

The Effect of Emerging Economies Operations on Knowledge Utilization: The Behavior of International Companies as Exaptation and Adaptation

Aaltonen Päivi, Torkkeli Lasse, Worek Maija

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**The Effect of Emerging Economies Operations to Knowledge
Utilization: The Behavior of International Companies as Exaptation
and Adaptation**

Päivi Aaltonen

Lappeenranta University of Technology,
School of Business and Management

Lasse Torkkeli

Lappeenranta University of Technology,
School of Business and Management

Maija Worek

University of Innsbruck
Department of Strategy, Management and Tourism

Abstract

No one informed the dinosaurs that their thermal insulation could someday be useful for another purpose, yet their feathers developed into wings. This example describes exaptation, the discovery of new uses for existing traits; complementary to adaptation. The former, which is similar to opportunity recognition, and the latter, which follows environmental demands, are paths of knowledge utilization. Following the notion of exaptive repurposing of knowledge in internationalization, this study illustrates how internationalizing emerging markets changes a firm's behavior from adaptive to exaptive, offering a systematic theory to analyze organizational behavior in a variety of contexts. This study illustrates how a change from developed to emerging locations demands new uses for existing knowledge. This expansion creates further possibilities for additional expansions to developing economies in a similar state. This is particularly important since it illustrates how organizations from developed markets adopt a behavior more similar to ones originating from emerging markets, such as the capability to deal with political instability. However, this process can take a significantly long time. Therefore, we suggest exaptation is an essential concept in understanding organizational learning patterns in emerging markets and that capabilities learned in emerging economies can further leverage organizational capabilities in other emerging locations.

Keywords: Exaptation, adaptation, emerging economies, innovation, internationalization, organizational learning

Introduction

Dinosaurs had feathers before they could fly. The original function of feathers was for thermal insulation, but they were found to be useful for gliding as well (Gould and Vrba 1982; Dew et al. 2004). This is the classic example of exaptation, the discovery of new uses for existing traits (Gould and Vrba 1982; Dew et al. 2004). Having similarities with entrepreneurial opportunity recognition (Sarasvathy 2001; Dew and Sarasvathy 2005; Dew et al. 2008), exaptation is complementary to the adaptive process (Cyert and March 1963; Gould and Vrba 1982; Lloyd and Gould 2017). Exaptation and adaptation describe the only paths of development, either solving a problem (Cyert and March 1963) or already possessing an answer (Andriani and Cattani 2016), according to evolutionary theory (Gould and Vrba 1982). Exaptation is, nonetheless, more common in humans (Garud et al. 2016; Mokyr 2000); explaining unique human characteristics from brain development (Garud et al. 2016) to strategic foresight (Dew et al. 2008). However, not all actions are exaptive. Studies indicate around 40% of innovations are (Andriani, Ali and Mastrogiorgio 2017), therefore, the dualism forms a simple yet systematic analysis tool for behavior. This perspective would benefit the understanding of internationalization of companies in emerging markets as the theories are applicable to all variances of nations, but further, they specifically illustrate that organizational behavior is shaped by emerging economies.

Using exaptation and adaptation is beneficial when examining the behavior of internationalizing companies in emerging markets, since they illustrate behavior in any given environment. Pascal pointed out that truth varies depending on the side of the Pyrenees and cultural studies continue to illustrate this (Hofstede and Hofstede 2005). Besides the division between developed and emerging economies, emerging markets have great diversity and develop constantly, whereas developed economies are described with less variety (Guillén and García-Canal 2009). Furthermore, operating in emerging economies can foster company behaviors that can be beneficial in developed economies as well. Theories have acknowledged that firms originating from emerging markets may follow a different path in internationalization (Guillén and García-Canal 2009). These firms are used to dealing with an unstable political environment, explore multiple paths to growth, and have increased flexibility (see also Guillén and García-Canal 2009: 31). These capabilities are highly similar to entrepreneurial ones; dealing with risk, limited resources, and uncertainty (Venkataram 1997; Dew et al. 2008). It has been further noted that knowledge gained in the home country can help in cross-country acquisitions (Guillen 2006; Marquis and Huang 2010), especially in coordination and control capabilities (Santangelo and Stucchi 2018), yet this re-use of existing knowledge is considered a static organizational capability (Dew et al. 2008). This raises the question: If organizations in emerging economies have such a variety of entrepreneurial skills, in addition to the above skills, for example, networking (Buckley et al. 2007) and institutional entrepreneurial ability (Lecraw 1993), should there not be a great number of successful global firms originating also from emerging economies? This leads to the conclusion that the emerging locations foster these skills, rather than seen them as organizational capabilities (innovation studies suggest sometimes similarly, see Anderson, Potocnik, and Zhou 2014). Following this logic, the present study suggests that not a firm's capability, but rather the locational demand in emerging

economies causes the search for new opportunities, enhances the capability to deal with uncertainty and political controversies. Exaptation and adaptation would offer the beneficial tools to examine this shift because we can illustrate the change in behavior based on time and location, which follows the notion of exaptive re-use of knowledge in internationalization (Santangelo and Stucchi 2018).

In order to study this phenomenon, our broad research question is formulated as follows: How does the expansion to emerging markets affect firm behavior, which is defined as either exaptation or adaptation? We examined longitudinal evidence of organizations that expanded from developed nations to emerging nations over a period of four decades, using a mixed methods analysis (Miles and Huberman 1994; Patton 2002; Teddlie and Tashakkori 2011). The case companies, having historical roots in Austria since the 1800s, started with subsidiaries in the Czech Republic in the 1990s, then later expanded to China and India in the 2000s and 2010s.

Our analysis reveals that when expanding to emerging economies from developed ones, adaptive behavior changes are dominantly used compared to exaptive one. This is partly in line with previous literature of exaptation in internationalization (Dew et al. 2008; Santangelo and Stucchi 2018), as the exaptive re-use was evident much longer than previously suggested. Furthermore, the exaptive behavior emerged in established organizations in Germanic Europe nearly instantly as they entered the previous Soviet region and continued further during the expansion to China and India. We conclude that expansion to emerging markets changes organizational behavior to be more suitable for emerging economies (Guillén, and García-Canal 2009), due to the location. This eventually led to case companies developing a new global strategy for emerging economies.

The present study is organized as follows: first, we review the relevant literature on the terms adaptation and exaptation. After this, we illustrate the methodology along with empirical context. Finally, we present the results in relation to theory with a discussion and conclusions.

Analyzing Locational Effect: Theoretical Background

Exaptation and adaptation share common morphemic origins, -aptation (Lloyd and Gloud 2017). Ad- refers to improving existing traits, whereas ex- refers to a new unknown purpose, previously called pre-adaptation (Gloud and Vrba 1982; Lloyd and Gloud 2017). This, while sometimes still mentioned (Cattani 2006), nonetheless implies teleology, knowing in the past already what the future use could be – which is impossible, making X more appropriate (Gloud and Vrba 1982). Adaptation in economics was firstly used in the behavioral theory of the firm (Cyert and March 1963), and the antecedents of exaptation in economics that have arisen from critique towards this theory (March 1991; Levinthal 1998; Aldrich and Rueff 2006). Later, notions of exaptation have continued to develop into the behavioral theory of an entrepreneurial firm (Dew et al. 2008) and effectuation logic (Sarasvathy 2001; Sarasvathy and Dew 2005). Their shared roots illustrate the mutual significance of both in understanding organizational behavior by describing elements the other term cannot.

Adaptation and exaptation are used by a variety of literature streams (Lewin and Volderba 2003; Andriani and Cattani 2016), yet their shared origins are in the evolutionary process. Variance is a necessity for the evolutionary process (Campbell 1969; Aldrich and Rueff 2006), and exaptation and adaptation describe the reasons for it. The wide usage of adaptation in management literature has sprouted some critique (Aldrich and Rueff 2006) and these can be concluded to be early notions of exaptation. Outside of Darwinian evolution, definitions of adaptation appear relatively often (Cyert and March 1963; Lewin and Volderba 2003; Aldrich and Rueff 2006) and suggest that variance in organizations is due to an incomplete search process or discontinuous information. This leads to further problems to solve: Do organizations learn via adapting to the environment? Starting from behavioral theory of a firm by Cyert and March (1963), the concept of adaptive organization has been further developed into single, incremental, and double, radical, loop learning (March 1991; Lewin and Volderba 2003). However, this is a source for some controversy among scholars. For example, some studies further argue double loop learning does not fully follow adaptive organizations (Aldrich and Rueff 2006), and this has been later followed by notions of exaptation by the same scholars (Levinthal 1991; March 1991; see also Andriani and Cattani 2016). Therefore, while adaptations have been a more popular concept of this evolutionary perspective, also brief notions of the term exaptation have existed for some time.

Uses for exaptation in previous theories have been multiple and the term is closely connected to human behavior in particular. Exaptation has been said to explain the emergence of novelty when no new technology is introduced (Levinthal, 1998; Adner and Levinthal 2002), and be a source of variation or performance potential (Grandori 2007). Variance in organizations includes intentional and blind variance (Aldrich and Rueff 2006), and adaptation can only explain intentional variance. Intentional variance can result from the above mentioned problematic research as suggested by Cyert and March (1963), yet blind variance can also result from luck, individual human behavior in everyday actions, or exogenous shocks (“jolts” Meyer 1982) that theories do not and cannot fully explain (Aldrich and Rueff 2006). Since humans have an advantage in comparison to other species

– constructing narratives, and abstract speech (Garud et al. 2016) – when including exaptation theory, it illustrates the human attributes adaptation cannot explain, for example, strategic foresight and creating luck (further on different types of luck see Garud et al. 2016). Observing exaptation is sensitive to retrospective bias (Gloude and Vrba 1982), which explains only in part the recently increased interest addressing the origins of variance. In retrospect, all behavior can be labeled adaptive (Gloude and Vrba 1982) and this may constitute as occasional luck from an evolutionary perspective (“evolutionary novelties” Campbell and Reece 2005: 482), yet a recent study concludes that 40% of new drugs started out as something else, following the definition of exaptation (Andriani et al. 2017). Exaptations are an essential human trait (Mokyr 2000), but only describe a part of behavior.

Based on behavioral approaches, adaptation and exaptation illustrate how and why knowledge is created and used. According to Cyert and March (1963), organizations must solve specific goals that arise from the external environment, such as shareholders, competition and employees. Since organizational subunits each have their individual goals, the effect of possible solutions limits the possibilities of general organizational solutions. In other words, despite a certain solution being best for one subunit, it can cause harm to another and is therefore impossible. This creates a cycle of limited solutions answering a set of well-defined problems; an adaptive organization. This, following the evolutionary definition of adaptation, is intentional development of a certain feature to better fit its niche (Gloude and Vrba 1982; Garud et al. 2016; Lloyd and Gloude 2017). However, organizations can also transform their environment rather than act within its limitations (Sarasvathy 2001). This notion, later connected to exaptation (Dew et al. 2004; Dew et al. 2008) and effectuation logic (Dew and Sarasvathy 2005), suggests that in addition to problem solving, organizations can create possible actions not aimed to solve problems. In adaptation, organization has a set of means to meet goals that are limited based on their effect (Cyert and March 1963). In other words, if a certain outcome is strictly defined beforehand, the effects of possible solutions limit the means available (Cyert and March 1963; Andriani and Cattani 2016). This is further illustrated in recent studies where exaptation is understood as knowledge utilization (Santangelo and Stucchi 2018).

Exaptations can not be entirely predicted, despite taking place often. The possible effects can be infinite, and the means are not limited by goals – if goals are met then they are residual effects (Dew et al. 2008; Andriani and Cattani 2016). In its simplified definition, exaptation translates to, I have a solution – what problem could this solve (Andriani and Cattani 2016). This is referred to as repurposing existing knowledge (Dew et al. 2004) and has been connected to internationalization (Santangelo and Stucchi 2018), entrepreneurial behavior (Dew et al. 2008), serendipitous discoveries (Dew et al. 2004; Cattani 2006), drug functions (Andriani et al. 2017), and a source of heterogeneity in economies (Felin et al. 2016). While connected to technological innovations (Andriani et al. 2017), exaptation and adaptation are complementary patterns of organizational behavior, which is similar to individual behavior in evolution (Gloude and Vrba 1982; Lloyd and Gloude 2017). However, despite some similarities, exaptation is not identical with, for example, effectuation logic (Sarasvathy and Dew 2005; Read et al. 2009). The origins of exaptation and

adaptation, are jointly a part of the evolutionary approach, organizational behavior, and exist simultaneously, despite their lack of illustration together. This could provide new insights to organizational behavior by considering the organizational environment as an eco-system (Korhonen and Snäkin 2005; Adner 2017). The difference of perspectives between adaptation and exaptation are illustrated in figure 1.

- insert fig 1 here -

Adaptation and exaptation processes are not mutually exclusive but complementary, or sequential, and similar to the multi-motor decision-making processes (Poole and Van de Ven 1995; Van de Ven and Poole 2010). Exaptive behavior is connected to firms actively seeking opportunities to use their core knowledge to achieve competences in a new market (Cattani 2006; Ganzaroli et al. 2014), or find out new uses for toxic by-products (Garud et al. 2016). Exaptations are connected to internationalization (Santangelo and Stucchi 2018), but may have several additional steps (Andriani and Cattani 2016). The presence of them explains why new traits are not fully effective immediately (Andriani and Carignani 2014; Andriani and Cattani 2016; Dew and Sarasvathy 2016), but empirical studies on internationalization have yet to include this. However, this further follows the notion of describing internationalization as an evolutionary process (Santangelo and Meyer 2017; Vahlne and Johansson 2017), and would benefit the study of emerging markets by explaining how change in location affects organizational behavior (similarly Santangelo and Stucchi 2018).

One categorization of emerging markets is between upper-middle income economies, such as Spain and Portugal; emerging economies, such as China, Turkey and India; and developing countries, such as Egypt; or oil-rich countries like Venezuela (Guillén and García-Canal 2009). Turkey has been an OECD country since the 1960s along with most of Northern and Central Europe (OECD Data 2018), but developed differently compared to Spain. Many Central Eastern European (CEE) nations gained their OECD status in the 1990s, such as the Czech Republic and Hungary (OECD Data 2018), and are currently closer to the upper-middle income categorization (Guillén and García-Canal 2009; OECD Data 2018). However, in the mid-1990s, they were closer to emerging economies (OECD Data National income, 2016), such as the current BRICS countries (Brazil, Russia, India, China, and South Africa). This is noted by studies as nearly all post-soviet regions experienced a significant decrease in their GDP in the early 1990s (Svejnar 2002:9). This illustrates a variety of organizational environments, consisting of multiple actors, policies, and institutions, where individuals are historically and geographically tied but also change over time (Autio et al. 2014). Defining organizational environment as an eco-system (Iansiti and Levien 2004; Korhonen and Snäkin 2005; Adner 2017), with exaptation and adaptation assumed, allows the inclusion of these components. Next, we will examine the empirical demonstration, by outlining the research methodology and the cases.

Method

Our study is based on connecting the exaptation and adaptation processes to internationalization process in emerging markets. However, analyzing exaptation can be challenging because there is a lack of established study designs (Andriani and Cattani 2016). Exaptation studies currently utilize both qualitative and quantitative methods, but we suggest a beneficial approach would be a mixed methods perspective, as a combination of methods would create a complementary picture (Hammersley 2008), emphasize philosophical orientation (Teddlie and Tashakkori 2011), and allow sequential quantification (Miles and Huberman 1986; see also Teddlie and Tashakkori 2011; Andriani and Cattani, 2016;) and qualification (Tashakkori and Teddlie 1998), making the research a question-driven design (Teddlie and Tashakkori 2011) and following previous examples (Cattani 2006). Based on this, we formulated our primary research question as follows, “How does the expansion to emerging markets affect firm behavior, defined as either exaptation or adaptation?”

In order to study exaptation and follow the mixed methods perspective, the philosophical foundations should be defined (Teddlie and Tashakkori 2011; Andriani et al. 2017). The previous studies have used both macro and micro perspectives, as both are acceptable in evolution (Lloyd and Gloud 2017). However, a large (Marquis and Huang 2010; Andriani et al. 2017; Santangelo and Stucchi 2018) or a small sample selection (Cattani 2006) leads to conceptual differences, either exaptation is intentionally (Cattani 2006) or unintentionally induced (Andriani and Carignani 2014; Andriani et al. 2017). Following human attributes (Mokyr 2000), firm level observations would follow the intentional perspective (Cattani 2006), and as this is also the focal point in internationalization process (Santangelo and Meyer 2017), a smaller sample would suit this study. Examples of such are case study approaches, where the number of cases can vary between 6-1 (Eisenhardt 1989; Siggelkow 2002; Eisenhardt and Graebner 2007; Yin 2011). Previous studies on exaptation have used the single case approach (Cattani 2006) of Siggelkow's (2002). Furthermore, as internationalization is an example of non-linear development (Santangelo and Meyer 2017), and this perspective would further emphasize the contextual significance of emerging locations.

Previous longitudinal observations of exaptation measure either differences between two time points (Marquis and Huang 2010; Santangelo and Stucchi 2018), follow a developmental path (Cattani 2006), or illustrate frequency (Andriani et al. 2017). These are in line with exaptation definition (Lloyd and Gloud 2017), as distinguishing previous and current function is mandatory (Andriani and Cattani 2016), but only the perspective of a developmental path (Cattani 2006) includes possibilities to observe also additional steps in the exaptation process (see Andriani and Cattani 2016). As the aim of this study is to follow the longitudinal development of international operations in emerging locations, a similar approach in material collection should be followed. Based on the dualism of evolutionary definitions (Gloud and Vrba 1982; Lloyd and Gloud 2017) and following our theoretical illustration, we continue by defining exaptation through comparison to adaptation (similarly, Dew et al. 2009).

We selected comparative longitudinal case study method, following studies of exaptation in internationalization (Santangelo and Stucchi 2018) and used mixed method analysis (Teddlie and Tashakkori 2011) to improve the fit of the design to our research question.

Cases Selection and Material Collection

As we aimed for longitudinal examination of internationalization to emerging economies, the changes in economic status in history was relevant. For cases representing emerging economies we adopted the previously introduced categories of developed, upper-middle-income, emerging economies, developing countries and oil-rich countries classes, where the last four are defined as emerging economies (Guillén and García-Canal 2009). The categories mentioned above do overlap with, for example, OECD classifications and upon closer inspection the differences can depend on, for instance, political history. Spain and Portugal, upper-middle-income countries (Guillén and García-Canal 2009), have been OECD countries since the 1960s, while Turkey, who joined around the same time (OECD Data 2018), is defined as a developing country (Guillén and García-Canal 2009). The Czech Republic lies in between upper-middle-income and emerging economies, yet according to studies, post-soviet regions experienced a significant decrease in their GDP in the early 1990s (Svejnar 2002). This indicates that most of the CEE prior to the mid-1990s would have fallen closer to the current emerging economies. In 1992, the Czech Republic's GDP index ranged from -15 to -40, as the OECD average was +5 (Svejnar 2002: 9). Therefore we concluded, that expansion to for example CEE countries in the mid-1990s would constitute as an emerging economy expansion, similar to current BRICS- countries. Based on this, we collected a list of available study subjects of expansions to emerging locations from developed, both currently and in the past. The number of cases following our desing was limited to a maximum of 6 (Eisenhardt 1989), yet following the previous examples in internationalization (Santangelo and Meyer 2017) and exaptation development (Cattani 2006), a single case would be enough (following Siggelkow 2002). We selected two case companies and suggest a comparison of two similar processes further validates the findings, and would benefit exaptation studies in international locations due to possible varieties in organizational environment.

Company A is a middle-sized electronic component manufacturer in Lower Austria, with over 1,100 employees, an annual turnover of 50 million Euros, and a total of seven locations globally. Established in the 1960s, it was founded under its current name in 1987. By 1992, a new production facility in the Czech Republic was established, followed by another one in 1994 in the Czech Republic. After a 200% increase in turnover between 1998 and 2000, new locations that were opened in China (2004) and India (2011). The original production plant from the 1960s in Austria still remains today as a subsidiary.

Company B is a global production facility that manufactures parts for automobiles. Their global revenue is 117 million Euros and they have 1,200 employees with production locations in Austria, the Czech Republic, China, and independent local units in North America, 2001, and in Mexico,

2017. Founded in 1888 and handed over to new management in 1930, the personnel were educated in a professional clock school based on company know-how. Acquiring over 200 employees by the 1960s, the first subsidiary was established in the Czech Republic in 1991. The opening of their third production facility was in China in 2006. New products were introduced in 2007 and a second production facility opened in China in 2010.

We conclude expansion to the Czech Republic in the 1990s constituted as an expansion to emerging economies. Furthermore, China and India are currently seen as emerging economies (Guillén and García-Canal 2009), and the GDP in relation to the average in OECD countries confirms this (OECD Data Base 2016), making the cases suitable to illustrate expansion to emerging economies. Austria currently has a higher than average GDP within OECD countries and is considered a developed economy in this study. The material collected includes the years 1900–2014. Figure 2 below illustrates the development of the Net National Income (NNI) of selected regions in comparison to the emerging economies categorization above.

- insert fig 2 here -

We followed a longitudinal case study type approach with the material collection, collecting material from all available sources (similarly Cattani 2006). Since financial data was available only from recent years, we collected other historical records, such as patents (similarly Cattani 2006; Andriani et al. 2017) and lists of current subsidiaries and establishment years. Following the mixed methods approach, a larger empirical material allows the possibility of diversity, rather than convergence, in conclusions (Patton 2002; Denzin 2009). This will provide greater insight into the complex aspects of the same phenomenon, thus, we also conducted additional interviews when possible (Case A) and relied on company printed material when not (Case B). The material collected is illustrated in Table 1.

- insert Table 1 here-

Analysis

The mixed methods approach does not mean a study design has complete freedom in method selection, but methods can be chosen to answer the particular research question (Teddlie and Tashakkori 2011; see also Straus and Corbin 1998; Bryman 2006). Following sequential design, we qualified the quantitative material (Patton 2002; Teddlie and Tashakkori 2011) by connecting locations, year, and patents into tables. This gave us a timeline of established subsidiaries, patents active, patent country scope and patent relation to others, following the definition of exaptive and adaptive processes, internationalization process and emerging economies presence. We followed this initial analysis with quantifying (Miles and Huberman 1994) company histories, interview and text material, to the tables. This demonstrated the company operations prior to international actions, origins of current product lines technology and one unpatented technology (Case A, 2), creating a

coherent and valid picture of the phenomenon (Patton 2002; Denzin 2009). Based on these, we divided the patent data according to their connections (European Patent Office categorization; patent application; text material) labeling them 1 through 7 in case A and F, G, H and B, and emergent subgenres of B and F to Ba, Bb, Fa and Fa, in case B, and collected these into tables. The resulting data is illustrated in Table 2, and further discussed in the following section.

- insert Table 2 here-

Findings

Based on the analysis, we identified four distinct phases that explain the behavioral changes of companies before and during their entry to emerging markets. These are named here (a) local embeddedness, (b) exaptive adjustment, (c) secondary chains, and (d) international embeddedness. The main findings based on Table 2 are summarized in Table 3.

- insert Table 3 here -

While the phases may overlap and differ slightly between the cases, the findings suggest that each has certain characteristics and follow the definitions of exaptive and adaptive behavior. Firstly, the locally embedded phase was evident over decades, since the 1800s for Company B and since the 1960s for Company A. With gradually increasing exports during this period, though production still remained in the home country, Austria, both companies had established their fields of operation. Company B developed from manufacturing clocks to a wholesaler and specialized in mileage counters in automobiles after the 1960s (company history). This resulted in three distinct patent families, named in this analysis as F, G, and H. Company A had developed power unit technology, referred to here as 3. Secondly, after the first international expansion to the Czech Republic, this status quo changed significantly. Early on, this was evident in new directions sought as the old core business was gaining revenue. For Company A, products 1, 2, 4, 5, 6, and 7 were completely new fields utilizing technology from 3. For company B, technology F was reintroduced after a pause beginning in the 1960s and completely new technologies B, E, and A were later introduced. Furthermore, Company B both paused a previous technology development (H) and gained revenue with G. Similarly, Company A continued to produce 3 and grow. Thirdly, these actions were further developed. For Company A, products 1 and 2 were kept in development while 4, 5, 6, and 7 were no longer pursued. For Company B, some of the new lines were paused (Bb, Fb, Ba, and G), some dismissed (Fa, E, and A) and some brought back into development (H). Finally, this resulted in a rather well-defined strategy after several decades around the 2010s. Company A no longer develops 3, and now focuses on 1 and 2. Company B continues with H and Bb, ended their previous line G, and re-directed two (Fb and Ba) to specific locations serving local customers. By taking a closer look at the findings, the exaptive and adaptive behavioral patterns emerge.

Local Embeddedness - Prior to International Expansion

Company A has a history of nearly 60 years and their first product (3), was built from original entrepreneurial inventions and expertise. This technology was based on fine electronics used in clocks, which further developed into various products that are still manufactured for some long run customers, such as large institutions like hospitals and hotels. The findings illustrate a relatively steady growth in markets and the production facilities were located in a developed economy prior

to 1992 (interview; patent data, 1992). Prior to the 1990s, the company operated under a different name, and up until 1988, the production and sales were locally concentrated. After a change in management in the 1990s, the first award winning innovation was created based on the company's technological expertise (patent data; interview). In 1992, their first international expansions were built in the Czech Republic, which is geographically close to the previous location (interview). According to the company, as the Cold War ended, the political atmosphere was more relaxed and, due to cheaper labor, the company production facilities were extended to the nearby location across the border. This facility was further expanded in 1994 (interview; company history). The operations between the Austrian headquarters and the facility in the Czech Republic were identified as a single operating unit (interview). However, prior to this, the company strategy based on our findings, seemed to illustrate a certain area of expertise, customer base, and a relatively steady growth. The expansion was due to improved efficiency and taking advantage of the political situation according to the company. But despite innovation (patents; awards), the company tended to operate in their own established field, which is concluded in this study to follow a more adaptive learning.

Currently, Company B is solely focused on the automobile industry and has several product lines for various usage in cars, some products utilizing similar technologies. By the 1960s, the core technological know-how was based on decades of craftsmanship in clock manufacturing dating back to the 1880s. Prior to the 1980s, the core technology development had decreased (G) as the manufacturing of clocks changed to wholesales and counters (H). Their biggest selling product (G) (patent data) still peaked in global sales in 1997 (company history). They also further developed into educational facilities in Austria, where an engineering school built around company expertise was founded. This followed the company tradition of historically having apprentices for senior crafters to teach their knowledge. Having two important export lines (G and H) in the early 1990s, the company built their first international manufacturing unit in 1994 in the Czech Republic, due to similar reasons like Company A (company history). The relaxation of the political atmosphere and attractive cheaper workforce just 50 kilometers away from company headquarters were the main reasons Company B also engaged in international expansion by constructing production facilities in the Czech Republic. However, just like Company A, Company B seemed to have a relatively set field of expertise, establishing new products based on similar technology and a set client base, which also follows an adaptive pattern. In addition to this, their core expertise was not in the automobile industry at this point, but, similar to Company A, Company B sold specialized products to a variety of industries that were built on top of a history of craftsmanship.

We can conclude the process following the first international expansion began with what we named in our analysis as locally embedded organizations. Both Companies A and B had long local histories: B for over a century and A for several decades. The long history was also a key characteristic in their technological know-how and served as a base for the first innovations and products (interview; patent data). Similarly, company traditions, history, and local environments are emphasized by the companies (interviews; company history). Furthermore, the first international locations were established in the 1990s in the Czech Republic, a German-speaking region close to Austria (roughly 30 kilometers). While a strict division based the companies' years

of establishment can be challenging to make, we suggest that around 1992–1994 the start of a new phase can be clearly seen as distinct from previous years, thereby, following an exaptive pattern.

Exaptive Adjustment - After the Expansion to Emerging Countries

After the first locations in the Czech Republic, a shift in the main developmental phases, new market discovery and product development, can be seen. This included searching for new markets to utilize previous knowledge, trials of entering completely new markets both geographically and product-wise, and pausing development of existing technologies. This period can be further divided into two sub-categories, the initiation of the new projects and the ending of them, labeled in here as exaptive adjustment and secondary chains, respectively (Andriani and Cattani 2016). Firstly, we focus on the years between the mid-1990s and the mid-2000s, which illustrate new initiatives, defined here as exaptive adjustment, to describe the nature of the phase more comprehensively.

Based on the definition stated prior, exaptation is evident when the solution made differs distinctly enough from previous solutions. Here, Company A established new product lines, illustrated here as 1, 2, 4, 5, 6 and 7 in figure 3. From these, not all products were continued for long, but products 1 and 2 are currently the basis for operations, according to the company. These lines were built on top of existing technology since 1994 and are also in collaboration with the facilities in the Czech Republic (patent data). Simultaneously, the company grew in revenue with the first core product (3), and the company reported a 200% increase in sales by 1995 (interview; company history). However, lines 1 and 2 were completely new areas to use technology. As improvement of line 3 became obsolete due to the rising mobile phone industry in the 1990s and the development in global markets eventually decreased after 1999 (patent data, interview); line 3 was still in production for a particular clientele and has a particularly long life cycle (interview). Officially, the first sub-range of these new products were launched in 1998 (1a), along with a second variation that was created for slightly different purposes (1b) (interview; patent data; company history), and together, make up Company A's current global product line 1 (interview; patent data).

However, the product lines were not only new ventures because product lines 4, 5, 6, and 7 were established. This suggests an intentional search for opportunities to use existing core knowledge without the knowledge of what could be useful, which follows the definition of exaptation (Cattani, 2006). This is further illustrated in the geographical scope of the new ventures. Between 1994 and 2007, two more locations were established in the Czech Republic and China. However, between 1992 and 1999, several additional new markets in developed countries and emerging economies were sought. Examples of such were Finland (1992), the Netherlands (1995), Germany (1992 – ongoing), Australia (1998-1999), and Japan (1994) (patent data). Most of these were not further pursued. Furthermore, some trials included rather far-fetched ideas to utilize the current knowledge, for example, electrical bicycles in the Netherlands. More details regarding these trials cannot be found from the information provided by the company but are available in public intellectual property documents. This nonetheless illustrates the idiosyncratic nature of the exaptive

phase, and further, the retrospective bias connected to differentiating exaptation from adaptation. While primary data suggests the company created a new direction (lines 1 and 2) as they grew larger (expansions in 1994 and 2007), a closer inspection reveals additional directions were also sought (patent data) both in exploring new locations and new product lines. This, not included in written company histories, further suggests that international expansion induced exaptive behavior—even if not all solutions made are currently not included in company strategy. However, based on a single case, this could also be related to particular changes in the industry (the introduction of mobile phone technology), but further observations from Company B seem to suggest similarly.

In Company B's case, the technologies are referred to based on their patent family and current production lines, such as sunroofs, doors, and steering. The core business followed technologies G and H, and prior to the 1990s, was focused on mileage counters. In 1994, an old unused technique from the 1960s (F) was helped to create to a new product, a sunroof mechanism for cars. This follows the definition of exaptation, for while it cannot be stated what the technology was previously used for, it can be stated that it seems the technology was, lying around (see further on categories of exaptation Garud et al. 2016). Interestingly, the utilization of this prior knowledge took place after the first expansion in 1991, and while no company records acknowledge this, it is currently connected to their core expertise: sunroof technology. Furthermore, an additional new technology, door locking (product line B), was introduced in 1998 and later in 2007 also transformed into another core product area, steering systems.

Since data showed no collaborations or external inventors, and both companies remarkably differed from either's previous field (G, H, and F), it suggests that core knowledge was repurposed for a new use, which follows the definition of exaptation (Cattani 2006). However, taking a closer look at evidence connected to the particular time period, we can see that not all trials were eventually formed into core products. An old technology (F), unused since the 1960s, was introduced globally in 1999 (patent data, 1999). Furthermore, a completely new technology was also introduced globally (product B) that same year (patent data). In the analysis, this period between the mid-1990s and the mid-2000s also included heavy investments in new directions (patent data, 1994–1997), and by further dividing the technologies into subcategories, Ba, Bb, Fa and Fb, we can illustrate the different solutions made. Several innovations were developed in the home country (patent data, 1992–2008), yet only a part of these were later kept in development. A new collaboration was introduced in the medical industry, product A in 2008, but it remained the only occurrence. Some old core technology was paused (patent data, 1998; patent data, 2005) in order to focus more on the new ones, but this was later revised and used to form the current core operations.

In conclusion, much of the events in Company B between 1991 and 2008 fall into the same experimental category, as did Company A's lines 4, 5, 6, and 7, which follow the definition of exaptation. However, repurposing knowledge in the initial stages of internationalization seemed to be exceeded, as the following phase resulted in the final selection from the opportunities available, which follows the definition of secondary chains in exaptation (Andriani and Cattani 2016).

Secondary Chains - The Development into Final Solutions

The previously introduced changes reached a conclusion after the mid-2000s. Depending on the company, this phase was completed relatively close to 2010, as the new ventures were either further pursued (Company A's 1 and 2) or not pursued (Company A's, 4, 5, 6, and 7; Company B's Fa, E, and A), ended (Company A's 3; Company B's G), or paused (Company B's Bb, Ba, and Fb), or re-introduced (Company B's H). While these events differ between the companies, they are considered either the final output of their exaptive process or the secondary chain of exaptation for this study, illustrating from the previous stage what was finally selected.

For Company A, lines 4, 5, 6, and 7 were ended. As some of these consisted of only one product, such as the electric bicycle, which were dismissed after one trial. However, some ventures starting in the previous phase, were further pursued, such as lines 1 and 2. For product line 1, this meant several incremental improvements and a global introduction of the technology, but for line 2, the development was due to an exogenous idea. While also based on a previous core technology (interview; patent data, 1999 – 2014), the competitive advantage currently related to line 2 is not the technology developed, but the production speed-enhancing system (interview). This was initiated with the help of external consulting in 2001 (interview) and further developed into an innovative self-monitoring system among the production facilities, which was introduced globally by 2009 and shortened manufacturing times from 160 days to only 5 days long. The self-monitoring system has been introduced globally and short-time planning has become the company's main strategy along with custom-made products (interview). However, this was a major shift in production design rather than technology, suggesting that it was an exogenously induced secondary exaptation of the product. Following the definition of exaptation, line 1 was firstly exapted—created using previous knowledge, and further developed into a final output: the current line. Line 2 was similarly exapted first, but further developed with changes in the production design.

For Company B, between 2005 and 2008, previously established technologies, Fb and Ba, were on hold (patent data), and the company built new locations in the United States in 2001 and the Czech Republic in 2004 and 2008 (company history). The financial crisis of 2008 caused the company to re-evaluate their operations according to the company, but this was not reflected in financial records (Orbis Data Base). More importantly, in the analysis, by 2010, paused developments were further allocated to specific production facilities (Fb and Ba) for local customers only (patent data, 2010). The process of finding a future direction for these took even longer, as the locations were established in 2001 and 2008 and the technology was only allocated to these locations in 2010. However, it is not currently a part of the globally available lines. Simultaneously during this period, the core product line G was ended (company history, 2016), and the previously paused technology H was revived. From the current technology, most parts (H and Bb) can be traced back to technologies in the 1980s and 1990s; however, between 1992 and 2008, they were not the major focal point of the company.

International Embeddedness – A New Direction Following Adaptive Cycle Emerges

Depending on the organization, around 2008 at the earliest for Company A, a phase where loose ends were tied seemed to emerge; we named this in our analysis as international embeddedness to contrast it with the first situation, local embeddedness. The experiments with new product lines, starting during the adjustment or later in the process, have a clear destination as a core technology, products to meet local customer demand, part vacillation in the organizational educational processes, or the ending of the line, to name a few. During the previous phase, some adjustments towards this stage were made (increasing development of core technology [patent data 1994 - 2008], allocating certain lines to specific locations, or still continuing production of currently exterminated lines). Not until this phase, however, was an innovation strategy adopted – a highly different creation than prior strategies at international locations.

Most all old product lines creating revenue during 1990–2010 have ended (Company B's G, Company history) or are now niche businesses (Company A's 3, interview). As soon as a new status quo was established, the significance of these products diminished. In the case of Company A, the old line is still in production in the home country serving only a few customers and the product life cycle is long – over a decade. It cannot be stated whether this product will continue to be developed or will end in the future. In Company B, their old main product peaked during this period in 1997 and has been reported by the company to now be finished. This did not happen until recent years, however, as the company had established a new, more strict strategy and business segment; becoming solely an automobile manufacturer. Between 2010 and 2017, the company continued to focus on their particular field and expanding in their areas. In 2011 and 2017, new locations were opened in India and Austria, respectively. These findings illustrated that after first entering emerging market domains, multiple trials took place. New products, markets, and directions were sought, but after operations had become more accustomed to the new location, these were eventually left out before further expansion. This indicates a significant learning phase in relation to place, creating a new direction for future strategy and was initiated by the expansion to emerging market locations.

New locations were built or expanded (a new location in 2010, expansions in 2010, 2011, and 2015, and two more new locations in 2017), the core business took its current form and the companies were globally repositioned. For example, before 2009, Company A's main competitive advantage was not only the production speed and global development for product 2, but the technology was only transferred to headquarters. Also, product 1, where the technology expertise is more crucial, was only heavily developed globally after 2007–2009. The results are collected in the following Figure 3 along with the theoretical framework.

- insert fig 3 here-

Prior to the first expansion (market with a line in figure 3), the firm's behavior followed an adaptive pattern. However, after establishing locations in the Czech Republic, exaptive behavior became evident. This trend continued for three decades and resulted in the establishment of locations first in China and then in India. After this, the behavior seemed to return to a more adaptive pattern. We shall now discuss the results and conclusions of this study along with managerial implications and future directions.

Discussion and Conclusions

Discussion

The results provide an insightful starting point for describing how the expansion of operations to emerging markets is linked to changes in organizational behavior. The case companies present interesting outcomes of learning after establishing locations in the Czech Republic.

Company A remained largely in emerging locations, and much of their customers are based in Asia, following horizontal expansion (Guillén and García-Canal 2009), however, their initial attempts to conquer developed markets are evident. The Netherlands, Finland and Germany were all possible locations to expand their customer base, yet these were not further pursued after the 2000s. The causality and interconnections of this would require further study, but the results can also be understood as creating a learning environment suitable only for emerging locations.

Company B took a different route, eventually. While having large car manufacturers as clients in the early stages of internationalization, these did not seem to play a large part at first. After the new path started to emerge, a clear change of locations in developed countries emerged. Company B transformed into local production facilities to serve only local clients.

Company B also distinguished the emerging sectors from development and focused on emerging locations, following a more vertical expansion (Guillén and García-Canal 2009). This also suggests that nearly a century of operations in developed economies had little change and the expansion to emerging locations forced or encouraged the organization to take a more experimental route, such as trying new product development and markets. This, presumably, further led to gaining knowledge of how to deal with the local workforce, adopting the ability to deal with political controversies and accepting uncertainty.

Conclusions

We conclude that as the internationalization process expands over several decades, it consists of multiple and simultaneous exaptive and adaptive processes. Based on these processes, we can see various phases where one characteristic is more dominant in each phase. This study suggests that entering emerging domains organizations learn to manage operations in these, yet this takes significantly long. International expansion to emerging markets creates the need to repurpose existing knowledge to a new purpose. A main contribution of our study is thus illustrating how internationalization to emerging markets creates a contextual disruption in organizational processes (Santangelo and Stucchi 2018) and demands new paths to be examined. Internationalization of firms has been called an evolutionary process for a long time (Madsen and Servais 1997; Contractor, 2007; Cantwell 2010), yet the extant studies have not applied true evolutionary theories. By applying evolutionary theory through the concepts of exaptation and adaptation and

illustrating the behavior of internationalizing firms, this study provides an important empirical verification of evolutionary theories as explanatory models in international business.

Repurposing existing knowledge has been linked to internationalization (Santangelo and Stucchi 2018), but not how they develop from there on. Following exaptation theory, we can illustrate that they are significant in the long run, as figures 1 and 3 demonstrate. The activities resemble the various stages of exaptation, the conscious search for uses of existing knowledge (Dew et al. 2004; Cattani 2006) in exaptive adjustment, and niche market creation (Andriani and Cattani 2016; Dew and Sarasvathy 2016) in secondary chains. We conclude that international expansion to emerging markets launched exaptive patterns, which follows a previous theory on internationalization to emerging economies (Santangelo and Stucchi 2018). This follows the notion that emerging economies require different capabilities of the organizations (Guillén and García-Canal 2009) and it is suggested here that the reason lies in the geographical location. Furthermore, contradictory to previous studies that conclude exaptive behavior is linked more to entrepreneurial firms and early stages (Dew et al., 2008), established firms under uncertainty may engage in exaptive behavior. However, as there is currently no comparable material on developed economies under a similar theory, this study demonstrates the need for further research. We conclude that capabilities developed in emerging locations equip the firms with the capabilities to do the same in expanded locations.

This study illustrates the importance of exaptation, a method for analyzing exaptation, and practical implications following the analysis method. The perspective used here has several benefits for studying entrepreneurship in a contextual setting because it offers a systematic theory framework to analyze complex actor networks, institutions, and entrepreneurial behavior that are tied to the environment. Following the evolutionary approach and describing institutions, culture, and other actors as an eco-system (Adner 2017) simplifies the otherwise complex network, and furthermore, enables empirical analyses of change on the individual level, as this study has illustrated. This is particularly important to globalization and entrepreneurship studies alike, including the context and interactions between context and entrepreneur to entrepreneurial opportunity recognition (Shane and Venkataram 2001; Jones and Wadhvani 2007), but especially by illustrating that entrepreneurial judgement is not a static quality or lost after stakeholder demands grow (Dew et al. 2008). According to this analysis, the internationalization process does not have well-defined lines or phases, but is, instead, dynamic and the development can be determined in the long run, or in these cases, over decades.

Moreover, as seen in the analysis, exaptation and adaptation can help explain the differences and changes in behavior when entering emerging markets in particular, thus, extending exaptation and adaptation's applicability to account for the extent of host market development. In summary, using exaptation in describing international expansion is beneficial since it illustrates how an unpredictable context can promote the usage of knowledge created for an entirely different purpose.

Managerial Implications, Study Limitations and Future Studies

Managerial Implications

The evolutionary concepts used here illustrate how incorporating a more behavioral research agenda to managerial decision-making would benefit the understanding of locational change. Based on this, and drawing further conclusions from evolutionary literature, the concepts of exaptation and adaptation represent behavior models suitable for single firm studies.

This study has several practical implications for managers, as it illustrates the unexpected elements presented in emerging locations and that there is no need to always create new practices from scratch. For example, open and fast informal communication channels were emphasized by Company A as a part of company culture which was attributed to innovation. However, these have also proven beneficial in overcoming timing delays when discussing operations in China. The habit of informal communication was based on the closely tied organization of the home location in the 1990s, but currently, the channels are used to minimize logistical dilemmas in Asia, according to the company. However, organizational practices developed at the home location are not always beneficial in emerging economies. Safety regulations are highly important in developed regions, but, in emerging economies they might not be as applicable in a similar manner. In India, the case company described a neglect towards safety regulations because of the major religious belief in reincarnation at the location. However, the care for company employees, which is embedded in the organizational culture, was transformed into a practice of accompanying female workers home from the factory. This illustrates, that in practice, the concern of employee safety can remain as a vague goal, and the actual practices will depend on each location. Incorporating a similar, more behavioral research agenda to managerial decision-making would also benefit the understanding of some additional challenges, such as longitudinal context, ambiguity, and low probability high consequence decision-making (Shapira 2008).

Study limitations and Future Studies

The results of this study illustrate how, in retrospect, several historical events can be seen as intentionally adaptive, but upon closer inspection, result from a more experimental approach of discovering new paths. This follows the sensitivity to retrospective bias in exaptation (Gloud and Vrba 1982), however, as it is not always mentioned in company histories or by the respondents, this may cause subjectivity in the conclusions. We suggest that this does not lessen the significance of the results due to the experimental design of the study.

The evolving and sequential research design and data conversions (Teddie and Tashakkori 2011) do allow a more emergent method, having similarities with grounded theory design (Straus and

Corbin 1998; Bryman 2006), and could provide beneficial attributes for future studies on exaptation. However, the method has been criticized due to the emphasis of the individual researcher's ability to choose the methods (Teddie and Tashakkori 2011). As the theory is relatively new in management, and it has been concluded to differ from approaches in evolutionary perspective (Garud et al. 2016; Lloyd and Gloud 2017), an exploratory research design could be beneficial and we suggest that the method chosen follows previous studies and is complementary to them. Furthermore, emphasizing diversity explains the phenomenon on a wider scale.

The empirical results suggest that emerging economies demanded new approaches from the companies', following the suggestion of locations creating certain capabilities, rather than organizations themselves (Guillén and García-Canal 2009). However, how could this be interpreted? Was it an additional benefit of entering emerging locations or a restraining phenomenon, limiting options to also expand to developed locations? The results indicate a clear change in direction, but was this involuntary, beneficial, or harmful to the organization in the long run? Answering this would require more in-depth studies of the case organizations, such as having several interviews to further explain the solutions chosen (Cattani 2006). The results suggest that this might have further enabled the expansion to emerging economies, such as China and, current consideration, Mexico. However, why did the operations not expand to the United States? We suspect the entry to emerging markets only leveraged capabilities suitable for emerging economies, as Company A demonstrated, but this would require further studies.

Innovation typologies have been introduced already by Schumpeter, therefore, the variety in possibilities to define innovations are naturally immersive. Innovation, creativity, and research and development can be presented as synonyms or divided into categories of typologies (Baregheh et al. 2009; Andersen et al. 2014), but, for example, innovations without commercial measure, process, service, sustainable innovation, or even business model innovations, are challenging to incorporate under a single observational measure for analysis. For example, Company A's line 2 is a mixture of both technological innovation and a manufacturing process innovation that started out as something else but, presumably, gained status as the core product line due to the immersive competitive edge, which was made possible by shortening manufacturing times. As this was not possible for other lines, it is suggested here that the innovation process specifically consisted of both invention-level and organization-level innovations (Baregheh et al. 2009; Mastrogiorgio and Gilsing 2016). Using behavioral theories to describe innovation could help the inclusion of various types, such as process, product and service innovations – as the focal point is currently much on technological product innovations (Andersen et al. 2014).

Exaptation and adaptation as organizational behavior reveal several directions to explore for future studies. What is the effect of a foreign location to specific innovations? Exaptation does include the notion of ambidexterity—an idea that a previous function needs not to be discarded as a new function emerges. Feathers still serve the purpose of thermal insulation despite the additional trait of flight being developed. The case companies illustrated development of old core products simultaneously with a new search for directions, which follows a sequential and simultaneous trait of organizational ambidexterity (Boumgarden et al. 2012; Gulati and Puranam 2009), but also in

times of disruptive change (O'Reilly and Tushman 2013), which follows the use of exaptation in internationalization (Santangelo and Stucchi 2018). Exaptation and adaptation illustrate the dynamic nature of organizational behavior, but concluding this either as an organizational capability or resulting from locational pressure requires more studies. Contradictory to previous theories (Dew et al. 2008), including both adaptation and exaptation as longitudinal evidence illustrates the presence of exaptive capabilities in established organizations as well.

Repurposing knowledge has been connected to cross-border mergers and acquisitions (Marquis and Huang 2010), as well as co-ordination and control capabilities (Santangelo and Stucchi 2018), but the results suggest that cultural environment is tied to location and may play a significant role. Company A explicitly explained how each location had a variety of issues, such as respect for authority in the Czech Republic in comparison to Austria and a lack of respect to law and regulations in India, which follows the differences of cultural studies (Hofstede and Hofstede 2005). Further examining the cultural differences' effect on innovation in emerging locations could provide more insight to entrepreneurial cross-cultural studies. Exaptation along with adaptation could also improve the illustration of these types of results. Finally, the emergent literature on exaptation in management remains scattered across disciplines. Combining the current literature streams to a single review would enable further theoretical advancement and provide a starting point to better illustrate the usage of exaptation along with adaptation. Previous research has been used in management in only a handful of papers and the latter in thousands yet as the theoretical antecedents illustrate, the complementary nature of the terms are crucial in explaining organizational behavior comprehensively.

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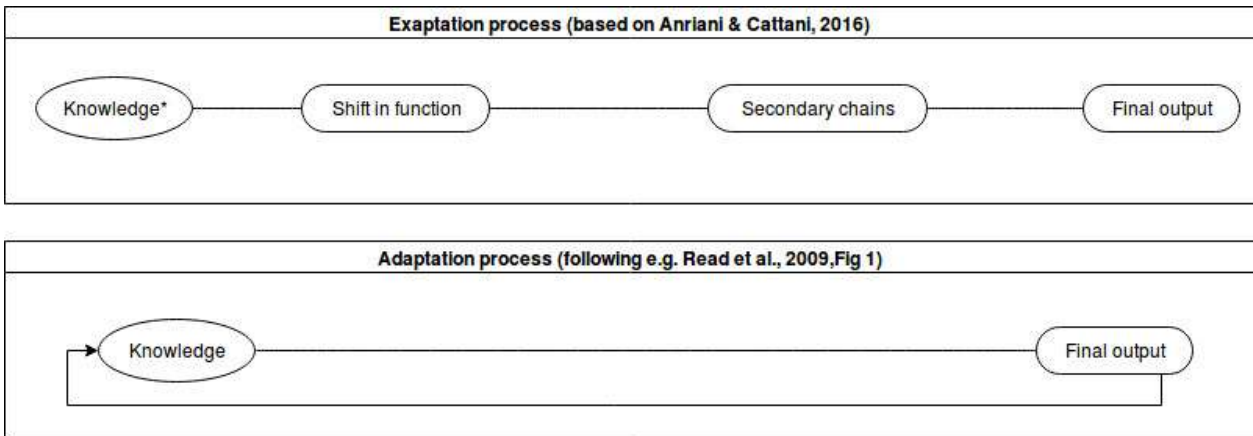
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* Domain of effectuation logic

Figure 1. Theoretical framework

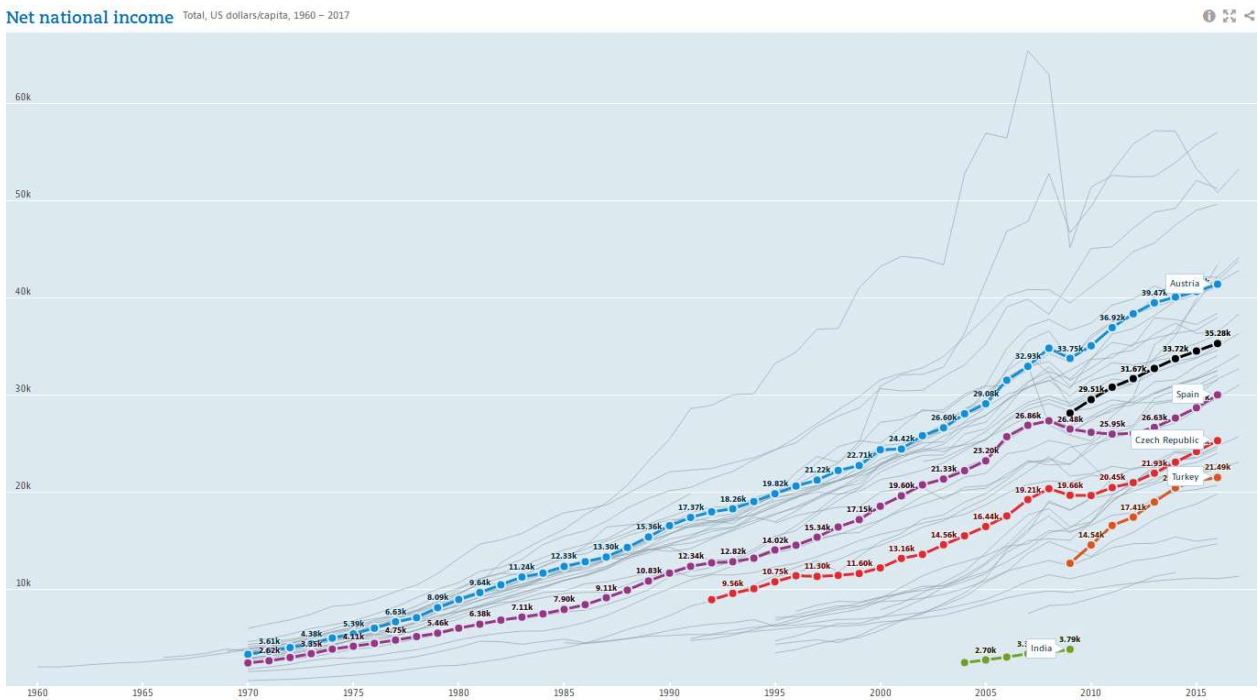


Figure 2. Development of Net National Income (OECD Data 2018)

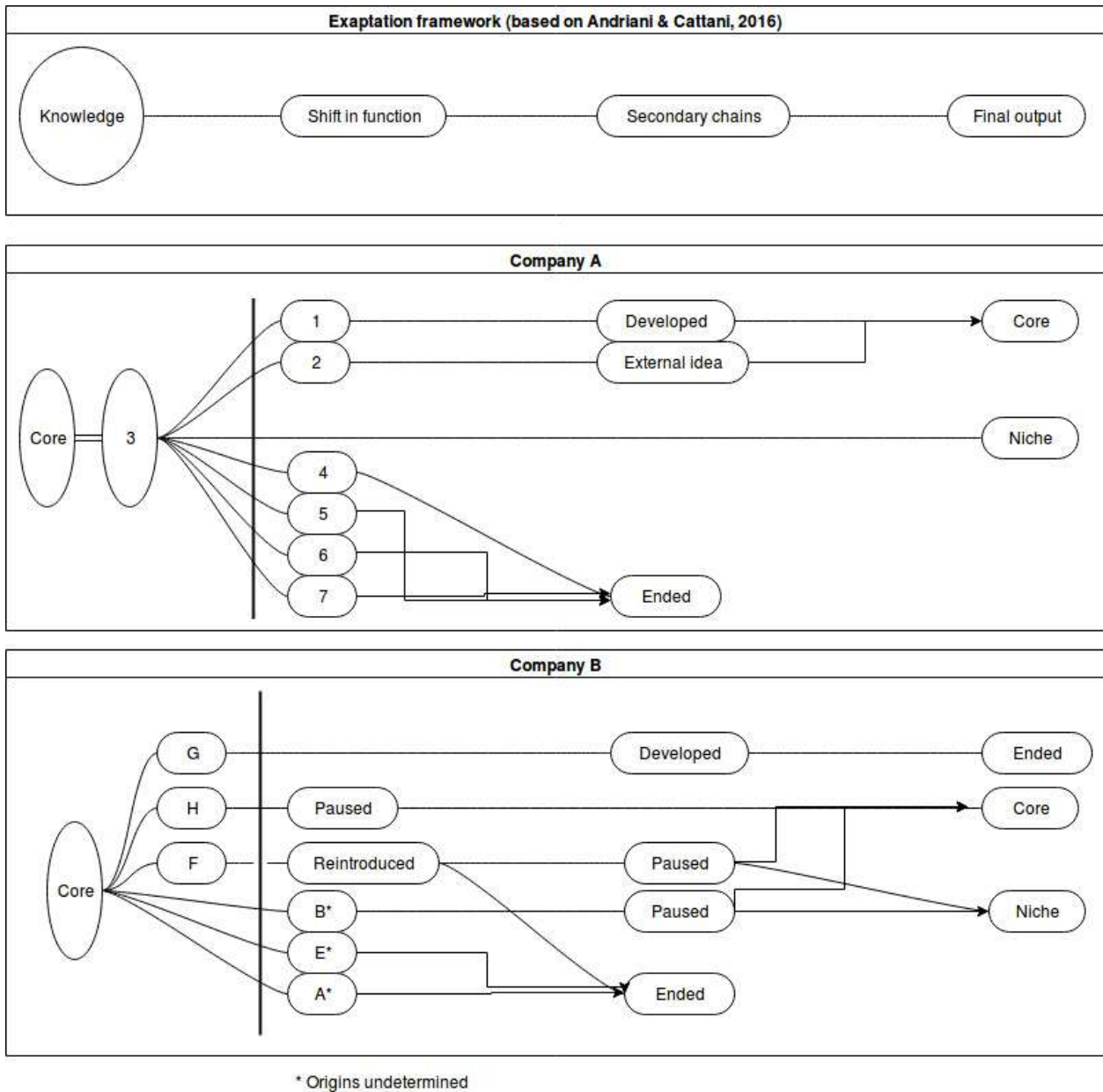


Figure 3. Findings and theory

Table 1. Data overview

Year	Data ID	Who	Audience	Other	Amount
<i>Interviews and participant observation</i>					

2016	Interview and Faculty visits	Director of operations/ Q. Manager, A	Researcher	Duration 3h + 1h	8 pages transcriptions + 4 pages field notes
<i>Archive Data</i>					
2016 - 2018	Patents	European Patent Office	Public		1514 pages
2016	Financial records	Orbis; A	Researcher	2004 - 2015	30 pages
2016	Product records	Representative, A	Public		30 pages
2016	Financial records	Orbis; B	Researcher	2010 – 2016	40 pages
2016	Product reports	Representative; B	Public	2015 - 2016	35 pages
2016	Company history	Promotional material; B	Researcher	150 years	142 pages
1990 -2016	Press releases	Public	Public		50 pages
2000 - 2016	Online/ print articles	Company B	Public		20 pages
2016 - 2018	Online material	Company web pages	Public		NA

Table 2. Findings

Years	Description	Details	Sources
<i>Company A</i>			
1960 – 1994	Local embeddedness	Technological knowhow based on craftsmanship	Company history
		First innovation	Company history; Interview
		Core product developed (3)	Interview; Patents, Technology H01;H02
		First production facility in Czech Republic 1992	Interview; Press material
		Second production facility in Czech Republic, 1994	Interview; Press material
1995 – 2004	Exaptive adjustment	New products (4,5,6)	Patents, Technologies B62; B60;G01
		New markets sought (Netherlands)	Patents, Technology B62
		Global radical innovation (7)	Patents, Technology G
		External ideas for innovation (2)	Interview
		Home country development (1)	Interview; Patents, Technology H01
		Globally incremental innovations (3)	Interview; Patents, Technologies H01, H02
		Global revenue with old core product (3)	Interview; Patents, Technologies H01, H02
2004 – 2008	Secondary chains	New production facility in China 2004	Company history; Interview
		Home country development (1)	Interview; Patents, Technologies H01, H02
		Core knowledge developed (2)	Patents, Technologies H01; H02
		Radical innovation globally facilitated (2)	Interview

		New markets not further pursued (Netherlands)	Patents, Technology B62
		New products dismissed (4,5,6,7)	Patents, Technology G; B62; B60; G01
		Globally incremental innovations (3)	Interview; Patents, Technologies H01, H02
		Global revenue with old core product (3)	Interview; Patents, Technologies H01, H02
2008 – 2017	International embeddedness	Old core product not developed (3)	Patents, Technologies H01; H02
		No change in main direction of products (1and2)	Interview; Technologies H01, H02
		New production facility in India 201	Company history; Interview
		New production facility in Austria 2017	Company history; Interview
<i>Company B</i>			
1880 – 1992	Local embeddedness	Craftmanship, education	Company history
		Core product lines development, radical innovations	Patents, Technologies F16 G04 G11
		Old core product line developed, radical innovations	Company hist., Patents, Technologies G06 G01 G11
		International export of radical innovations	Company hist., Patents, Technol. G01 G04 G06 H01
		Old core product line developed	Company hist., Patents, Technol. G01 G04 G06 H01
		New product line started	Company history; Technology H01; H02
1992-2004	Exaptive adjustment	Incremental innovation globally introduced	Patents, Technology B29
		Global incremental innovations	Patents, Technologies H01; H02
		First production facility in Czech Republic 1994	Company history
		New technologies introduced globally	Patents, Technologies H05; B60; F21; E05
		Revenue for old core product peaks 1997	Company history; Patents, Technologies G
		Second production facility in USA 2001	Company history
		Global incremental innovations; Radical home	Patents, Technol. H01; H02; H05; B60; F21; E05; B29
		Growing revenue of old products	Company history; Patents, Technology G; H
		Old core knowledge repurposed	Patents, Technology F16
2004 – 2008	Secondary chains	Technologies dismissed	Patents, Technologies F21; E05; F4
		New directions sought (financial crisis)	Company history; Patents, Technologies A61
		Niche technologies to specific locations (US, China)	Patents, Technologies F16; B29
		Expansion of location in Czech Republic, 2004	Company history
		New location in China, 2008	Company history
		Growing revenue due to old products	Company history; Patents, Technology G; H
		Globally incremental innovations, radical home	Patents, Technologies H01, H02; B60
		Development of core product lines	Patents, Technologies H01, H02; B60
2009 - 2017	International embeddedness	Old core product ended	Company history, Patents, Technology G
		Focus on one industry	Company hist., Patents, Technology H01, H02, B60
		Core technologies developed, 5 product lines	Press material; Patents, Technologies H01, H02; B60
		Globally incremental innovations, radical home	Patents, Technologies H01, H02; B60
		New location in Mexico 2017	Company history; Press material

Table 3. Summary of main findings

Case A	Local embeddedness	Exaptive adjustment	Secondary chains	International embeddedness
	Core product 3	Global incremental innovation	Global incremental innovation	Not developed, Niche
	Core knowledge	New product 1	Home country development	Global incremental innovations; Line 1
		External ideas for innovation 2	Home country development	Global radical innovations; Line 2
		New products 4,5,6,7	Dismissed	
Case B	Local embeddedness	Exaptive adjustment	Secondary chains	International embeddedness
	Core product G	Global incremental innovation	Paused	Ended
	Core product H	Paused	Home country development	Core product line H
	Core knowledge F	New product Bb	Paused	Core product line Bb
		New product Fb, Ba	Paused	Core product and niche
		New products Fa, E	Dismissed	
		Collaboration A	Dismissed	