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Technology acquisitions: technology type as a differentiator

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Abstract

Acquiring small technology firms for their technology is a phenomenon with rising importance but subject to high failure rates. Taking a decision-making perspective, we focus on the decisions of acquisition timing and deal value as antecedents of technology acquisition success. Combining qualitative and quantitative research we identify technology type as a key driver of decision outcomes, introducing performance vs. functionality-focused technology acquisitions as a new distinction. We argue that performance-focused acquisitions take place earlier in a target's life cycle than functionality-focused ones and that the deal value is higher for the latter. Our theoretical arguments are based on the development of technology and market risks of both technology types.

Technology acquisitions: technology type as a differentiator

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Abstract: Acquiring small technology firms for their technology is a phenomenon with rising importance but subject to high failure rates. Taking a decision-making perspective, we focus on the decisions of acquisition timing and deal value as antecedents of technology acquisition success. Combining qualitative and quantitative research we identify technology type as a key driver of decision outcomes, introducing performance vs. functionality-focused technology acquisitions as a new distinction. We argue that performance-focused acquisitions take place earlier in a target's life cycle than functionality-focused ones and that the deal value is higher for the latter. Our theoretical arguments are based on the development of technology and market risks of both technology types.

Keywords: technology acquisitions, technology type, decision-making, uncertainty, risk

JEL Code: M20, O32

1. Introduction

In 2012 multinational storage giant and serial acquirer EMC bought two companies, XtremIO and Syncplicity. EMC's overall objective was to source technology externally – a phenomenon with rising importance in the fast paced high technology industries (Ahuja & Katila 2001; Makri et al. 2010). While the acquisitions of XtremIO and Syncplicity appear like any other two instances of external technology sourcing on the surface, interesting differences appear when looking deeper. XtremIO is a manufacturer of all-flash arrays that was founded in 2009. At the time of the acquisition XtremIO neither had a finished product nor any customers or revenue and its age was roughly three years. With the technology purchase, EMC aimed at enhancing “speed, performance and flexibility in the datacenter”¹. Syncplicity is a provider of a cloud file-sharing service similar to the well-known Dropbox application. Prior to the acquisition Syncplicity boasted more than 50,000 business customers. The acquisition took place five years after Syncplicity had been founded in 2007. With the acquisition EMC “deepens [its] mobile collaboration solution set”².

In summary, XtremIO's technology had a better performance than EMC's existing technology. Syncplicity's technology, in contrast, adds a whole new set of functionalities to EMC's product portfolio. Therefore we refer to the first case as a “performance-focused acquisition” and to the second case as a “functionality-focused acquisition”. The maturity profiles of both targets at the respective time of acquisition are entirely different. XtremIO was rather immature as its product was still unfinished, while Syncplicity was quite mature with a large set of customers. In terms of age at acquisition, XtremIO was also younger than Syncplicity. EMC is a serial acquirer with more than 60 acquisitions between 2005 and 2014, highly structured and standardized acquisition routines and a clear focus on learning (Tanriverdi & Du 2011). Why would EMC acquire companies with such largely different maturity profiles? Is one of the two acquisitions simply a deviation from routines (Mayer & Kenney 2004) or is there a systematic difference? What can we learn from this example about the timing of acquisitions in general?

¹ <http://www.zdnet.com/article/emc-acquires-xtremio-flash-storage-in-the-datacenter/>

² <http://www.esg-global.com/blogs/emc-acquires-syncplicity-deepens-mobile-collaboration-solution-set/>

Current literature provides contradicting results regarding the optimal timing of acquisitions. (Ransbotham & Mitra 2010) in their study of high-technology acquisitions find evidence for “acquiring early in the face of uncertainty”. (Alvarez & Stenbacka 2006) show with their compound real option approach that “increased [...] uncertainty with respect to the implementation of [...] synergies] tend to slow down the takeover activities”.

Uncertainty as the source of risk is a key issue in acquisition decision-making (Pablo 1996). In the case of the XtremIO, acquisition uncertainty is high because it is unclear if a finished all-flash array technology will outperform competing hybrid arrays. This is, first and foremost, technology uncertainty. In the case of Syncplicity, it is uncertain if a combined offering will see adoption rates that are higher than that of EMC’s competitors – so there is market uncertainty. Current literature acknowledges different sources of uncertainty (Alvarez & Stenbacka 2006; Chaudhuri et al. 2005; Ransbotham & Mitra 2010; Warner 2006) but does not explicitly analyze their impact in regards to acquisition timing. Assuming a systematic effect, current literature cannot explain the vastly different maturity profiles of EMC’s two focal acquisitions.

We argue that technology type, i.e. performance-focused technology vs. functionality-focused technology, holds the key to understanding the differences in acquisition timing. In addition we hypothesize that the deal value of performance-focused acquisitions is systematically lower than that of functionality-focused acquisitions. Thus, the distinction between performance-focused and functionality-focused acquisitions is relevant from a theoretical and practical perspective because it directly influences acquisition decisions.

To study the effect of different technology types we employ a multiple case study design (Yin 2003) followed by a quantitative analysis of technology acquisitions. We focus on serial acquirers in the information and communications technology (ICT) industry benefitting from their routine behavior (Brueller et al. 2015). For our case study we conducted 13 interviews with current or former heads of M&A of serial acquirers and current or former top executives of startups and studied numerous secondary sources.

Our qualitative findings reveal that the distinction between performance vs. functionality-focused acquisitions is relevant and a major driver of uncertainty and thereby maturity level at the time of

acquisition. Considering both market and technology uncertainty we find that overall uncertainty of performance-focused technology is lower at an early stage. This results in the different acquisition timing and different maturity profiles of acquired companies.

Deal value of performance-focused acquisitions is lower than that of functionality-focused acquisitions for two reasons: Performance-focused acquisitions occur earlier so that non-technological assets contribute less to the overall deal value. A generally higher synergistic fit and lower uncertainty of performance-focused technology do not fully compensate this difference.

This paper is organized as follows: In section 2 we review the relevant literature. Section 3 provides a description of the empirical context and research design. In section 4 we elaborate on the qualitative study and focus on our conceptual framework, hypothesis building and qualitative results. Our quantitative methods, data set and expected results are described in section 5. Please note that at the time of writing the quantitative analysis is work in progress. We discuss our findings, their implications and limitations and suggestions for future research in the last section.

2. Literature review and theory

2.1 Technology sourcing via acquisition of technology-based firms

High-technology industries such as ICT are subject to frequent technological change and short product development cycles (Bower 2001; Chaudhuri & Tabrizi 1999; Makri et al. 2010; Ransbotham & Mitra 2010). It is not surprising that even for large innovative companies technological gaps appear that internal R&D cannot fill in time due to diseconomies of time compression (Dierickx & Cool 1989). Tacitness of knowledge and its integration with other resources often prevents efficient transfer through strategic alliances (Coff 1999). Hence, companies make frequent use of technologically motivated acquisitions (Ahuja & Katila 2001; Bannert & Tschirky 2004; Bower 2001; Makri et al. 2010; Puranam et al. 2006; Ranft & Lord 2002).

Between 40% and 90% of all M&A fail to generate value (Bauer & Matzler 2014). Similarly, technologically motivated acquisitions frequently do not live up to expectations (Chaudhuri & Tabrizi 1999; Puranam & Srikanth 2007; Steensma & Corley 2000) with potential failure rates of up to 80%

(Puranam & Srikanth 2007). Given that each year billions of dollars change hands to gain access to new technologies, this is a highly relevant phenomenon for research.

2.2 Decisions in mergers and acquisitions

Acquisitions can be analyzed in terms of decision-making processes (Haspeslagh & Jemison 1991, p.13) in the pre-acquisition and post-merger integration phases. Decisions in one stage affect the subsequent stages of the acquisition (Pablo 1996). Pre-acquisition decision-making serves as an antecedent for enabling a successful integration (Haspeslagh & Jemison 1991, p.15). We group three sub-decisions into the pre-acquisition phase: target selection, timing of acquisition and deal value. The decisions regarding selecting the best target and choosing the right deal value are important because they drive acquisition outcomes (Pablo 1996). Timing in terms of target maturity affects acquisition success or failure (Brueller et al. 2015; Mayer & Kenney 2004). Similarly, we consider two sub-decisions regarding the integration phase: degree of integration and integration speed. While integration to a certain extent is required, choosing the wrong degree of integration can ultimately destroy value (Pablo 1994). The speed of integration is crucial because it determines the amount of disruption and how quickly benefits from the acquisition can be realized (Angwin 2004; Bauer & Matzler 2014).

Drivers of decisions regarding the pre-acquisition and integration phases that have been prominently studied are, *inter alia*, strategic fit (Kaul & Wu 2015; Larsson & Finkelstein 1999), organizational fit (Datta 1991), cultural fit (Bauer & Matzler 2014) and environmental factors (Haleblian et al. 2009). In technology acquisitions, a key driver of acquisition decision outcomes that has hitherto received little attention is technology type. Only a few categories of technology type have been investigated so far in acquisition research: component technology vs. standalone products (Puranam et al. 2009), process vs. product innovation (Cefis & Marsili 2012) and complementarity vs. compatibility (Léger & Quach 2009). These differentiations are important: (Puranam et al. 2009) show that the distinction between component technologies and standalone products influences the decision regarding the degree of integration. From the perspective of potential acquisition targets the propensity of acquisition increases if a firm engages in product innovation (Cefis & Marsili 2012). According to (Léger & Quach 2009) acquirers acknowledge the beneficial effects of compatibility when merging software portfolios

integrating them into target valuation. The study of technology type as a driver of acquisition decisions is especially important from a practical perspective: Technology type is readily observable by managers of acquiring firms. Thus, managers can apply the results to their decision-making more easily than if they had to consider rather abstract, broadly defined drivers such as “combination potential” or “relatedness” (King et al. 2004; Larsson & Finkelstein 1999). A close connection to real life is warranted in the context of acquisitions as failure rates remain high despite decades of research.

In the remainder of this paper we focus on decision outcomes and their drivers with regard to acquisition timing and acquisition deal value. Our understanding of both decisions is still limited even though they are highly relevant in technology acquisitions. In addition, they are interrelated and provide a perfect context to study the impact of technology type in terms of performance vs. functionality-focused acquisitions.

2.2.1 Timing in technology acquisitions

From a very general perspective the study of time is important because "strategy scholars often view time as a hidden and unrecognized dimension of strategy that has the potential to create competitive advantage" (Shi et al. 2012). In the context of acquisition management our understanding of temporal aspects is still limited (Shi et al. 2012).

The study of acquisition timing is particularly relevant both from a theoretical and practical perspective. Acquisition timing has received only very limited attention in literature. In their literature review on the temporal perspective of M&A, (Shi et al. 2012) identified only 7 empirical studies considering acquisition timing as a key variable (out of 144 studies dealing with the concept of time in M&A). To the best of our knowledge only (Warner 2006) models timing as the dependent variable with regards to technology acquisitions. Other studies use timing as an input in studying different phenomena such as first mover advantages in merger waves (Carow et al. 2004).

From a practical perspective the decision of acquisition timing is relevant because financial performance and success of post-merger integration is contingent on acquisition timing in terms of target maturity (Brueller et al. 2015). Acquisition timing relative to the market cycle has a significant effect on post-merger performance (Kusewitt 1985). Frequently, target age operationalizes acquisition timing. This line of research shows that with target age the rate of acquirer new product introduction

decreases (Puranam et al. 2006), revenues gained from acquisitions become more immediate and financial performance improves (Chaudhuri et al. 2005) and acquirer abnormal returns decline (Ransbotham & Mitra 2010).

2.2.2 Deal value in technology acquisitions

The determination of price is an important outcome of the acquisition decision-making process (Haspeslagh & Jemison 1991, p. 41, p. 50; Straub et al. 2012). From a practical perspective, choosing the proper deal value is difficult due to a high risk of overpaying that is caused e.g. by the “winner’s curse” (Varaiya & Ferris 1987). A high acquisition premium may have a negative impact on acquisition performance (Datta et al. 1992; Haunschild 1994; Hayward & Hambrick 1997). A deal value that is too high, puts pressure on post-merger integration efforts to recapture lost value (Krishnan et al. 2007). The riskiness of deciding for a certain deal value is in comparison to internal resource allocation decisions exacerbated due to the irreversible nature of acquisitions (Alvarez & Stenbacka 2006; Toxvaerd 2008).

In high-technology industries the study of deal value is especially relevant from both a practical and theoretical point of view: The risk of overbidding is high because of large uncertainties regarding an assessment of the target’s knowledge-based assets (Coff 1999). In his study of related vs. unrelated acquirers of targets in knowledge intensive industries, Coff (1999) discovered that related acquirers employ compensation mechanisms such as offering lower bid premia, while unrelated acquirers do not. From a theoretical perspective, the profit through acquisitions – that is materially influenced by the deal value – is not well understood in high-technology environments, because here innovation as opposed to diversification is the objective (Ransbotham & Mitra 2010).

We study acquisition timing and deal value in unison because both decisions are closely interlinked (Alvarez & Stenbacka 2006; Brueller et al. 2015; Ransbotham & Mitra 2010; Toxvaerd 2008): Timing through its impact on the likelihood of success or failure of post-merger integration influences the choice of deal value (Brueller et al. 2015). In addition, the trade-off between the technological flexibility and the uncertainty of valuation of early stage targets (Ransbotham & Mitra 2010) drives both potential overbidding and acquisition timing.

3. Empirical context and research design

3.1 Empirical context

We study the decisions of acquisition timing and deal value with respect to technology type in the context of the ICT industry due to its fast life cycle and frequent technology acquisitions. We expect to find rich evidence for both performance-focused (e.g. faster databases) and functionality-focused (e.g. richer KPI monitoring) acquisitions. In the ICT industry many dominant players engage in M&A so frequently that they are called serial acquirers. In relation to Cisco Systems the term “acquisition & development” instead of “research and development” (R&D) has become established (Paulson 2001). We focus on serial acquirers for two reasons: First, they have built standardized routines for their M&A activities (Brueller et al. 2015) so that a common logic should govern all of their acquisitions making their M&A decisions comparable with each other. These routines facilitate successful acquisitions (Brueller et al. 2015) so that much can be learned from studying serial acquirers. Second, due to their breadth of acquisitions, serial acquirers should buy both performance and functionality-focused technology making them an ideal subject to study differences in decision outcomes regarding technology type. In the logic of Eisenhardt (1989), serial acquirers represent extreme cases where largely consistent decision-making meets distinct technology types.

3.2 Research design

We follow a sequentially ordered, mixed method research design to address our research question from different angles and gain a comprehensive understanding of the focal phenomenon (Edmondson & McManus 2007; Jick 1979). Our approach consists of a qualitative part for exploration and hypothesis building and testing and a quantitative part where we test hypotheses on our dataset.

For both parts we define serial acquirers by setting a threshold at 20 or more acquisitions within 10 years. This is similar to (Brueller et al. 2015) who studied firms with at least 10 acquisitions in 4 years. We exclude companies that have their core operations mainly in consulting or outsourcing services. The acquisitions in our dataset took place between 2005 and 2014. This timeframe accommodates both a reasonably good recollection of events of our interview partners and a variety of easily accessible secondary sources.

In the qualitative part we focused on the enterprise software industry. We conducted a total of 13 semi-structured interviews. Among those were nine interviews with current or former heads of M&A of serial acquirers with a total of 371 acquisitions in 2005 - 2014. Key questions were related to the reasoning behind technology acquisitions and differences in decision-making regarding performance and functionality-focused acquisitions. Preparing for these interviews we gathered information from secondary sources such as press releases, company websites and analyst reports on all M&A transactions conducted by the company in the relevant timeframe as found in ThomsonOne. To enhance our understanding of acquisition decisions we interviewed four current or former C-level executives of (non-)acquired startups on topics such as uncertainty and risk in product development.

In our quantitative study we extended our industry scope to ICT for a richer variety of acquirers and technologies. We create a dataset consisting of more than 100 technology acquisitions from several serial acquirers. As we employed the conceptual ideas from our qualitative work in designing and interpreting the quantitative study, there is a high complementarity between both approaches. Due to the close dependence of both parts we report them in sequential order (Henkel et al. 2014).

4. Qualitative study and conceptual framework

4.1 Data collection and analysis

As the phenomenon we study is novel, we follow the approach of creating a nascent theory in our qualitative analysis (Edmondson & McManus 2007) and use induction to study our research question. This approach is especially suitable in settings where little prior evidence is present and current understanding is limited. The objective of our qualitative research is the creation of a conceptual frame and the generation of hypotheses.

All 13 interviews took place in a timeframe of four months in 2015. The interviews lasted between 26 and 89 minutes with an average duration of 56 minutes. The nine M&A managers we interviewed are current or former senior executives of large firms in enterprise software with a deep involvement in M&A decisions. The current or former C-level startup executives of the remaining four interviews had relevant experience in that their startup had been either acquired or approached for acquisition. Interviews were tape recorded and transcribed. In our analysis of the interviews we employed a

dedicated and evolving coding scheme. We analyzed the interviews continuously to refine our interview guide where necessary.

4.2 Conceptual framework

Our interviews together with the study of literature and secondary sources resulted in a conceptual framework that introduces the concept of performance vs. functionality-focused acquisitions in technology acquisitions. This concept emerged based on interviewees' statements regarding the potential ways of how acquisition targets differentiate their product offerings based on technology:

"For example [a technology company] says it is not the [transmission] speed anymore but it is [data] volume [...]. Maybe I cannot reach 1 millisecond but only ten, but then I can reach not one megabyte but one terabyte per second. Or I simply offer certain features like reliability [...]." (serial acquirer's head of M&A [Interview 3])

These statements relate to quality dimensions in product development. We take a product-based view on quality where quality "can be assessed objectively" (Garvin 1984) and focus on performance and functionality. Both performance and functionality are recognized as quality dimensions in product development literature (Garvin 1987). For example (Paulson Gjerde et al. 2002) state that: "R&D investment [...] suggests the exploration of new, previously unanticipated improvements. These improvements may [...] allow superior performance [...] or provide additional functionality." They provide an example for performance-focused technology by citing a scanner company's annual report: "The company's strategy is to compete principally on the basis of performance and quality [...] R&D projects were aimed at improving the size, weight, reliability, quality, and readability of scanners at increased distances, faster speeds and higher-density codes." Another example relates to functionality-focused technology: "Hewlett-Packard originally designed the HP85 to function solely as a personal computer, but discovered that its functionality could be expanded such that the HP85 could also be used as an equipment controller" (Paulson Gjerde et al. 2002).

The distinction between performance and functionality-focused technology is novel in the context of technology acquisitions. Both technology types can readily be the motive for acquisition. For example companies acquire a target's technology for better performance in terms of speed:

"[...] we acquired a company called [target name], which promises to have blazing fast [data transfer] capabilities and it's sort of order of magnitude change from anything that we thought we could develop [...]"(serial acquirer's head of M&A [Interview 6])

Also functionality is a common motive for technology acquisitions:

"[Target name] is also a very exciting technology story. We need them for analytics [...]. And [target name] was in a very nice niche [...] where non-data scientists can draw conclusions from the data. This niche functionality [...] is what we bought back then." (serial acquirer's head of M&A [Interview 1])

In the following we present working definitions of performance and functionality-focused acquisitions.

Performance-focused acquisitions: In performance-focused acquisitions the acquired technology replaces or integrates with existing technology within a product that the acquirer develops. Thereby one or several performance dimensions of the focal product are improved while the functionality does not change. The relevant performance dimension should be an objectively measurable quantity (Garvin 1987) such as speed, accuracy or latency. From an input-output perspective, a product that is enhanced with performance-focused technology receives roughly the same inputs and generates conceptually the same outputs but at better performance.

"[...] and I will say that [name of serial acquirer] has historically done more of what you are calling the performance improvement, [...] well this is the term you use a lot over here is 'it is a better mouse trap' [...] So, we have a mouse trap, they have a mouse trap, but theirs (referring to an acquisition target) is better." (serial acquirer's head of M&A [Interview 13])

Functionality-focused acquisitions: In functionality-focused acquisitions the acquired technology adds a new component to an existing product or adds a new product to the acquirer's product portfolio. This component or new product contains new functionality while in the first case no performance dimension is altered. The enhanced or new product takes new inputs and/or produces new or altered outputs that were previously not available.

These two definitions can be expressed in terms of filling a functionality gap for functionality-focused technology or replacing an old technology with one that has better performance for performance-focused technology:

"[...] you may think about it [...] in terms of there being a gap versus the replacement [...]" (serial acquirer's head of M&A [Interview 13])

To illustrate performance and functionality-focused acquisitions we present an example for each case:

In 2014 database developer MongoDB acquired storage engine developer WiredTiger for its performance-focused technology. MongoDB's website states that "For many applications, WiredTiger will provide [...] lower storage costs, greater hardware utilization, and more predictable performance [...]."³ Clearly cost, utilization and predictability are the relevant performance dimensions. No changes should be expected in terms of the functionality of MongoDB's database products.

In 2012 software giant Adobe Systems acquired EchoSign for their electronic signature technology, a new functionality. The press release on Adobe's website states: "EchoSign's pioneering electronic signature solution will be a key component of Adobe's document exchange services platform [...] By adding electronic signature capabilities to Adobe's document exchange services platform, we will be addressing the need to provide better customer experiences [...]."⁴

Generally, performance and functionality-focused acquisitions are two extremes of a continuum. Many cases of technology acquisitions are mixed so that classification is determined by relative focus.

4.3 Hypotheses and results

In generating our hypothesis we first review the central role of uncertainty and risk in acquisition decision-making. Then we construct uncertainty profiles for performance and functionality-focused acquisitions. Last we derive hypotheses for acquisition timing and deal value.

4.3.1 Market and technology uncertainty of targets in technology acquisitions

³ <https://www.mongodb.com/press/wired-tiger>

⁴ <http://www.adobe.com/aboutadobe/pressroom/pressreleases/201107/071811AdobeAcquiresEchoSign.html>

Acquiring another company is a risky undertaking because it is generally irreversible (Alvarez & Stenbacka 2006; Toxvaerd 2008). According to (Pablo 1994) risk guides understanding of the outcomes of acquisition decision-making processes but despite its central role has been given little attention. (Bowman 1982) states that risk is "the uncertainty [...] that exists before the commitment rather than afterwards". We follow this ex-ante conceptualization of risk in relation to acquisition decisions and build our arguments from a perspective of uncertainty as the source of risk. Uncertainty in technology acquisitions has two primary components, market uncertainty and technology uncertainty (Chaudhuri et al. 2005; Ransbotham & Mitra 2010; Warner 2006).

The key differences of performance and functionality-focused acquisitions lie in characteristics of the technology development and in the outside-in screening and due diligence process. We consider this in two stages focusing on pre-market product development. In the first stage we establish baseline uncertainty profiles for performance and functionality-focused acquisitions from a perspective of product development and innovation management. This baseline uncertainty decreases over time (Moenaert & Souder 1990) and largely resolves with a product's market introduction. In the second stage we modify these baseline uncertainty profiles to reflect the uncertainty perceived by the acquirer, which is relevant for decision-making (Pablo 1994). We combine insights from literature and our qualitative research in both stages.

Market uncertainty baseline

Performance-focused technology is very similar in functionality regarding an acquirer's established product. Its performance is expected to be better than that of the acquirer's product so that demand can be estimated based on an existing market. Hence, market uncertainty is low for performance-focused technology throughout development.

Functionality-focused technology provides an altered way of working resulting in a more or less strong behavioral change. Thus, customer adoption is rather unpredictable prior to a product's market introduction and market uncertainty is higher for functionality-focused technology. It decreases slowly with market exploration.

Technology uncertainty baseline

Performance-focused technology needs to reach a performance threshold, which represents a non-trivial advancement over existing technology. Thus, technology uncertainty is generally high. However, technological uncertainty decreases discontinuously at certain stages during development. At the very beginning technological uncertainty is governed by theoretical predictions:

"[...] I am building a quantum computer that no one has and I have a certain theory, that a quantum computer is at some point in time performing so well that even the best cloud is not better [...]. Then that is the first bet." (serial acquirer's head of M&A [Interview 3])

Uncertainty decreases when first performance measurements become available. When measurement conditions approach real life technological uncertainty drops discontinuously to a low final level at the time of a first product introduction:

"[...] developers] have made the main technology decisions so early and tested them already that [they] know, in principle it works. And from there on it just continues." (serial acquirer's head of M&A [Interview 3])

In the case of functionality-focused technology, only product usability needs to be ensured – performance plays a subordinate role. Hence, technology uncertainty of functionality-focused technology is lower than that of its counterpart.

Performance and functionality focused technology share scalability and security as drivers of technology uncertainty:

"That is then the biggest risk, where you get some code that [...] may have worked in pilot situations but does not scale. [...] So all the sudden you go from 'this has to work across twenty or thirty servers' to 'it has to work across two or three thousand servers' and maybe does not scale." (serial acquirer's head of M&A [Interview 13])

It might appear that the technology uncertainty of performance-focused technology should be rated much higher than that of functionality-focused technology because reaching a performance goal seems more challenging than making new functionality work properly. We argue, however, that this is not true because the possibility of conducting performance measurements of performance-focused technology drives task analyzability, which in turn reduces uncertainty (Souder & Moenaert 1992).

The above uncertainty profiles are not visible to an acquirer. We assume that during a screening phase there is no direct information flow between target and acquirer. This assumption is not unreasonable as even during a formal due diligence, information flows may be highly restricted to prevent competitive disadvantages in case of failed negotiations (Haspeslagh & Jemison 1991, p. 54). In this setting an acquirer has two primary sources of information to evaluate uncertainty: Publicly available knowledge about the target and the acquirer's internal knowledge about markets and technologies. We argue that evaluating a target's uncertainty profile with these sources of information is analogous to examining an object through a speckled lens: The acquirer will see some aspects of the target sharper than the target itself (superior internal knowledge accessible) while other aspects appear clouded (only outside-in perspective available). We operationalize the notion of the speckled lens by shifting the baseline uncertainty profiles derived above either up (clouded vision - higher uncertainty) or down (sharper vision - less uncertainty). This concept is similar to (Pablo 1994)'s concept of risk perception: She argues that only perceived risk is relevant in decision-making because ultimately the decision maker's assessment of "the situation, [her] estimates of how extensive and controllable risks are, and [the] confidence in those estimates" (Pablo 1994) drive decision outcomes. Hence, we analyze perceived uncertainty as the source of perceived risk.

Perceived market uncertainty

Performance-focused technology targets the same or a similar market as the acquirer with superior performance. One can expect that the acquirer has superior knowledge about market demands and developments through long standing relations and continuous customer interactions. The acquirer's market knowledge is likely better than that of the target. This leads to a downward shift of market risk:

"[...] even though there is a resistance to what you call the performance improvement and [...] you know, we have one that is not as good and we bring one that is better, when it was done, [...] those performed far better than the gap fillers. And the reason why is, you actually have everything in place already to sell it. You are selling it right now." (serial acquirer's head of M&A [Interview 13])

Functionality-focused technology addresses a similar or a different market than the acquirer. In the first case, the functionality is new for existing customers. A changed marketing approach may be required making it slightly more difficult to predict demand. In the second case, customers are new and

the acquirer cannot rely on existing market knowledge. Consequently, we expect no shift of market uncertainty.

[Interviewee referring to functionality-focused acquisition] *“You can usually tell what the customers want and what they will use but, again, you do not have the empirical evidence. And when you are actually selling it, you know. So I do not think [customer need] is something where it is so unknown on the technology expansion (functionality-focused technology) side, I think it is more on the performance improvement side things are so well known. It is just really an advantage.* (serial acquirer’s head of M&A [Interview 13])

Perceived technology uncertainty

Performance-focused technology replaces some component of an existing acquirer product with a new technology that has improved performance attributes. We argue that perceived technology uncertainty is shifted up slightly. This shift is the result of two counteracting effects: First technological uncertainty should be shifted upwards considerably because knowledge about the technology is only available from an outside-in perspective. However, two effects – similarity and relevant prior experience – mitigate this upwards shift somewhat. Performance-focused technology replaces a part of an existing product so that potentially there is some similarity between the acquirer’s and target’s technologies. Incumbents are known for producing sustaining innovations (Christensen 1997) along established performance trajectories. Thus, an acquirer may have conducted R&D in a similar direction as the target but failed (Henkel et al. 2015) leading to prior experience.

Interviewee referring to performance-focused technology: *“[...] we have in house experts in the area, so we can do a level of technology diligence that is really world class, you know, there is not a lot of risk because we see what they have, we know how to test it we know how to compare and contrast it to what we are doing [...]”* (serial acquirer’s head of M&A [Interview 9])

Functionality-focused technology usually fills a white space or gap. Thus, similarity and prior knowledge play no or only a minor role in assessing uncertainty. We argue that perceived technology uncertainty of functionality-focused technology experiences a larger shift upwards than that of performance-focused technology.

Other factors such as quality of code and compatibility in general drive technology uncertainty, as well. We can safely ignore them in our assessment of differences as they should affect both types of technology acquisition in the same way.

4.3.2 Acquisition timing in performance and functionality-focused acquisitions

There is a close relationship between uncertainty and the decision of acquiring now or later (Alvarez & Stenbacka 2006; Ransbotham & Mitra 2010; Toxvaerd 2008). Acquirers generally face "the choice between raiding or waiting" (Toxvaerd 2008). However, why should acquirers wait with a potentially promising acquisition given the possibility of a preemptive take-over by a competitor (Toxvaerd 2008)? In a real options logic there is a "value of delay" as postponing an acquisition gives firms more time to search for a more suitable target, allow for technological progress or the convergence of industries. Most importantly waiting resolves some uncertainty (Ransbotham & Mitra 2010; Toxvaerd 2008).

A manager pondering the best acquisition timing takes overall perceived uncertainty incorporating both technology and market uncertainty into account. As shown above, an acquirer will perceive market uncertainty of performance-focused technology to be lower than that of functionality-focused technology and technology uncertainty to be on a similar level. Consequently overall uncertainty at a pre-market stage is lower for performance-focused technology. (Alvarez & Stenbacka 2006) in their real option approach of acquisition timing argue that lower implementation uncertainty leads to earlier acquisition. They propose "homogeneity with respect to products and services" (Alvarez & Stenbacka 2006) as a proxy for implementation uncertainty. This homogeneity is certainly higher for performance-focused technology.

Thus we predict:

Hypothesis 1 - Performance-focused acquisitions occur earlier in a target's life cycle (less maturity) than functionality-focused acquisitions.

Our interviews provide initial support for this hypothesis:

Interviewer: "If you had to think about the differentiation between the performance improvement and the technology expansion (functionality-focused technology) [...], which one would feel more comfortable even acquiring earlier than the other one?"

Interviewee: "[...] *it is the performance improvement, because [...] you are in a better position to value that risk, and to know that it is ready, and you have a much better, stronger feedback loop in terms of understanding what to do to make it better. If you go too early, on the technology expansion (functionality-focused technology) then it is kind of "fall flat on its face", you are not exactly sure why and those typically get just thrown out [...]"* (serial acquirer's head of M&A [Interview 13])

Interviewer: "*Would you be fine with it (performance-focused technology) not being validated in the market as much?"*

Interviewee: "*Yes, in that case the answer is yes. [...] and in other cases like as they get bigger when we move into that kind of third and fourth categories (acquisitions focused on new functionality or products) so that's where I would rather see some traction revenue wise.*" (serial acquirer's head of M&A [Interview 9])

4.3.3 Deal value in performance and functionality-focused acquisitions

As we have established in previous chapters, the decision on the deal value is both important and risky. In very general terms, it is driven by a number of factors such as information asymmetry (Coff 1999), signs of quality such as patents (Grimpe & Hussinger 2007), level of competition, interorganizational linkages with e.g. interlock partners (Haunschild 1994), agency problems caused e.g. by seeking "white knights"⁵ (Toxvaerd 2008), bargaining power of acquirer (Alvarez & Stenbacka 2006), merger booms (Shelton 2000) or managerial hubris (Roll 1986).

These factors apply to both, performance and functionality-focused acquisitions. To understand their potential differences we focus on drivers of deal value that take the idiosyncratic properties of both types of technology acquisitions into account: acquisition timing (see above), technology relatedness and uncertainty. Timing in terms of maturity or target age is relevant because older firms have more assets and cost more (Ransbotham & Mitra 2010). Technology relatedness operationalized using patent data raises the deal value significantly (Grimpe & Hussinger 2007). Uncertainty drives deal value because it elicits a coping behavior in acquirers causing a discount in acquisition bids (Alvarez & Stenbacka 2006; Ransbotham & Mitra 2010).

⁵ Preferred acquirer – see e.g. <http://www.investopedia.com/terms/w/whiteknight.asp>

We study the effect of these drivers on deal value using the real option framework proposed by (Ransbotham & Mitra 2010). We use the acquirer's optimal bid as a proxy for deal value:

The optimal bid can be decomposed into three parts: the acquirer's private valuation, a common value and a bid discount. The private value represents the target's unexplored growth opportunities in terms of a synergistic fit that some acquirers can better realize than others. An acquirer's flexibility in shaping the target, e.g. its technological trajectory, influences the private value, as well. Common value measures the value of the target's mature operations: "Mature operations have tangible products or services, established customers and revenue streams, and well-defined business models" (Ransbotham & Mitra 2010). While private value decreases with target age because of decreasing flexibility, the value of mature operations increases because of increasing scale. High uncertainty regarding technology and market increases the range of valuations of the target's mature operations. To account for this effect, acquirers incorporate a bid discount that is higher the more uncertain technology and market conditions are. The bid discount decreases with declining uncertainty and thus with target age (Ransbotham & Mitra 2010).

In this framework we now analyze the deal value in the pre-market stage and the market stage for both performance and functionality-focused acquisitions.

Pre-market stage

In the pre-market stage the mature value of operations is virtually non-existent for both technology types. Thus, private value is the dominant contribution to deal value. We argue that the private value for performance-focused acquisitions is higher than that of functionality-focused acquisitions. This makes sense because synergistic fit is likely higher and more clearly defined where technological relatedness is higher. In addition the bid discount is likely lower for performance-focused acquisitions due to lower overall uncertainty as argued above.

Taking these arguments together, we predict:

Hypothesis 2a: In the pre-market stage, the deal value of performance-focused acquisitions is higher than that of functionality-focused acquisitions.

Market stage

Once products are introduced to the market, the value of mature operations rises sharply for targets with both performance and functionality-focused technology. While the effect of larger size and scale of operations on valuation might be the same for both types of technology, uncertainty is much lower with regards to performance-focused technology from the perspective of an acquirer. The private value in terms of potential synergistic fit and flexibility in shaping the target decreases for both performance and functionality-focused acquisitions.

"You just see it inevitably as companies grow, they are going to cost a lot more and the more you pay, you typically pay more on [...] things that you actually do not want." (serial acquirer's head of M&A [Interview 13])

However, the synergistic fit is still higher for performance-focused technology so that the relative contribution of private value does not change.

Hence, we argue:

Hypothesis 2b: In the market stage, the deal value of performance-focused acquisitions is higher than that of functionality-focused acquisitions.

When we take acquisition timing into account, we expect that on average, performance-focused acquisitions occur closer to the pre-market stage and functionality-focused acquisitions occur rather in the market stage. Thus, if we want to produce a prediction regarding functionality-focused acquisitions and performance-focused acquisitions in general, we need to compare deal values across stages.

The private valuation largely drives the deal value of performance-focused acquisitions in the pre-market stage. For functionality-focused acquisitions the value of mature operations is the largest contributor to the deal value in the market stage. We argue that the assets in the market stage have a greater influence on deal value than the opportunity of synergy in the pre-market stage.

Thus we predict:

Hypothesis 2c: Overall, the deal value of functionality-focused acquisitions is higher than that of performance-focused acquisitions.

4.4 Summary

Our findings enable us to introduce performance and functionality-focused acquisitions as a new concept in technology acquisitions. For both types of technology we construct bottom up uncertainty profiles. Using these uncertainty profiles we generate hypotheses for acquisition timing and deal value in regard to technology type.

Building uncertainty profiles from a target's perspective yields the following results: Generally technology and market uncertainty decrease during product development. Technology uncertainty is slightly higher for targets with performance-focused technology. On the contrary, market uncertainty of targets with performance-focused technology is lower because market demand for performance improvement is more easily predictable than that for any particular new functionality.

The acquirer perceives a potential target's uncertainty profile through a "speckled lens" leading to a downwards shift in uncertainty where the acquirer has better information than the target and an upwards shift in the opposite case. As a result acquirers consider technology uncertainty to be roughly equal for both technology types. Market uncertainty, however, is perceived as lower for performance-focused technology than for functionality-focused technology.

Technology and market uncertainty drive acquisition timing. Overall perceived uncertainty is lower for targets with performance-focused technology. Thus, we hypothesize that performance-focused acquisitions takes place earlier in a target's life cycle than functionality-focused acquisitions. Our interviews provide initial evidence supporting this hypothesis.

In real options logic, deal value is a function of an acquirer's private valuation, a common value of the target's mature operations and an uncertainty discount. We argue that in the pre-market and market stages an acquirer's private valuation is higher for performance-focused acquisitions than for functionality-focused acquisitions. The same is true for the value of a target's mature operations. In each stage the bid discount is smaller for performance than for functionality-focused acquisitions. This leads to the hypothesis that in the pre-market and market stages, the deal value for performance-focused acquisitions is higher than for functionality-focused acquisitions. Considering differences in acquisition timing, we compare the pre-market stage of a performance-focused technology with the market stage of a functionality-focused acquisition. We hypothesize that overall the deal value of

performance-focused acquisitions is lower than of functionality-focused acquisitions due to the large valuation impact of a target's mature operations.

5. Quantitative study

Please note that the quantitative analysis is currently work in progress. We expect results in early 2016.

5.1 Sample

Our dataset consists of more than 100 acquisitions by several serial acquirers from the ICT industry in the timeframe 2005 - 2014. The timeframe is the same as in the qualitative study for reasons of consistency and availability of relevant data. Our definition of technology acquisitions follows related research: "the acquisition of small technology-based firms by large established firms to gain access to their technologies" (Puranam et al. 2009).

We retrieved information on acquirers and acquisitions from ThomsonOne where we filtered for firms in the ICT industry based on their Standard Industrial Classification (SIC) codes. To identify technology acquisitions, we followed the established approach of examining media coverage of the acquisition searching for cues that indicate technology sourcing as the key motivation (Ahuja & Katila 2001; Puranam et al. 2009).

5.2 Dependent variables

To study acquisition timing we need to define a reference point. We conceptualize acquisition timing via a target's maturity and use three dependent variables: Target age at the time of acquisition (Brueller et al. 2015; Chaudhuri et al. 2005; Ransbotham & Mitra 2010), target size at the time of acquisition (Brueller et al. 2015) and target product development stage. While the first two variables use the date of founding as a reference point, "product development stage" is a dummy that is 0 if all products are in a pre-market stage and 1 if at least one product is available on the market generating revenues. Choosing an event dummy as a measure of acquisition timing is in line with (Warner 2006) who studies acquisition timing relative to technology standard setting. "Product development stage" as an operationalization of acquisition timing is the only variable that is not biased by unknown systematic

effects causing the development of performance-focused technology to take longer on average than functionality-focused technology.

For hypotheses 2a, 2b and 2c we choose deal value and deal value per employee as our dependent variables (Brueller et al. 2015). Especially for acquisitions of small companies information on deal value is often not available leading to a reduced number of observations.

5.3 Independent variable

Our independent variable is technology type capturing the effect of performance vs. functionality-focused acquisitions on acquisition timing and deal value. The technology type dummy is 0 for functionality-focused acquisitions and 1 for performance-focused acquisitions. We relied on expert coding of press releases, analyst reports, product information sheets around the time of acquisition (Ahuja & Katila 2001; Puranam et al. 2009). Two coders assessed the information to determine which technology type describes best the focal acquisition. Ambiguous cases were discussed and categorized based on consensus.

To optimize classification precision and ensure high inter-coder reliability we developed a coding algorithm. Technology acquisitions were classified as performance-focused under two conditions: Mentioning of a performance dimension (e.g. speed, compression ratio) that the technology improves and the existence (or at least development) of a product with worse performance at the acquirer's. We classified a technology as functionality-focused also under two conditions: The functionalities that are being added need explicit mentioning and it is necessary that the acquirer's products did not have the same functionality prior to the acquisition. A statement that the acquired technology complements the acquirer's existing products is insufficient as this applies to both technology types.

5.4 Controls

In our models for acquisition timing and deal value we have controls that fall into three categories: target-related, acquirer-related and environment-related. Target-related controls are privately held status (Ransbotham & Mitra 2010), target prior patenting (Grimpe & Hussinger 2007; Ransbotham & Mitra 2010) and venture capital investment. Our acquirer-related controls are acquisition experience (Warner 2006) and R&D expenditures (Warner 2006). As environment-related controls we include

acquirer target investment - toeholds - (Toxvaerd 2008), bidding competitions (Brueller et al. 2015) and product type in terms of hardware vs. software (Chaudhuri et al. 2005). Information on bidding competitions is retrieved from media coverage. We add "prior research" as a control for acquisition timing to reflect whether a target is a spin-off from a university or an established industry player. Considerable work on a technology done prior to the founding of a target may have a confounding effect on target age. For deal value we treat target age, target size and target product development stage as target-related controls.

5.5 Regression analysis

We use ordinary least squares (OLS) regression for target age, target size, deal value and deal value per employee and logistic regression for target product development stage as a dependent variable. Based on our hypotheses we expect the following results: The coefficient for technology type is significant and negative in all regressions. This would provide support for hypotheses 1 and 2c. To test hypotheses 2a and 2b we consider only acquisitions in the pre-market stage and market stage respectively by restricting the sample based on the dummy for target product development stage. In both cases we expect the technology type coefficient to be positive and significant to support hypotheses 2a and 2b.

6. Discussion and conclusion

6.1 Implications for theory

Our study yields important contributions to acquisition decision-making literature regarding the role of four concepts: technology type, market and technology uncertainty, time and routines of serial acquirers.

We are the first to introduce the differentiation between performance and functionality-focused technology in acquisition literature and study its impact regarding acquisition decision outcomes. Thereby we highlight the role of technology type in the research of technology acquisitions which has hitherto received limited attention (see Cefis & Marsili 2012; Léger & Quach 2009; Puranam et al. 2009 for notable exceptions). Our research makes a strong case for putting technology type at the

center of technology acquisition research alongside with other concepts such as size, relatedness and overlap of knowledge bases (Ahuja & Katila 2001; Sears & Hoetker 2014). In general technology should receive higher attention in acquisition decision-making where it is a frequently neglected issue (James et al. 1998).

By building market and technology uncertainty profiles dependent on technology type and relating them to decision-making we add to the general understanding of the mechanisms associated with uncertainty and decision-making in acquisition research. This is in line with research conducted by e.g. (Chaudhuri et al. 2005).

We provide an important extension to the study of time in M&A where especially the "when" role is severely understudied (Shi et al. 2012). Next to (Warner 2006) our research is the only one explicitly addressing acquisition timing as the dependent variable in relation to technology acquisitions. Generalizability is higher: While (Warner 2006) studies acquisition timing in the context of standard setting, our results apply also to industries where standard setting plays a subordinate role.

In addition our research qualifies the results by (Brueller et al. 2015). They relate poor acquisition performance to deviation from an acquirer's routines. In their reasoning, differences in target maturity constitute such a deviation. We argue that technology type has systematic effect on acquisition timing operationalized by target maturity and suggest that serial acquirers take this effect into account in their decision-making. Hence, this systematic effect does not represent a deviation from routines. Routines regarding acquisition timing and target maturity are driven by considerations of uncertainty and risk instead of target age.

6.2 Implications for management

Our results are highly relevant for both M&A managers of acquiring firms and for investors or founders of companies seeking a trade sale.

Managers of acquiring firms benefit in three ways:

First, M&A managers can better shape the decision-making processes in their own firm by building upon the distinction between performance and functionality-focused acquisitions. When justifying

acquisition proposals or simply evaluating risk they can use this distinction together with the specific properties of each technology type to make a convincing argument.

Second, non-serial acquirers can benefit by learning from serial acquirer's timing and deal value decision-making dependent on technology type. If a company has only experience with acquiring one type of technology, our results reduce confusion if the acquisition of a target with the other technology type is considered.

Third, the distinction between performance and functionality-focused acquisitions is very practical, i.e. it is easy to distinguish one from the other. If cases are not clear cut, the distinction by technology type provides a meaningful clustering for a target's technologies thereby reducing complexity of decision-making.

Investors and founders whose objective is a trade sale gain in two respects:

In the pre-acquisition phase, they can, depending on technology type, steer their own company's development trajectory to better meet an acquirer's maturity requirements. In the acquisition negotiation phase, they can tune their negotiation strategies based on technology type to make a more convincing case.

6.3 Limitations and suggestions for future research

Our research comes with limitations. As we studied only the ICT industry, generalizability can be questioned. The distinction between performance and functionality-focused technology only works in industries with system products. Hence, our results should apply in the medical instruments industry but not in biotechnology.

While the definitions of performance and functionality-focused acquisitions are mutually exclusive, mixed cases occur frequently. Here, our results may have reduced applicability - though clustering of a target's technologies by type may be a viable workaround for M&A managers.

Last, we cannot fully exclude endogeneity bias: There are multiple sub-industries within ICT on levels below the hardware vs. software differentiation such as "speech recognition software" or "video editing software". Some of these sub-industries may have innovation trajectories that primarily move along

performance dimensions while other sub-industries may be saturated in terms of performance improvements so that innovations mainly add new functionality. Depending on the sub-industry there could be unknown drivers of acquisition timing or deal value that are correlated with technology type.

There is ample opportunity for future research. Obvious possibilities are studying the same phenomenon in different industries or extending the scope to include other acquisition decisions. Especially a further study of the dependence of degree and speed of integration on technology type should provide interesting results.

References

- Ahuja, G. & Katila, R., 2001. Technological acquisitions and the innovation performance of acquiring firms: a longitudinal study. *Strategic Management Journal*, 22(3), pp.197–220.
- Alvarez, L. & Stenbacka, R., 2006. Takeover Timing, Implementation Uncertainty, and Embedded Divestment Options. *Review of Finance*, 10(3), pp.417–441.
- Angwin, D., 2004. Speed in M&A Integration: *European Management Journal*, 22(4), pp.418–430.
- Bannert, V. & Tschirky, H., 2004. Integration planning for technology intensive acquisitions. *R and D Management*, 34(5), pp.481–494.
- Bauer, F. & Matzler, K., 2014. Antecedents of M&A success: The role of strategic complementarity, cultural fit, and degree and speed of integration. *Strategic Management Journal*, 35(2), pp.269–291.
- Bower, J.L., 2001. Not All M & As Are Alike – and That Matters. *Harvard business review*, (March), pp.93–101.
- Bowman, E.H., 1982. Bowman 1982 - Risk Seeking by Troubled Firms.pdf. *Sloan Management Review*, 23(4), pp.33–42.
- Brueller, N.N. et al., 2015. Knowing when to acquire: The case of multinational technology firms. *International Business Review*, 24(1), pp.1–10.
- Carow, K., Heron, R. & Saxton, T., 2004. Do early birds get the returns? An empirical investigation of early-mover advantages in acquisitions. *Strategic Management Journal*, 25(6), pp.563–585.
- Cefis, E. & Marsili, O., 2012. Going, going, gone. Exit forms and the innovative capabilities of firms. *Research Policy*, 41(5), pp.795–807.
- Chaudhuri, B.Y.S. & Tabrizi, B., 1999. Capturing the Real Value in High-Tech Acquisitions. *Harvard business review*, (September–October), pp.123–130.
- Chaudhuri, S., Marco, I. & Tabrizi, B.N., 2005. The Multilevel Impact of Complexity and Uncertainty on the Performance of Innovation-Motivated Acquisitions. In *HBS Corporate Entrepreneurship Research Conference 2005*.

- Christensen, C.M., 1997. *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail* 1st ed., Harvard Business Review Press.
- Coff, R.W., 1999. How Buyers Cope with Uncertainty when Acquiring Firms in Knowledge-Intensive Industries: Caveat Emptor. *Organization Science*, 10(2), pp.144–161.
- Datta, D.K., 1991. Organizational fit and acquisition performance: Effects of post-acquisition integration. *Strategic Management Journal*, 12(4), pp.281–297.
- Datta, D.K., Pinches, G.E. & Narayanan, V.K., 1992. Factors Influencing Wealth Creation from Mergers and Acquisitions: A Meta Analysis. *Strategic Management Journal*, 13(1), pp.67–84.
- Dierickx, I. & Cool, K., 1989. Asset Stock Accumulation and the Sustainability of Competitive Advantage : Reply. *Management Science*, 35(12), pp.1504–1512.
- Edmondson, A.C. & McManus, S.E., 2007. Methodological fit in management field research. *Academy of Management Review*, 32(4), pp.1155–1179.
- Eisenhardt, K.M., 1989. Building Theories from Case Study Research. *Academy of Management Review*, 14(4), pp.532–550.
- Garvin, D.A., 1987. Competing on the eight dimensions of quality. *Harvard Business Review*, 65(87603), pp.101–109.
- Garvin, D.A., 1984. What Does “Product Quality” Really Mean? *Sloan Management Review*, (Fall), pp.25–43.
- Grimpe, C. & Hussinger, K., 2007. Pre-empting Technology Competition Through Firm Acquisitions. *ZEW Discussion Papers*, No. 07-027.
- Haleblian, J. et al., 2009. Taking Stock of What We Know About Mergers and Acquisitions: A Review and Research Agenda. *Journal of Management*, 35(3), pp.469–502.
- Haspeslagh, P.C. & Jemison, D.B., 1991. *Managing Acquisitions: Creating Value Through Corporate Renewal* 1st ed., Free Press.
- Haunschild, P.R., 1994. How much is that company worth? Interorganizational relationships, uncertainty, and acquisition premiums. *Administrative Science Quarterly*, 39(3), pp.391–411.
- Hayward, M. & Hambrick, D., 1997. Explaining the premiums paid for large acquisitions: Evidence of CEO hubris. *Administrative Science Quarterly*, 42(1), pp.103–127.
- Henkel, J., Rønde, T. & Wagner, M., 2015. And the winner is—Acquired. Entrepreneurship as a contest yielding radical innovations. *Research Policy*, 44(2), pp.295–310.
- Henkel, J., Schöberl, S. & Alexy, O., 2014. The emergence of openness: How and why firms adopt selective revealing in open innovation. *Research Policy*, 43(5), pp.879–890.
- James, A.D., Georghiou, L. & Metcalfe, J.S., 1998. Integrating technology into merger and acquisition decision making. *Technovation*, 18(98), pp.590–591.
- Jick, T.D., 1979. Mixing Qualitative and Quantitative Methods : Triangulation in Action. *Administrative Science Quarterly*, 24(4), pp.602–611.
- Kaul, A. & Wu, B., 2015. A capabilities-based perspective on target selection in acquisitions. *Strategic Management Journal*.
- King, D.R. et al., 2004. Meta-analyses of post-acquisition performance: Indications of unidentified moderators. *Strategic Management Journal*, 25(2), pp.187–200.

- Krishnan, H. a., Hitt, M. a. & Park, D., 2007. Acquisition premiums, subsequent workforce reductions and post-acquisition performance. *Journal of Management Studies*, 44(5), pp.709–732.
- Kusewitt, J.B., 1985. An Exploratory Study of Strategic Acquisition Factors Relating to Performance. *Strategic Management Journal*, 6(2), pp.151–169.
- Larsson, R. & Finkelstein, S., 1999. Integrating Strategic, Organizational, and Human Resource Perspectives on Mergers and Acquisitions: A Case Survey of Synergy Realization. *Organization Science*, 10(1), pp.1–26.
- Léger, P.-M. & Quach, L., 2009. Post-merger performance in the software industry: The impact of characteristics of the software product portfolio. *Technovation*, 29(10), pp.704–713.
- Makri, M., Hitt, M.A. & Lane, P.J., 2010. Complementary Technologies, Knowledge Relatedness, and Invention Outcomes in High Technology Mergers and Acquisitions. *Strategic Management Journal*, 31(August 2015), pp.602–628.
- Mayer, D. & Kenney, M., 2004. Economic Action Does Not Take Place in a Vacuum: Understanding Cisco's Acquisition and Development Strategy. *Industry & Innovation*, 11(4), pp.299–325.
- Moenaert, R.K. & Souder, W.E., 1990. Transfer Model for Integrating Marketing and R&D Personnel in New Product Development Projects. *Journal of Product Innovation Management*, 7(2), pp.91–107.
- Pablo, A.L., 1996. Acquisition Decision-Making Processes: The Central Role of Risk. *Journal of Management*, 22(5), pp.723–746.
- Pablo, A.L., 1994. Determinants of Acquisition Integration Level: a Decision-Making Perspective. *Academy of Management Journal*, 37(4), pp.803–836.
- Paulson, E., 2001. *Inside Cisco: The Real Story of Sustained M&A Growth* 1st ed., Wiley.
- Paulson Gjerde, K. a., Slotnick, S. a. & Sobel, M.J., 2002. New Product Innovation with Multiple Features and Technology Constraints. *Management Science*, 48(10), pp.1268–1284.
- Puranam, P., Singh, H. & Chaudhuri, S., 2009. Integrating Acquired Capabilities: When Structural Integration Is (Un)necessary. *Organization Science*, 20(2), pp.313–328.
- Puranam, P., Singh, H. & Zollo, M., 2006. Organizing for innovation: managing the coordination-autonomy dilemma in technology acquisitions. *Academy of Management Journal*, 49(2), pp.263–280.
- Puranam, P. & Srikanth, K., 2007. What they know vs. what they do: how acquirers leverage technology acquisitions. *Strategic Management Journal*, 28(8), pp.805–825.
- Ranft, A.L. & Lord, M.D., 2002. Acquiring New Technologies and Capabilities: A Grounded Model of Acquisition Implementation. *Organization Science*, 13(4), pp.420–441.
- Ransbotham, S. & Mitra, S., 2010. Target Age and the Acquisition of Innovation in High-Technology Industries. *Management Science*, 56(11), pp.2076–2093.
- Roll, R., 1986. The Hubris Hypothesis of Corporate Takeovers. *Journal of Business*, 59(2), pp.197–216.
- Sears, J. & Hoetker, G., 2014. Technological overlap, technological capabilities, and resource recombination in technological acquisitions. *Strategic Management Journal*, 35(1), pp.48–67.

- Shelton, L.M., 2000. Merger market dynamics : insights into the behavior of target and bidder firms. *Journal of Econ*, 41(1), pp.363–383.
- Shi, W., Sun, J. & Prescott, J.E., 2012. A Temporal Perspective of Merger and Acquisition and Strategic Alliance Initiatives: Review and Future Direction. *Journal of Management*, 38(1), pp.164–209.
- Souder, W.E. & Moenaert, R.K., 1992. Integrating Marketing and R&D project Personnel within Innovation Projects : an Information Uncertainty Model. *Journal of Management Studies*, 29(4), pp.485–512.
- Steensma, H.K. & Corley, K.G., 2000. On the Performance of Technology-Sourcing Partnerships : The Interaction Between Partner Interdependence and Technology Attributes. *Academy of Management Journal*, 43(6), pp.1045–1067.
- Straub, T., Borzillo, S. & Probst, G., 2012. *A Decision-Making Framework to Analyze Important Dimensions of M&A Performance*, Emerald Group Publishing Limited.
- Tanriverdi, H. & Du, K., 2011. EMC Corporation : Managing IT M&A Integrations to Enable Profitable Growth by Acquisitions. *Information Systems*, p.29.
- Toxvaerd, F., 2008. Strategic merger waves: A theory of musical chairs. *Journal of Economic Theory*, 140(1), pp.1–26.
- Varaiya, N.P. & Ferris, K.R., 1987. Overpaying in Corporate Takeovers: The Winner's Curse. *Financial Analysts Journal*, (June), pp.64–70.
- Warner, A.G., 2006. Managing Uncertainty in a Formal Standards-Based Industry: A Real Options Perspective on Acquisition Timing. *Journal of Management*, 32(2), pp.279–298.
- Yin, R.K., 2003. *Case Study Research: Design and Methods* 3rd ed., SAGE Publications.