

**EDAMBA Journal**

**Thesis Competition 2013  
Summaries**

*Editor*  
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## Foreword from the President

**EDAMBA, the European Doctoral programmes Association in Management and Business Administration** has the mission to support and facilitate cooperation by providing and managing a network to exchange information, disseminate best practices and raise the quality of doctoral education among its members in Europe and beyond. For the past quarter century, **EDAMBA** has helped the participating schools to increase the quality of their Doctoral programmes, as well as to create an environment of excellence with a European perspective, all the while pursuing diversity. In many ways it has proved to be an unparalleled forum of discussion to schools that have a long established tradition of doctoral education and also to those who have recently started this new practice. The ultimate goal is to have the **EDAMBA** network reach as far and wide as possible, while at the same time maintaining the integrity of the various programmes within the network.

Currently EDAMBA has 60 doctoral programmes as members of the Association coming from 24 countries. It is governed by the General Assembly, which elects each year an Executive Committee. The main current activities of the Association are the Annual Meetings, the Research Summer Academy, the Consortium on Doctoral Supervision, the Thesis Competition.

The Annual meetings have become during the years the main platform for discussing common problems and issues, discussing impressive changes in the doctoral landscape and promoting best practices among the Directors of Doctoral programmes in the association. The Summer Academy operating since 1992 with its international dimension has been the privileged forum for dialogue on research paradigms and methodologies while building a strong scholarly network among doctoral students coming from a broad range of programmes and disciplines.

The Winter Academy launched in 2008 aims at improving the quality of doctoral supervision by fostering a dialogue among senior and junior faculty and developing competent supervisors for addressing the shortage of qualified faculty in Business and Management studies in the European Universities and Business Schools. In the steps of the Winter Academy, as a joint initiative between the EIASM and EDAMBA in shaping the new landscape of global doctoral education, EDAMBA runs a Consortium on the importance of supervision in doctoral education. A European Code of Practice for Doctoral Studies in Management and Business has just been published for consultation with our membership and wider community.

The Thesis Competition was first launched in 2003. It aims at distinguishing high-quality doctoral dissertations which have significantly contributed to new knowledge in all areas of business studies and management. The top-3 peer reviewed abstracts are given prizes and the short-list of selected abstracts is published in this EDAMBA journal. With this publication, we hope to contribute to the dissemination of distinguished doctoral dissertations from throughout our network in Europe and worldwide.

Dimitris ASSIMAKOPOULOS

EDAMBA President



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# **The impact of failure experience in product development on exploration, knowledge usage, and financial performance of the firm**

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## **Abstract**

*This thesis addressed three questions regarding learning from failure: 1) How does firms' failure experience influence their search activities? 2) How does firms' failure experience affect their performance? and 3) How does firms' exploration and exploitation influence the impact of failure on performance? Based on the theoretical lens of learning from failure, absorptive capacity, and exploration and exploitation, the series of longitudinal quantitative studies in this thesis revealed that firms' failure experience negatively affects exploratory search, positively influences R&D performance, and exhibits a mixed blessing on firms' financial performance. Boundary conditions of the relationships were discussed.*

Failure experience in organisations is associated with risk, uncertainty, and financial losses (Cope, 2011; Cyert & March, 1992; Kim, Kim, & Miner, 2009; Sitkin, 1992) which signal changes that managers may make in their subsequent exploration and exploitation (March, 1991). Risk aversion and performance feedback perspectives suggest contrasting implications for exploration and exploitation after failure experience (Greve, 1998, 2003; Lewin, Long, & Carroll, 1999; Shepherd, Covin, & Kuratko, 2009). On the one hand, research reveals that managers follow the logic of reducing uncertainty and risk (Shepherd, 2003; Shepherd et al., 2009), which drives exploitation because the benefits from exploitation are more certain (Lewin et al., 1999). On the other hand, performance feedback theory suggests that failure triggers exploratory search, and organisations that performed poorly are thus more likely to reorient than organisations that experienced success (Greve, 1998, 2003). Although theoretical work has proposed that the trade-off between risk-taking and risk aversion tends to be made in favour of more exploitation (Hannan & Freeman, 1984, 1989; Levinthal & March, 1993), little research has been conducted to examine this tendency empirically. Answering the first research question in this thesis regarding how firms' failure experience influences their

search activities, I examined empirically the contradictory arguments about firms' reactions to their failure experience in the R&D intensive pharmaceutical industry. The findings revealed a negative relationship between failure experience and exploration in product development in R&D intensive firms.

Organisations learn from experience (Argote & Miron-Spektor, 2011; Cyert & March, 1992; Huber, 1991; Levitt & March, 1988) and organisational performance improves with experience (Argote, 1999; Cyert & March, 1992; Huber, 1991; Levitt & March, 1988; Miner, Kim, Holzinger, & Haunschild, 1999; Pisano, Bohmer, & Edmondson, 2001; Rerup & Feldman, 2011; Thompson, 2001). Failure experience may be too expensive to waste because organisations learn mainly by encountering problems (Cyert & March, 1992; Sitkin, 1992) and failure can thus lead to positive outcomes such as learning (Nonaka & Takeuchi, 1995). The more negative consequences an organisation experiences, the more it is induced to learn (Homsma, Van Dyck, De Gilder, Koopman, & Elfring, 2009). Following the traditional learning curve perspective (Argote & Epple, 1990; Thornhill & Amit, 2003), I hypothesized a positive relationship between failure experience and organisational learning outcomes, which was denoted by knowledge usage. Knowledge usage is a dimension of organisational learning outcomes is rooted in absorptive capacity theory (Cohen & Levinthal, 1990; Zahra & George, 2002) and refers to a firm's capability in converting research discoveries into product development, given a certain amount of R&D input. Answering part of the second research question in this thesis regarding how firms' failure experience affects their knowledge usage and organisational performance, the results supported a positive relationship between failure experience and knowledge usage.

A positive relationship between failure experience and knowledge usage may not imply a positive relationship between failure experience and financial performance because some scholars argue that rent generation may not be directly associated with rent appropriation (Durand, Bruyaka, & Mangematin, 2008). Empirical research demonstrates that firms are capable of translating their learning from experience into financial gains. However, the assumption that firms are capable of converting their learning outcomes into financial improvement may be problematic in a context of high frequency of failure. A reason may be that failure is a special type of experience that undermines a firm's financial performance, signals problems in the firm's history, and causes negative emotional responses among employees. Challenging this assumption that firms' learning from failure experience is linearly associated with their financial improvement, I hypothesized an inverted U-shaped relationship between failure experience and firm financial performance. Answering part of the second research question in this thesis regarding how firms' failure experience affects their knowledge

usage and organisational performance, my findings showed an inverted U-shaped relationship between failure experience and financial performance. Firms' learning from failure resulting in financial gains may be an approximation in the context of low frequency of failure. Firm financial performance suffers along with increasing failure.

I further examined related boundary conditions on the impact of failure experience on firms' knowledge usage and financial performance. These boundary conditions are contexts that affect learning and moderate the relationship between failure experience and organisational performance (Argote & Miron-Spektor, 2011). Since search triggered by failure experience is associated with exploring new knowledge and exploiting existing knowledge (March, 1991), exploration and exploitation were used as the theoretical lens to interpret the boundary conditions. Exploration employs varied and dispersed knowledge in new ways and exploitation leverages existing knowledge in well-understood ways (Levinthal & March, 1993; March, 1991). Returns to exploration are less certain, further in time, and further in space than to exploitation (Levinthal & March, 1993). Answering the third research question in this thesis regarding how firms' exploration in product development influences the impact of failure experience on knowledge usage and organisational performance, I completed the development of the model by examining the conditional impact of exploration on knowledge usage and financial performance. The results demonstrated that exploration positively moderates the relationship between failure experience and knowledge usage, and negatively moderates the relationship between failure experience and financial performance. Table 1 summarizes the hypotheses and the results.

**Table 1 Hypotheses and Results**

<b>Hypotheses</b>	<b>Statements</b>	<b>Results</b>
1a	<i>There is a positive relationship between failure experience and the tendency for exploration in product development of R&amp;D intensive firms.</i>	Not supported
1b	<i>There is a negative relationship between failure experience and the tendency for exploration in product development of R&amp;D intensive firms.</i>	Supported
2a	<i>There is a positive relationship between failure experience and knowledge usage.</i>	Supported
2b	<i>Exploration positively moderates the positive relationship between failure experience and knowledge usage. Specifically, when exploration is higher, the increase of knowledge usage associated with increasing failure experience is faster than when exploration is lower.</i>	Supported
3a	<i>There is an inverted U-shaped relationship between failure experience and financial performance.</i>	Supported

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3b *Exploration negatively moderates the Supported inverted U-shaped relationship between failure experience and financial performance. Specifically, when exploration is higher, change in financial performance associated with increasing failure is slower than when exploration is lower.*

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The global pharmaceutical industry provides an ideal empirical setting for this research because of its R&D intensity, high frequency failure events, and consistent regulations. 165 pharmaceutical firms in Europe and North America mainly were selected for the studied period from 1990 to 2008. The sample firms were related to 17,349 records of drug development in Pharmaprojects, 709,407 records of patents in Derwent Innovations Index, 5,978 records of alliances in LexisNexis, and financial data in Research Insight (including Compustat and Global Vantage).

### **Contributions**

The findings of this thesis make a number of contributions to theory and research. First, this research contributes to organisational learning theory by examining the effects of a dimension of experience on learning outcomes. A special issue of Organization Science focuses on learning from rare events that have major consequences (Lampel, Shamsie, & Shapira, 2009). Researchers also show interests in learning from events that occur more frequently than rare events, such as learning from alliances (Lavie & Miller, 2008; Pangarkar, 2009; Zollo & Reuer, 2010) and learning from contracting experience (Vanneste & Puranam, 2010). Little empirical research has examined learning from events that occur highly frequently over time, such as failed product development. Understanding learning from various dimensions of experience contributes to organisational learning theory because experience with different properties can have different effects on organisational learning outcomes (Argote & Miron-Spektor, 2011).

Second, I advance the organisational learning literature by clarifying, articulating, and elaborating the effects of failure on firms' knowledge usage and financial performance longitudinally. Although previous studies acknowledge the importance of failure

experience and the positive outcomes of learning from failure (Baum & Dahlin, 2007; Homsma et al., 2009; Madsen & Desai, 2010), it has remained equivocal an understanding of the learning effects that underlie the impact of failure experience on organisational knowledge usage and financial performance. I demonstrate longitudinally different routines of the impact of failure experience on organisational outcomes. Organisations thus face a dilemma of favouring between knowledge usage and financial performance. Failure experience can be considered as invaluable to the organisational learning and R&D processes. However, what improves organisational learning may not automatically improve organisational financial performance. Organisational financial performance may not change in a linear manner consequently. This leads to the next contribution.

Third, this thesis contributes to the learning from failure literature by revealing a mixed blessing that failure gives to organisational financial performance. Learning from failure is essential to organisational adaptation. A heated debate in the literature is to what extent failure-induced learning triggers positive performance outcomes (Desai, 2010; Rerup & Feldman, 2011). This study contributes to this debate and reveals the double-edged impacts of failure on organisational financial performance. The influence of failure experience on financial performance is positive before a certain threshold. After this threshold, the influence of failure experience appears to become negative. Experiencing failure can be considered a motivation for organisational financial performance if failure experience is well under control. This contribution has implications on which future insights can be critically leveraged.

Fourth, in an effort to further enrich understanding of the impact of failure experience on organisational knowledge usage and financial performance, I examine the contingent role of exploration and exploitation in shaping the relationships between failure experience and knowledge usage and between failure experience and organisational financial performance. Some scholars focus on learning from different types of failure experience at various levels (Bonesso, Comacchio, & Pizzi, 2011; Desai, 2011). Some study different effects between learning from failure and learning from success (Kim et al., 2009; Madsen & Desai, 2010). Few have examined boundary conditions of the learning from failure effects. This study provides new insights about the boundary conditions in the internal context of organisations. This finding also contributes to the exploration and exploitation literature by theorizing the moderating impact of exploration and exploitation on organisational outcomes (Anand, Mesquita, & Vassolo, 2009).

## **Theoretical Implications**

### *Low Frequency versus High Frequency of Failure and Its Consequences*

A special issue of Organization Science focused on learning from rare failure events (Lampel et al., 2009). These rare events were interpreted as interruptions that triggered learning and redirected organisational identity (Christianson, Farkas, Sutcliffe, & Weick, 2009). The studies in the special issue of Organization Science generally discussed how organisations learn from failure events that occurred at low frequency and exhibited significant consequences.

Less is known regarding organisational learning from failure events that occurred more frequently. This is an important issue as firms in these situations have incentives to build mechanisms for learning from failure and to minimize the negative impact of failure. Consequences of learning from frequent failure events may be different from those of learning from rare events. The research reported in this thesis forwards this stream of literature by developing theory to predict consequences of learning from frequent failure events. By logic, consequences of learning from frequent failure events may be different from consequences of learning from rare failure events because organisations may generally not be able to make substantial changes frequently. In addition, paying more attention to highly frequent failure events or small failures may prevent failures with severe consequences (Cannon & Edmondson, 2005; Sitkin, 1992). Therefore, understanding learning from various types of failure experience contributes to organisational learning theory because experience with different properties may have different effects on organisational learning outcomes (Argote & Miron-Spektor, 2011; March, 2010).

The research reported in this thesis yields a portrait of learning from highly frequent failure events. The results may imply that effects of learning from frequent failure events may be different from effects of learning from rare failure events. Firms that experienced frequent failure events tended to be risk averse and focus on their existing routines. This finding and some of the findings in the special issue on learning from rare failure events of Organization Science discussed earlier are complementary. The results may also imply that effects of learning from frequent failure events on firm performance may be curve linear, which are different from the existing assumptions in the field. The latter tends to support a linear impact of failure on firm performance.

### *Learning From Failure and Organisational Outcomes*

Prior research shows that firms learn by encountering problems (Cyert & March, 1992; Levitt & March, 1988). Scholars have developed various perspectives on whether

and how firms learn from their failure experience (Anchordoguy, 2000; Barnett & Freeman, 2001; Barnett & Pontikes, 2008; Brown & Jones, 1998; Kim & Miner, 2007; Nunez-Nickel, Gutierrez, & Carmona, 2006; Renn, Allen, Fedor, & Davis, 2005; van Witteloostuijn, 1998; Weber & Camerer, 2003; Wezel & van Witteloostuijn, 2006). These studies generally reveal a positive relationship between failure experience and organisational learning outcomes.

Advancing this stream of literature, I introduced an indicator of learning outcomes, knowledge usage, examined it in the context of R&D intensive firms, and revealed empirically a positive relationship between organisational learning from failure experience and knowledge usage. I also examined the relationship between failure experience and firm financial performance. As stated earlier, scholars generally examined learning outcomes, such as generation of new ideas and insights (Homsma et al., 2009), reduced accident cost (Baum & Dahlin, 2007), whether an attempt fails (Madsen & Desai, 2010), and whether an accident occurs (Desai, 2010). Empirical research on how failure experience results in financial performance is limited. Addressing this issue in an empirical context, I found that failure experience is positively related to firm financial performance at a decreasing rate.

#### *Performance Increase versus Performance Decrease after Failure*

Both qualitative and quantitative research argues that performance improvement can be an outcome of organisational learning from failure (Baum & Dahlin, 2007; Cope, 2011). Scholars that examined various aspects of organisational learning outcomes, such as generation of new ideas and insights (Homsma et al., 2009) and reduced accident cost (Baum & Dahlin, 2007), generally revealed a positive relationship between failure experience and organisational learning outcomes. However, translating learning from failure into financial improvement may not occur linearly or smoothly. There is a heated debate in the literature as to what extent failure-induced learning triggers positive performance outcomes (Desai, 2010; Rerup & Feldman, 2011).

Advancing this debate, the research reported in this thesis differs from prior research on the organisational performance implications of failure experience in a way that the current research has revealed a mixed blessing that failure gives to organisational financial performance. Organisational learning from failure may be related to positive financial performance before certain thresholds, after which the influence of failure experience may appear to become negative on financial performance. The inverted U-shaped relationship between failure experience and organisational financial performance may imply that the process of value creation from failure experience is complex and not linear. Learning, especially learning from failure, may be a necessary but not essential

antecedent of organisational performance improvement. Experiencing failure may be considered a motivation for organisational financial performance if failure experience is well under control. However, it is unclear how firms minimize the negative impact of failure on financial performance when failure experience exceeds certain thresholds.

#### *Learning From Failure and Boundary Conditions*

An emerging stream of research highlights the importance of understanding the boundary conditions that govern learning. For instance, researchers have examined if failure experience prompts firms to make technological investments, and if these investments help boost firm performance (Desai, 2010). Desai (2010) found that technological investments mediate the relationship between failure-induced learning and organisational performance. Desai's (2010) findings demonstrated that additional investments may play a supplementary role in organisational learning from direct failure experience.

Enriching this emerging stream of literature in a different way, I portrayed a different boundary condition, the moderating role of exploration in organisational learning from failure experience. I showed that exploration in product development has different effects on knowledge usage and financial performance. Exploration may strengthen the impact of failure experience on knowledge usage and weaken the impact of failure experience on financial performance. This contingent role of exploration may be an important issue because the choice between exploration and exploitation may be driven particularly by the firm's failure experience, and in turn influences the effects of failure experience on knowledge usage and financial performance. For instance, as shown in the research findings of this thesis, firms make the choice of exploitation after experiencing failure, which in turn positively moderates the inverted U-shaped relationship between failure experience and financial performance. Firms' financial performance may thus increase faster and decrease more slowly in an exploitative context. The maximum performance may also be reached in an exploitative context.

### **Practical Implications**

#### *Knowledge Usage versus Financial Performance*

The research reported in this thesis revealed that learning from failure experience may trigger knowledge usage and improve financial performance at a decreasing rate. Further examination showed that knowledge usage does not have a significant relationship with financial performance. These results may suggest that managers might face a balance between rent generation (i.e. knowledge usage) and rent appropriation (i.e. financial

performance). Managers that tend to motivate organisational learning from failure on the one hand and to pursue superior financial performance on the other hand may need to make trade-offs between the two. High levels of knowledge usage, which may imply more effective learning from failure, may not be inherently more profitable than low levels of knowledge usage. Although risk and failure should be supported (Baden-Fuller, 2005), high levels of failure do more harm than good to firms' financial performance. Managers should control the levels of failure because financial performance may decrease after a certain threshold of failure.

#### *Encouraging Learning from Failure versus Minimizing Failure*

An important implication of the research reported in this thesis may be for managers that endeavour to manage failure experience in their product development processes. Managers should not ignore failure but should treat it as invaluable information for learning. Increases in knowledge usage and financial performance may suggest the need for managers to encourage learning from failure. Learning from failure may make firms more capable of utilizing knowledge and more profitable if failure is well under control. However, failure is associated with individual grief and organisational financial losses. Managers are thus suggested to minimize the negative impact of failure experience on aspects of firms. Firms may need to support employees to engage in learning from failure on the one hand (Carmeli & Gittell, 2009) and may need to reduce failure or its negative impact on the other hand. Firms that perform both needs well may be extraordinarily rare because of (at least partially) their managers' limited understanding of failure experience (Edmondson, 2011).

This point is consistent with researchers' suggestion of an organisational environment that tolerates failure and coexists with high standards for financial performance. Failure and fault are virtually inseparable in most firms. Only leaders may create and reinforce an environment that counteracts the blame game and makes employees feel responsible for learning from failure. This requires consistently reporting failures, systematically analysing them; and proactively searching for opportunities to experiment (Edmondson, 2011).

#### *Exploring versus Exploiting after Failure*

Acknowledging the inherent tension between exploration and exploitation in organisational learning, I provided an answer to researchers' call to specify antecedents that trigger exploration and exploitation (Lavie, Stettner, & Tushman, 2010). I enriched the empirical literature by proposing and examining the role of failure experience as an important antecedent of exploration and exploitation in product development. Firms'

failure experience may be associated with exploitation within specific domains of product development, resulting in the imbalance between exploration and exploitation. This specialization within domains may increase a firm's capabilities in knowledge utilization on the one hand and may cause the firm locked out of the market on the other hand (Levinthal & March, 1993; March, 1991). The tension between exploration and exploitation may be intensified when it is associated with firm performance. Researchers suggest that performance improvement is associated with balancing exploration and exploitation across domains (Lavie, Kang, & Rosenkopf, 2011). Since failure drives exploitation within specific domains at the expense of exploration, managers may pursue exploration in other domains to maintain balance in the long term. However, experiencing failure in some domains and engaging in exploration in other domains may imply more challenges that firms may encounter.

Needs to balance exploration and exploitation may not only exist in the relationships between exploration and exploitation and their antecedents and consequences but also exist while using exploration and exploitation as moderators to shape organisational learning outcomes. This seems a more difficult task of coping failure for managers in R&D intensive firms. The results reported in this thesis show that the contingent role that exploration plays in the relationship between failure experience and knowledge usage contrasts with that in the relationship between failure experience and financial performance. Balancing exploration and exploitation is not only important for firms' strategic renewal but also essential for organisational learning from failure experience. Firms that make changes in their search orientation following failure may not simultaneously improve knowledge usage and financial performance.

Management of product development in R&D intensive firms may focus on various dimensions (i.e., various domains) of knowledge involved in product development. For instance, managers may decide to focus on a few domains in their firms to benefit from specialization within these domains while exploring new knowledge within other domains in product development or at a different level of analysis. In association with the domain separation approach of exploration and exploitation, managers may decide to achieve balance at a level (e.g., the intra-organisational, organisational, or inter-organisational level) that suits the development stages of their firms. For example, since specialization increases efficiency and effectiveness of product development, it may be essential for firms to form alliances within or across their industries to provide fully functional products.

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