.476
	Equal variances not assumed			.500	65.657	.619	.094	.188	-.281	.469
Impact of Political Risk	Equal variances assumed	.477	.490	.263	261	.793	.054	.205	-.350	.458
	Equal variances not assumed			.250	60.536	.804	.054	.216	-.378	.486
Impact of Macro-Economic Risk	Equal variances assumed	**6.221**	**.013**	**6.140**	**261**	**.000**	**1.160**	**.189**	**.788**	**1.532**
	Equal variances not			5.319	56.294	.000	1.160	.218	.723	1.597

Comparisons of Perceptions about NPD project risks from Top management versus others										
	assumed									
Impact of Social Risk	Equal variances assumed	1.960	.163	-1.056	261	.292	-.218	.207	-.625	.189
	Equal variances not assumed			-1.138	68.822	.259	-.218	.192	-.601	.164
Impact of Natural Risk	Equal variances assumed	.037	.847	-.883	261	.378	-.185	.210	-.598	.228
	Equal variances not assumed			-.876	63.025	.384	-.185	.211	-.608	.237