New ways of knowledge reprocessing: Absorptive capacity characteristics needed for the big bang disruption of free smartphone navigation applications

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TomTom's share price and likewise the revenue generated from the consumer market have decreased dramatically during the last years. The purpose of this paper is to examine the reasons behind this sudden drop, which has started to take its course at the end of 2007. Therefore this paper links the theory of big bang disruptions to the concept of absorptive capacity. This way the paper aims at providing a foundation for future research. In order to do so, this investigation draws on qualitative research methods. Secondary data is gathered from diverse sources and then associated to the applicable absorptive capacity phase. Based on the absorptive capacity phases, this paper outlines characteristics a firm needs for either conventional radical innovations or big bang disruptions. With the help of these elements, the research detects a lack of absorptive capacity characteristics needed for big bang disruptions on the part of TomTom. By proving that TomTom has to build up a different absorptive capacity than usual to meet the challenges of big bang disruptions, this research offers valuable insights into the concept of absorptive capacity. The information that the kind of absorptive capacity determines the type of innovation a firm pursues adds new value to scientific literature. Moreover the case study of TomTom serves as a foundation for future studies elaborating on the generalizability of these observations.

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1. INTRODUCTION

With the rise of the smartphone market, big bang disruptions appear to be omnipresent. The theory of big bang disruptions is built upon the concept of disruptive innovations characterized by Christensen (1997). According to him, disruptive innovations underperform established products at first, thus giving present companies time to act. Instead of beating incumbent products with superior performance, disruptive technologies develop other features leading to customer value (Christensen, 1997). For example disruptive technologies are often cheaper or more customized. This, however, does not seem to apply to big bang disruptive technologies anymore. Downes and Nunes (2014) have just recently figured out that that kind of disruptions can be better, cheaper and more customized at the same time. Consequently big bang disruptions compete on all three generic strategies at once instead of focusing on one of them. Firms pursue the strategy of low cost, differentiation and focus simultaneously. This, in turn, increases the speed of market adoption dramatically (Downes & Nunes, 2014). The classic diffusion curve is shortened because information barriers, which have previously raised concerns of the consumers, have declined. Consumers' purchases are usually well elaborated because of more information that exists due to review websites or social media services.

As an example for a big bang disruption Downes and Nunes (2013) suggest the innovation of free navigation applications for smartphones, which are competing with producers of classic portable navigation devices, such as TomTom. It is argued that these free smartphone navigation applications accomplish all three characteristics of a big bang disruption. They are considered to be better, cheaper as well as more customized than classic portable navigation devices. Although, as demonstrated later, TomTom has been continuously innovative, profits in the consumer market have been declining recently. This is probably due to the fact that smartphone applications like Google Maps, Waze or skobbler are offered either for free or for relatively little money. To make this possible Google Maps has adopted an "ad-supported business model" (Yovanof & Hazapis, 2008, p. 570). Waze and skobbler, on the other hand, are using user-generated maps to keep their costs to a minimum. It strikes that both business model differentiate considerably from the one TomTom has in place. The negative development in the consumer market is also reflected in TomTom's share price (see Figure 1), which has never really recovered since the economic crisis in 2008. Almost simultaneously, in 2007 and 2008, smartphones based on iOS and Android were launched. In combination with the previously mentioned navigation applications they started to constitute a substitute for the portable navigation devices.

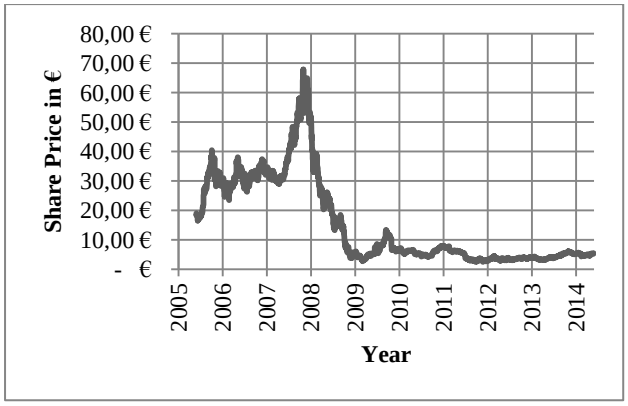

Figure 1: TomTom (Tom2.AS) Share Price Development, adopted from Yahoo!Finance (2014)

It seems that TomTom has lost its dominating position in the consumer market for navigation devices at the time smartphones were introduced to the market. Since the disruption has originated externally, brought to the market by other companies than TomTom, the obvious question is if TomTom could have prepared for the big bang by generating sustainable competitive advantage in order to keep up its supremacy. Several researchers have already suggested that firms can make use of external knowledge sources in order to search for new innovations, and thus performing sustainably better (e.g. Cohen & Levinthal, 1990; Fabrizio, 2009; Todorova & Durisin, 2007; Zahra & George, 2002). In order to analyze the knowledge gathering process of TomTom, the absorptive capacity model seems to suit best. In their paper, Zahra and George (2002, p. 198) reconceptualize absorptive capacity by defining it "as a set of organizational routines and strategic processes by which firms acquire, assimilate, transform and exploit knowledge for purpose of value creation".

This paper builds upon this model and connects it to the theory of big bang disruptive innovations. Given the fact that TomTom has continuously launched radical innovations during the last decade (see Figure 2), it can be assumed that TomTom has actually a high level of absorptive capacity. However, with this new kind of disruptive innovation, it seems to be more challenging for incumbent firms to keep sustainable competitive advantage. This is especially the case, since the new competition is often originating from other industries (Downes & Nunes, 2014). The aim of this research is therefore to find out if TomTom did require different absorptive capacity characteristics when responding to big bang disruptive innovation of free smartphone navigation applications.

Consequently the research question is:

To what extent do the elements of TomTom's absorptive capacity have to differ from the conventional absorptive capacity characteristics when it comes to big bang disruptions?

Disruptive innovations in general have gathered increasing attention with Christensen (1997), when several initially successful firms have suffered from them. However, the big bang disruption has only just been recognized as a new kind of disruptive innovation in scientific literature. Despite that, Downes and Nunes (2014) already discuss the characteristics and potential strategies on how to deal with big bang disruptions thoroughly. That is why this research focuses solely on the application of the concept of absorptive capacity on the theory of big bang disruptions. So far the concept of absorptive capacity has only been considered in relation with regular innovations. In addition, by providing a contemporary, detailed case study, more insights into big bang disruptions will be provided.

Based on the reviewed literature, several propositions will be formulated and examined with the help of desk research.

2. THEORY

2.1 TomTom – A short overview

In order to examine the relationship between the concept of absorptive capacity and the theory of big bang disruptions with the help of TomTom's case study, the company first hast to be introduced.

Founded in 1991 in the Netherlands, TomTom first started developing various software for handheld computers (TomTom, 2005). Only in 2004, TomTom launched its first portable navigation device TomTom GO (TomTom, 2005), a solution that offers both the necessary hardware and the navigation

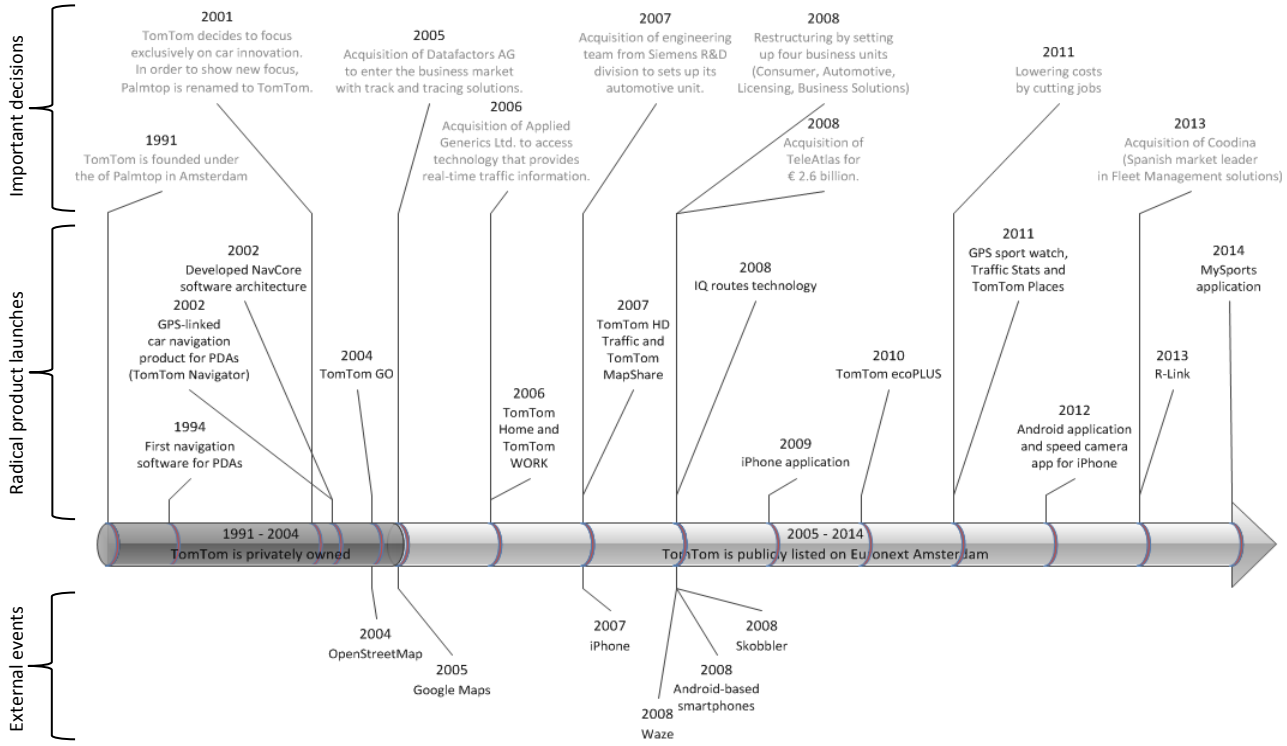

Figure 2: TomTom Timeline

software in one product. From then on, TomTom only launched products in the navigation system industry. One year later, in 2005, TomTom went public on the Euronext Amsterdam Stock Exchange.

The organization did not only constantly launch incremental innovations, but also started offering new solutions, thus expanding the business. According to Chandy and Tellis (2000) many researchers are convinced that large companies lose the ability to introduce radical innovations. However, although TomTom has got a large scale of operations, this does not seem to be the case here. The company has stayed innovative. As demonstrated in Figure 2, the company has launched several products and services over the years. For example, TomTom penetrated the business-to-business market in 2006 by launching TomTom WORK (TomTom, 2006). Furthermore, radical innovations such as TomTom RIDER for motorcycles or a GPS sport watch were launched in 2010 and 2011, respectively (TomTom, 2011a). Integrating additional service innovations like MapShare boosts customer value for TomTom (Shelton, 2009). This indicates that TomTom's absorptive capacity is actually quite sufficient when it comes to conventional radical innovations.

Next to that several companies have been acquired. This way TomTom has been able to vertically integrate itself. For this purpose the acquisition of a company creating mapping databases in 2008, that is TeleAtlas, was probably most important (TomTom, 2008).

This innovative behavior, among others, led to an enormous increase in revenues and share prices culminating at the end of 2007. Despite the innovative efforts, the share price started to decrease dramatically from then on. Revenues, more specifically the revenues arising in the consumer market, have dropped as well. "Between 2008 and 2012, TomTom's consumer revenue fell by more than half" (Downes & Nunes, 2014, p. 18). In its annual reports, TomTom has recognized that and argued repeatedly that the sales of portable navigation devices have reduced (e.g. TomTom, 2009, 2010, 2011a, 2012). Basically there are three argumentations for this. First of all the economic crisis could have had an effect due to its negative impact on consumer spending (Kotz, 2009). Secondly the market for portable navigation devices could have been saturated (Novelli, 2012). However, Novelli (2012) considers the technologic substitution of smartphone navigation applications to be the main reason for the recession in TomTom's consumer market.

It must be mentioned as well that TomTom has reacted promptly to the loss of sales of portable navigation devices by setting up three additional business units shortly after the share price recession in 2008. Next to the consumer market, TomTom currently also has automotive, licensing and business solutions (TomTom, 2008). Nevertheless, the damage of the smartphone market appears to have an ongoing effect on TomTom's business.

2.2 The big bang disruption of free smartphone navigation applications

The growing damage for TomTom starting from free smartphone navigation applications is in line with the theory of Downes and Nunes (2014), who state that big bang disruptions can wipe out whole markets over night. Indeed it seems like the market for portable navigation devices does not have much of a future.

Downes and Nunes (2013) name three characteristics, which differentiate big bang disruptions from regular disruptive innovations. The first characteristic is linked to the three generic strategies by Porter (2008), which are the pursuit of cost leadership, differentiation and focus. He claims that companies should focus on one of those strategies as prime objective to be able to compete in an industry. It happens only very rarely that firms are able to center more than one of those strategies at the same time (Porter, 2008). However, it seems like companies

launching big bang disruptions do not have to choose between these alternatives anymore. According to Downes and Nunes (2013, p. 52) big bang disruptions "compete on all three disciplines at ones": The innovations are both better, cheaper and more customized at the same time.

Secondly big bang disruptions also differ in their market diffusion. Traditionally, market adopters can be divided into five different types: Innovators, early adopters, early majority, late majority and laggards (Conway & Steward, 2009). Having that many different types of adopters implies that it takes some time until the product is completely adopted by the market. Downes and Nunes (2014), however, suggest that the innovation is adopted by everyone almost immediately. According to them there are two types of market adopters, namely trial users and everyone else.

Finally, big bang disruptions are said to distinguish from disruptive innovations in the way companies innovate. On the one hand, conventional disruptive innovations usually underperform entrenched products, but lead to customer value by changing other features, such as the price or the size of a product (Christensen, 1997). Big bang disruptions, on the other hand, "seek innovation through rapid-fire, [and] low-cost experimentation on popular platforms" (Downes & Nunes, 2013, p. 52). The fact that these experiments are carried out directly in the market suggests that it must be possible to spot potential big bang disruptions before market launch. This approach seems to be similar to the one of lean-startups. Here companies work together with potential customers in order to gain early feedback instead of developing in secret (Blank, 2013).

Often new technologies have made these direct market tests possible in the first place. It strikes that big bang disruptions are often combinatorial innovations. Here products are created by recombining different sets of technologies into something new (Varian, 2004). The major attribute of combinatorial innovations lies in the degree of novelty of the ideas used for the innovation. Brynjolfsson and McAfee (2012) state that ideas that are combined into a combinatorial innovation are not newly invented, but they already exist for some time. Consequently value is only gained through the combination of ideas, but not because of the ideas themselves.

Downes and Nunes (2014) refer to platforms from which companies can launch their big bang disruptions as exponential technologies. These exponential technologies allow companies to link diverse technologies with each other without having to invest any great effort. Smartphones are considered to be an example for such technologies.

"Product developers in a growing number of industries find combinatorial innovation is both faster and less expensive than having new parts custom-built to specification" (Downes & Nunes, 2014, p. 66). Consequently platforms like smartphones allow companies to shorten innovation cycles and to release products to the market without having to expect big losses.

Having another look at Figure 2, it can be noticed that the most prevalent smartphones were released at the time TomTom's consumer revenue started to decline. Almost contemporaneously with the introduction of the iPhone and Android-based smartphones in 2007 and 2008, free and low-priced navigation applications like Google Maps, Waze or skobbler were launched. With this development, TomTom's competition has broadened. Those companies have acted as described in theory by Downes and Nunes (2014): They have waited for the technology to be advanced enough and subsequently combined it with a suiting business model. Waze and skobbler are both based on OpenStreetMap, while Google's application is built upon Google Maps. As can be observed in Figure 2, the foundation for the disruptive applications has already existed several years in advance of the rise of smartphones: Both OpenStreetMap and Google Maps have existed already since 2004 and 2005, whereas smartphones were only launched in 2007 and 2008.

TomTom, on the other hand, only released its navigation application for iPhone and Android in 2009 and 2012, respectively. The firm reacted to the happenings in the environment, instead of being proactive. In addition TomTom's navigation apps are not free of charge, while products like Google Maps and Waze are. As shown in the following, these smartphone applications manage to pursue all three generic strategies of Porter (2008) at once.

Since companies like Google have adopted an ad-supported business model (Yovanof & Hazapis, 2008), they are able to pursue the generic strategy of cost leadership. Next to that Downes and Nunes (2014) also consider free smartphone navigation applications as better because they can be constantly updated and released. This process is more pedestrian with the classic portable navigation devices. In addition it is positively argued that smartphones support cloud-based computing, which leads to the fact that "data storage and data processing on the smartphone can be kept to a minimum" (Downes & Nunes, 2014, p. 20). Furthermore, since navigation applications are also integrated with the remaining features of smartphone, it can also be regarded as more customized (Downes & Nunes, 2014). As an example the link to social media as well as contact lists can be mentioned. This makes clear that the big bang disruption of free smartphone navigation applications is able to pursue all three generic strategies at once.

2.3 Absorptive capacity

In order to analyse TomTom's reaction on this complex phenomena, the concept of absorptive capacity seems very suitable, since it describes the external knowledge processing of an organization.

Absorptive Capacity has first been recognized as the "ability to recognize the value of new information, assimilate it, and apply it to commercial ends" (Cohen & Levinthal, 1990, p. 128). This basically describes the ideal process when dealing with external knowledge. Zahra and George (2002) even assume that firms can gain competitive advantage by adapting to dynamic market conditions. According to them, organizations can use their absorptive capacity to generate knowledge to create other organizational competences.

In their reconceptualization, Zahra and George (2002) divide the concept of absorptive capacity into two parts. First of all organizations can build up potential absorptive capacity including the acquisition and assimilation of external knowledge (Zahra & George, 2002). This is then, contingently, followed by an organization's realized absorptive capacity made up of the transformation and exploitation of external knowledge (Zahra & George, 2002).

The term acquisition describes the process of pinpointing and, subsequently, acquiring externally generated knowledge that is critical to a firm's operations (Zahra & George, 2002). Secondly, the assimilation of this external knowledge involves the comprehension and interpretation on an organizational level (Zahra & George, 2002).

Thirdly, "transformation denotes a firm's capability to develop and refine the routines that facilitate combining existing knowledge and the newly acquired and assimilated knowledge" (Zahra & George, 2002, p. 190). The two sets of information are often completely incongruent. If transformed successfully,

the external knowledge can be exploited in the end. Existing competencies can be leveraged or new ones can be created (Zahra & George, 2002).

Next to these two main building blocks, that are potential and realized absorptive capacity, Zahra and George (2002) also include activation triggers, social integration mechanism and regimes of appropriability as additional factors in their model influencing the process of absorptive capacity. Activation triggers are defined as the events causing the absorptive capacity process to start (Zahra & George, 2002). Next to that, social integration mechanism describe the extent to which information is shared within an organization (Zahra & George, 2002). In this context Zahra and George (2002) have determined that the use of such factors might decrease the gap between potential and realized absorptive capacity. Finally, "regime of appropriability refers to the institutional and industry dynamics that affect the firm's ability to protect the advantages of (and benefit from) new products and processes" (Zahra & George, 2002, p. 196).

This analysis, however, mainly focuses on the two fundamental building blocks, that are potential and realized absorptive capacity. These elements are assumed to be critical for the analysis. The additional moderators are only incorporated in the theory and analysis when clear differences between conventional and big bang disruption absorptive capacity characteristics become visible.

When it comes to this essential segmentation, it has to be annotated that "firms can acquire and assimilate knowledge but might not have the capability to transform and exploit the knowledge for profit generation" (Zahra & George, 2002, p. 191).

Based on the diverse radical innovations TomTom has launched (see Figure 2), it can be assumed that TomTom has got sufficient absorptive capacity to be innovative. That is why the question arises why TomTom failed to be proactive when the big bang disruption of free smartphone navigation applications was launched. It can only be assumed that the absorptive capacity process TomTom has implemented for conventional radical innovations differs from the absorptive capacity characteristics needed for the big bang disruptions.

This assumption leads to the following proposition:

P1: At the time the smartphones were launched, TomTom had built up sufficient absorptive capacity to launch conventional radical innovations.

Then again, the decline in consumer revenue and the persistent share price recession lead to the second proposition:

P2: At the time the smartphones were launched, TomTom failed to build up absorptive capacity characteristics needed to launch big bang disruptions.

This suggests that TomTom must change its reprocessing of external knowledge in order to act proactively on big bang disruptive innovations. As demonstrated in Table 1 the firm's characteristics needed for the two types of absorptive capacity do indeed differ. The most prevailing contrast seems to be the variation in speed. The absorptive capacity process appears to pass by much faster in case of big bang disruptions. It seems that all four phases take up less time than conventional innovations.

Starting with the acquisition of new knowledge firms conventionally interact with the environment with the help of a research and development department (Caloghirou, Kastelli, & Tsakanikas, 2004; Veugelers, 1997). Ideas from external sources and entities are gathered and investigated. Big bang disruptions, however, are usually built upon products that are already available in the market (Downes & Nunes, 2014). That is why the focus on research must have decreased. There is a shift from closed to open innovation (Chesbrough, 2003). Therefore companies increasingly rely on innovations made by other firms. Firms wanting to create big bang disruptions must proceed in the same way by especially looking out for alternative platforms instead from which their product or service can be launched. Furthermore a difference in the events triggering the acquisition can be observed. The absorptive capacity process is triggered either internally or externally (Zahra & George, 2002), for example by performance drops or radical innovations. This also applies to big bang disruptions. However, Downes and Nunes (2013) specifically mention that the acquisition of external information about big bang disruptions can also be triggered by failed experiments in the past. Accordingly, firms must also prospect those failed experiments and assess the information when it comes to big bang disruptions. Previously, this has not been considered as an important activation trigger in academic literature.

Regarding the assimilation of knowledge, it seems that, in order to launch big bang disruptions, it is especially important to create an organizational awareness for combinatorial innovations. Traditionally, it is said that prior knowledge should resemble the newly acquired knowledge in to some extent (Cohen & Levinthal, 1990). However, this seems hardly possible in case of big bang disruptions since new platforms can arise in completely different industries than the one the company is mainly operating in. Instead the knowledge base must be increased by working together with customers, suppliers or industry analysts (Downes & Nunes, 2014), who can help interpreting the gathered knowledge.

Since the importance of research during the phases categorized as potential absorptive capacity has declined, it can be supposed that the attention for the transformation and exploitation phase must increase. There are indeed some fundamental differences recognizable during the transformation of knowledge. First of all, firms have to combine knowledge that is already existent instead of combing existent knowledge with newly acquired knowledge. Exponential technologies must be combined with the existing product. Furthermore differences become obvious when it comes to the business model of a firm. Traditionally new business ideas are matched with the business model that is currently used by a firm. New product, service or process ideas are executed against the business model (Blank, 2013). In contrast to that, firms looking for big bang disruptions must search for new business models that suit the business idea (Downes & Nunes, 2014).

The main difference, however, is discernable during the exploitation. Conventionally, products are tested with a selected group of customers before being introduced in the market (Downes & Nunes, 2014). Big bang disruptions, however, are launched directly in the entire market (Downes & Nunes, 2014). This speeds up the entire absorptive capacity process dramatically. The time to market is decreased enormously because the product is tested directly with the consumers in the market. Companies launching big bang disruptions do not emphasize secrecy or patents because customer feedback is valued higher (Blank, 2013). Instead imitation becomes difficult for competitors due to other factors. For example a distinguishing business model can prevent competitors from copying the business idea.

All in all, it seems that big bang disruptions require a modified absorptive capacity process, which is less costly, but elapses much faster.

Table 1: Comparison of conventional and big bang absorptive capacity characteristics

	Absorptive capacity stages (according to Zahra & George, 2002)	Conventional absorptive capacity wisdom organizations follow in order to be innovative	Absorptive capacity wisdom organizations need to apply in order to launch big bang disruptions (unless indicated otherwise, information is derived from Downes & Nunes, 2014)

Potential absorptive capacity	*Acquisition*
	(Identify and acquire externally generated knowledge)
		• Absorptive capacity process is triggered either internally by organizational changes or performance drops or externally, e.g. by radical innovations or technological shifts (Zahra & George, 2002). Approach is more reactive.
		• Absorptive capacity in form of a full staffed Research & Development department (Veugelers, 1997).
		• Interaction with the environment (Caloghirou et al., 2004).
		  ○ External sources
		  ▪ Patent databases
		  ▪ Journals
		  ▪ Conferences
		  ▪ the Internet
		  ○ External entities
		  ▪ Firms
		  ▪ Universities
		  ▪ Research Centres
			• Absorptive capacity can be triggered by failed experiments in the past. Approach is more proactive.
			• Focus is not on Research & Development anymore because innovations are built upon readily available products.
			• Watch out for exponential technologies (platforms from which products or services can be launched).
			• Look out for different business models applied for competitive products.

	Assimilation *(Comprehending and interpreting the knowledge)*	• Prior technological knowledge must be similar to the newly acquired knowledge in order to facilitate assimilation (Cohen & Levinthal, 1990). • Prior knowledge should also be detailed, which fosters creativity (Cohen & Levinthal, 1990).	• Awareness for combinatorial innovations when interpreting the knowledge. • Increase the knowledge base by working together with customers, suppliers or industry analysts.
Realized absorptive capacity	*Transformation* *(Combine existing knowledge and newly acquired knowledge)*	• Combine existing knowledge with newly acquired and assimilated knowledge (Zahra & George, 2002). • The new business idea is matched with the business model currently in place (Blank, 2013).	• Combine knowledge that is already existent. The acquired knowledge is often not new and can thus be transformed faster (combinatorial innovation). • Connect exponential technologies with the existing product. • Search for new business models that suit the new product/service idea (Blank, 2013). • Big bang disruptions often require business model innovation at this phase.
	Exploitation *(Existing competencies can be leveraged or new ones can be created)*	• Testing with a selected group of customers followed by a contingent release to the entire market (Downes & Nunes, 2014). • Firms are "operating in stealth mode" (Blank, 2013, p. 67). • Patents are often considered as an indicator for the exploitation capability of a firm (e.g. Narasimhan, Rajiv, & Dutta, 2006; Zahra & George, 2002). • Failure is unexpected and considered as an exception (Blank, 2013).	• Launch low-cost experiments directly in the entire market. • The overall time to market is decreased. • No focus on secrecy or patents as customer feedback matters more than secrecy (Blank, 2013). • Pinpoint market entry with the right platform, partners and business model. • Failure is expected and fixed by iterating on ideas and pivoting away from ones that don't work (Blank, 2013).

3. METHODOLOGY

3.1 Data collection

In order to test the two propositions of this study data is gathered with the help of desk research. Consequently this study mainly consists of secondary data. Nevertheless, the analysis can benefit from both internal and external data.

The sample examined in this paper will be solely one firm, namely TomTom. This way this paper serves as an example case, which might later be generalized further.

As for the desk research, there are several sources to be examined. The Internet serves as the most valuable source when researching outside organizational boundaries because it offers several important sets of information for the market research on TomTom.

First of all there are journals publishing scientific articles. These journals are searched with the help of different search engines, namely Google Scholar and Scopus. In addition to that this paper is taking into account online communities such as blogs or forums, which might offer an additional view on the happenings in the past. Newspapers, documentaries and publicly available interviews are taken into account as well.

Finally, this paper also takes into account information published by TomTom itself. This includes annual reports, financial statements as well as press releases published on the company's website.

These types of information are systematically worked through in order to gather important views on TomTom's reaction on the big bang disruption of free smartphone navigation applications. To do so, this paper takes into account the three-step process about evaluating potential secondary data sources by Saunders, Lewis, and Thornhill (2009). According to them the first step of the evaluation is to assess the overall suitability of the gathered data. The relevance of the information for the research question and propositions is judged. During the second step, data is examined more detailed, weighing the validity and reliability. This leads to the final step, which includes the assessment of costs and benefits of the data. If data is not publicly available for free, this information is not taken into consideration.

3.2 Type of analysis

This analysis is a case-oriented analysis, meaning that the analysis aims to understand the particular case of TomTom's way of dealing with free navigation applications for smartphones.

Since there is no standardized method for qualitative analysis, Saunders et al. (2009) have found three dimensions of qualitative analysis. Based on these the type of analysis can be described. The first dimension considers the extent to which the analysis is structured. In this case the analysis is semi-structured. This can be explained with the help of the second dimension, which examines the formalization of the analysis. The analysis of this paper is formal to the extent that the data is categorized into different units. However, at the same time it also relies on interpretation because the data collected from the diverse sources is often ambiguous. The final dimension looks at the procedure of analysis. In this case the analysis is rather deductive with a predetermined analytical framework.

The coding units of this categorization are two building blocks of the absorptive capacity model, namely potential absorptive capacity and realized absorptive capacity, and the two types of innovation that are compared with each other, in this case the conventional radical innovations and the newly discovered big bang disruptions. Results gathered are only divided into the two categories potential and realized absorptive capacity instead of being separated into the four phases of absorptive capacity. This is due to the reason that it is difficult to find specific information on the assimilation and transformation phase within secondary data only. Often primary data is more insightful when it comes to these two phases.

The analytical framework is built corresponding with the theory presented in Table 1. The results are also presented in a Table comparing the theoretical absorptive capacity characteristics with the case of TomTom. In order to get a better overview, the results table only includes those absorptive capacity characteristics on which information has been found. The items left out in the results table are inked greyly in Table 1.

Furthermore, for the column of big bang absorptive capacity characteristics information on a late change of certain absorptive capacity characteristics is taken into consideration because it might offer clues on TomTom's absorptive capacity at the time before the smartphone navigation applications were introduced. This is equally applicable to information on the market. If there was certain information on the market, but it is lacking evidence that TomTom actually grasped that information, this information might also be useful for interpretation. That is why it is also included in the column of absorptive capacity elements needed for big bang disruptions.

This way the analysis can reveal if TomTom only had the absorptive capacity characteristics needed for conventional radical innovations at the time the smartphones were launched or if the company actually also had implemented elements needed for big bang disruptions already.

The analysis will be qualitative solely. This way the research question can be answered best.

4. RESULTS

4.1 TomTom's potential absorptive capacity characteristics

First of all, the results on TomTom's potential absorptive capacity are presented. This is then followed by the results found on TomTom's realized absorptive capacity and the revision of the hypotheses.

To start with, the results summarized in Table 2 give some indication on the activation triggers causing the absorptive capacity process on smartphone navigation applications to start. The platforms for the innovation of navigation applications were already launched in the late 2000s. To be exact, the iPhone was launched in 2007 and the first android-based phone was launched in 2008. However, the TomTom smartphone applications were only released relatively late in comparison to other navigation applications. The TomTom iPhone application was launched in 2009 (TomTom, 2009) and the android application in 2012 (TomTom, 2012). This indicates that the absorptive capacity process might have been triggered solely by the performance drop or the radical innovation of smartphones itself. At the same time scientific literature also proofs the symptoms for big bang disruptions actually have been there. Experiments combining GPS devices with mobile phones have been performed more than ten years prior to the introduction of the first smartphone (e.g. Makino, Ishii, & Nakashizuka, 1996). However, there is no evidence that TomTom actually grasped that information.

In fact TomTom has continuously tried to deemphasize the threat of smartphones and the related platform innovation of free smartphone navigation applications (Laurent, 2008). Chief executive Harold Goddijn denoted mobile phones as less sophisticated than classic portable navigation devices

Table 2: Summary of results on TomTom's absorptive capacity

	Conventional absorptive capacity characteristics (carried over from Table 1)	Information found on TomTom	Absorptive capacity characteristics for big bang disruption (carried over from Table 1)	Information found on TomTom and its market. (Information might also originate from the years after the smartphone launch)
Potential absorptive capacity	*Absorptive capacity process is triggered internally or externally*	Late release of smartphone applications (TomTom, 2009, 2012) suggests that TomTom has acted in a reactive way instead of being proactive. TomTom did not take the threat of smartphones seriously (Laurent, 2008).	*Absorptive capacity process especially triggered by failed experiments in the past*	There were several experiments combining GPS devices with mobile phones (e.g. Makino et al., 1996).
	Focus on Research & Development department	Increasing Research & Development expenses year by year up to 2008 (TomTom, 2005, 2006, 2007, 2008, 2009, 2010, 2011a, 2012, 2013a).	*Less focus on Research & Development*	Reorganization of Research & Development department only in 2011: Reduced time to market (TomTom, 2011b).
			Look out for exponential technologies	Rumors about the iPhone since 2002 already (Markoff, 2002).
			Look out for competitors applying different business models competitive products	OpenStreetMap and Google Maps already exist since 2004 and 2005. Both companies use different business models than TomTom (Yovanof & Hazapis, 2008).
			Working closely together with customers, suppliers or industry experts to increase knowledge base	Only recently TomTom has invited its community to work actively together on projects (TomTom, 2013b, 2014).
Realized absorptive capacity	*Existing knowledge is combined with new knowledge.*	TomTom's focus was not on combinatorial innovations, but on creating something new and improving existing products incrementally (compare Figure 2).	*Knowledge that is combined with each other is already existent (combinatorial innovation).*	iPhone application in 2009 was TomTom's first combinatorial innovation (compare Figure 2).
	Business model currently in place is executed against the gathered knowledge	TomTom's business model is pressurized by smartphones. This indicates that TomTom has kept its business model instead of looking for new ones (Wolde, 2010). TomTom rejects the business model of Google and Nokia, who are offering their navigation services for free (Turton, 2010).	*Search for new business models that suit the new product/service idea*	Most applications are offered for free at the moment (Kimbler, 2010). Common business models for mobile applications are freemium based ones, business models where you pay per-usage (Müller, Kijl, & Martens, 2011) or ad-supported business models (Yovanof & Hazapis, 2008).
	Testing with a selected group of customers; operating in stealth mode, use of patents to protect the innovation	During 2006 and 2007 TomTom has issued several patents (Orbis, 2014): Three patents in 2006, two patents in 2007.	*Low-cost experiments directly in the entire market, no focus on secrecy or patents*	Number of patents TomTom issued has decreased from 2008 onwards (Orbis, 2014): one patent in 2011 and one in 2012.
			Overall time to market is decreased	TomTom decreased its time to market only recently (TomTom, 2011b).

(Laurent, 2008). In addition he said they were too small to compete with the standalone devices of TomTom (Laurent, 2008). TomTom representatives pointed out that, according to their opinion, smartphone navigation applications would not replace classic portable navigation devices (Kaplan, 2010). This is comparable to its main competitor Garmin, who failed to see the threat of smartphones completely (Hesseldahl, 2003, 2012).

Resemblances can also be determined when it comes to the element of looking out for exponential technologies when building up potential absorptive capacity. There are rumors about the iPhone since 2002 already (see Markoff, 2002). Nevertheless, it seems like TomTom did not take that into consideration when planning future products or services.

The same applies to the big bang absorptive capacity element of looking for different business models applied on competitive products. For example OpenStreetMap and Google Maps already exist since 2004 and 2005, respectively. Both companies have implemented business models that are fundamentally deviating from the one TomTom uses (Yovanof & Hazapis, 2008). This information could be used during the realized absorptive capacity phase when it comes to business model innovation.

Regarding TomTom's collaboration with customers, suppliers or industry experts, press releases demonstrate that TomTom has invited its community to work actively together on projects only recently (TomTom, 2013b, 2014). This implicates that TomTom did not collaborate that closely with its stakeholders at the time the first smartphone navigation applications were launched.

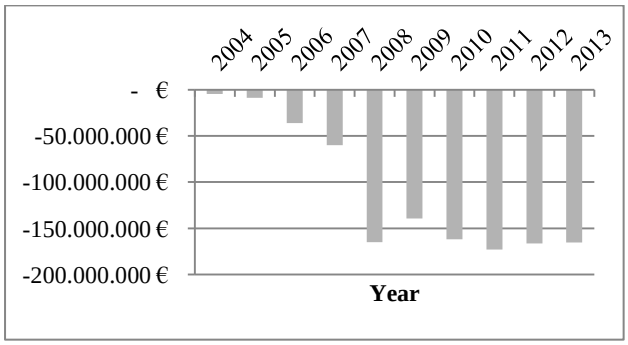

Figure 3: Research and development expenditure TomTom

Furthermore, the theoretical framework discussed in Table 1 suggests that the absorptive capacity characteristics a firm needs for big bang disruptions differ in terms of research and development practices. In order to develop big bang disruptions the focus on research and development is supposed to have decreased because combinatorial innovations are built by combining existing knowledge. Yet TomTom's research and development expenses have increased year by year up to 2008 (TomTom, 2005, 2006, 2007, 2008, 2009, 2010, 2011a, 2012, 2013a). This is also demonstrated in Figure 3. Later, in 2011 TomTom reorganized the department in order to simplify new product introductions (TomTom, 2011b). The focus on research and development is herewith decreased. The fact that TomTom only changed its research and development department in 2011 affirms the assumption that TomTom had only built up sufficient conventional absorptive capacity characteristics at the time the smartphones were released to the market.

As for TomTom's potential absorptive capacity, it can be summarized that the hypotheses are applicable to the case of TomTom. At the time the first smartphones were built TomTom had built up sufficient potential absorptive capacity to launch conventional radical innovations, whereas the absorptive capacity elements needed for big bag disruptions were virtually nonexistent. However, the results also reveal that TomTom has adapted some of the potential absorptive capacity needed for big bang disruptions at a later point in time.

4.2 TomTom's realized absorptive capacity characteristics

Comparable to its potential absorptive capacity, TomTom did not have the necessary realized absorptive capacity either in order to meet the challenge of big bang disruptions at the time the first smartphone was launched.

To begin with the type of knowledge TomTom uses for its innovations is analyzed. Conventionally existing knowledge is combined with new knowledge to be radically innovative. This is also what TomTom did. The company's focus did not lie on combinatorial innovations, where solely existent knowledge is combined with each other. As summarized in Figure 2 TomTom consistently used newly gathered knowledge for its innovations or tried to improve its products incrementally. TomTom's very first portable navigation as well as service innovations like TomTom MapShare can serve as an example. The iPhone application in 2009 was TomTom's first combinatorial innovation.

One of the most prevailing differences in organizational absorptive capacity characteristics is the way business models are handled. Traditionally acquired and assimilated knowledge, which is transformed into a new product or service idea, is adjusted to the established business model. This has indeed also happened in the case of TomTom when the iPhone and Android smartphone application was innovated. As pointed out by Kimbler (2010) most smartphone applications are offered free of charge. Therefore common business models used in the mobile application market are, for example, freemium-based ones. Here the application itself is offered for free, but to in order to access certain content the user is charged extra (Müller et al., 2011). Other examples include pay per-usage business models (Müller et al., 2011) or ad-supported business models (Yovanof & Hazapis, 2008). However, TomTom has rejected business models of its competitors like Google or Nokia, who are offering their navigation services for free (Turton, 2010). Although its business model has suffered from the free navigation applications offered by competitors (Wolde, 2010), TomTom has decided to stick with it. The organization is executing the gathered knowledge against its business model instead of adapting it to the circumstances of the new market. This demonstrates that TomTom has not adopted the absorptive capacity characteristics needed for big bang disruptions on this point.

Next to the differences in business model innovation, absorptive capacity also differs for big bang disruptions when it comes to the actual market launch. Traditionally, firms have mostly operated in secret before launching a product. This way and by issuing patents, companies could prevent competitors from copying new product, process or service ideas. As suggested by Zahra and George (2002), the number of patents TomTom issued over the years has been examined to ascertain its exploitative capability. It turned out that TomTom has compiled relatively many patents before the release of smartphones, whereas the number of patents issued after the release of smartphones is relatively low. During the years 2006 and 2007 TomTom issued a total of five patents (Orbis, 2014). After those years TomTom only issued two more patents in 2011 and 2012 (Orbis, 2014). The patents mainly relate to the portable navigation device itself as well as services such as the dynamic travel information and other minor methods.

Finally, Downes and Nunes (2014) mention one more absorptive capacity characteristic needed for big bang disruptions, that is a reduced time to market. TomTom has reorganized its organization to achieve that (TomTom, 2011b). However, the restructuring process has happened in 2011 after the smartphones have been on the market for some time already. Hence it can be reasoned that TomTom's time to market was longer at the time the big bang disruption of free smartphone navigation applications was launched. Consequently the company did not meet this characteristic at that point in time.

After all, all signs point to the propositions that TomTom did meet the conventional realized absorptive capacity standards at the time the smartphones were launched, but was missing the realized absorptive capacity characteristics needed for big bang disruptions. It strikes, however, that TomTom has built up many of those characteristics during the years after the smartphone launch.

Thus the propositions seem to be true for both stages of absorptive capacity, namely potential and realized absorptive capacity. There are no signs that TomTom had also built up any absorptive capacity elements needed for big bang disruptions at the time the smartphones were launched.

5. DISCUSSION

This section is used to interpret the results. By this means the research question regarding TomTom's absorptive capacity elements is answered. At the same time possible reasons and causes for not having adopted the absorptive capacity characteristics needed for big bang disruptions are discussed. Finally, this part also considers this paper's contribution to existing literature.

This research reveals some essential absorptive capacity elements needed for big bang disruptions that have not been considered as necessary before. Starting with the activation triggers for each absorptive capacity process, some major differences regarding the intensity of the trigger can be observed. Concerning this matter Zahra and George (2002, p. 194) state that "the intensity of the trigger will influence the investments in developing the requisite acquisition and assimilation capabilities". Conventionally, the absorptive capacity process was mostly triggered by organizational changes, technological shifts or performance drops. This also applies to this case study. The item triggering the absorptive capacity process needed for big bang disruptions, however, is much more proactive. Organizations have to look out actively for failed experiments in the market. Comparing the two activation triggers for the different types of absorptive capacity in TomTom's case, the intensity of the trigger might indeed have been a decisive factor. It seems natural that the intensity of the latter approach is far lower than, for example, performance drops. Consequently the experiment of the integration of GPS systems in mobile phones might be have appeared to be too superficial, leading the company to focus primarily on other matters.

As for the realized absorptive capacity, the way business models are handled has turned out to be majorly different. While companies executed their business model against new product, process or service ideas traditionally, they now have to look for new ones that are actually suitable for the new business idea. However, in practice this can be quite challenging for companies. For example a change in business model can often lead to a decrease in revenue for the existing products or services at first. "Typically, the gross margins for the emerging one are initially far below those of the established technology" (Chesbrough, 2010, p. 358). In case of TomTom, the existing portable navigation devices would probably need another business model than the smartphone application. This is how a conflict might arise. In order to overcome those challenges, Chesbrough (2010) points out that companies have to develop the organizational capability of business model innovation first.

Thirdly, one of the most prominent differences in absorptive capacity characteristics between conventional radical innovations and big bang disruptions is the way firms operate and launch the product. For the customary radical innovations, companies have often operated in secret to prevent competitors from copying a product. However, for big bang disruptions this process is conversed. Companies need to try to include customers as early as possible in the innovation process in order to gather valuable feedback. This can be problematic from several perspectives. First of all a tradeoff between conventional radical innovations and big bang disruptions emerges from these two contrasting approaches. Companies cannot pursue both strategies at the same time as the two features secrecy and openness fundamentally differ from each other. Furthermore, it can also be difficult from a change management perspective. Stakeholders and especially employees have to be convinced that something, that was previously taken for granted, now has to be changed.

Recapturing the research question, it can be said that the results manifest several changes in absorptive capacity when it comes to big bang disruptive innovations. These elements have to be segmented into two categories. On the one hand there are some absorptive capacity characteristics that influence the way firms think and act only slightly. To these belong, for example, a decreased focus on research and development or an increased collaboration with customers, suppliers and industry experts. On the other hand big bang disruptions require certain absorptive capacity elements that must change TomTom's way of thinking. Partly these elements were taken for granted previously. Therefore they were often not even considered when being concerned with a firm's absorptive capacity. One element serving as an example is the way business models are dealt with. The continuous search for new business models was not even considered an option before the rise of big bang disruptions. Other aspects differentiating enormously from traditional absorptive capacity elements are, for instance, the absorptive capacity triggers or the focus on combinatorial innovation. Consequently the results highlight that TomTom has to change its absorptive capacity elements fundamentally in order to adjust itself to big bang disruptions. However, it is also proven that this has already happened to some extent.

After all, the results also imply that there is one more dimension that distinguishes not only one particular phase of absorptive capacity, but the entire process. This is the matter of speed. It has turned out that the various absorptive capacity characteristics needed for big bang disruptions speed up the entire absorptive capacity process. On the one hand there is the decreased effort spent on research and development because the knowledge is already available in the market. This is associated with the platforms providing the basis for combinatorial innovations. As observed in the TomTom case, companies often do not have to develop hardware on their own any. Taking into account the example of navigation applications, the software, which was already used elsewhere, just had to be transferred to the platform of a smartphone. This can save precious time. Next to that there is the fact that big bang disruptions are launched directly in the market. This equally decreases the overall time to market.

Due to this acceleration of the absorptive capacity process, it can be reasoned that realizing the absorptive capacity is of

particular importance in the case of big bang disruptions. Only by releasing experiments quickly to the market, extensive feedback can be gained. Gathering feedback from customers and other stakeholders is, in turn, the essence of big bang disruptions. In contrast to conventional radical innovations, it is not that much of a problem if the experiment is a failure or not.

At this point, it has to be annotated that the absorptive capacity characteristics found to be necessary for big bang disruptions resemble the theory of born globals ins many respects. Born globals are considered to be young venture pursuing the goal of internationalization immediately after the start of the firm (Gabrielsson & Manek Kirpalani, 2004). Accordingly, companies like Waze or OpenStreetMap can also be considered as such. Freeman, Hutchings, Lazaris, and Zyngier (2010) register similarities such as the rapid knowledge development or the proactive strategy for building absorptive capacity to generate knowledge. This suggests that born globals might have the perfect absorptive capacity requirements to launch big bang disruptions. Following this thought, companies aiming at launching big bang disruptions, might want to try to act like a born global.

All in all, the research question can herewith be confirmed positively. There are noteworthy differences between the absorptive capacity elements needed for conventional radical innovations and those needed for big bang disruptions in the reviewed case of TomTom. The firm has to make extensive changes regarding its absorptive capacity in order to adjust to big bang disruptions. Then again the changes in a firm's absorptive capacity might require changes in the organizational structure as well.

As described above, these modifications might be difficult to implement as some of the absorptive capacity characteristics are firmly established in the TomTom's core strategy. The company's business model is just one example for this purpose.

Finally, potential unintended consequences that might arise when adopting the absorptive capacity characteristics necessary to pursue a big bang disruption innovation strategy have to be discussed. Since TomTom has not actually implemented those characteristics yet, the unintended consequences can only be studied theoretically. Analyzing the absorptive capacity characteristics needed for big bang disruption, the question arises if there is a tradeoff between the conventional absorptive capacity characteristics and those needed for big bang disruptions. For example a decreased focus on research and development, which is assumed to be an absorptive characteristic for big bang disruptions, automatically leads to the fact that the conventional absorptive capacity characteristic is less developed. Similarly, a focus on platform innovation could lead to a neglect of regular radical innovations.

6. SCIENTIFIC AND PRACTICAL IMPLICATIONS

This research contributes to existing literature by pointing out differences in absorptive capacity for big bang disruptions. The paper proposes several absorptive capacity elements that are specifically needed for big bang disruptions. Since the concept of big bang disruptions has only recently been scientifically ascertained, this paper is the first to analyze the effect of big bang disruptions on a firm's absorptive capacity. The fact that the type of innovation a firm wants to pursue must be compatible with the firm's absorptive capacity is also new. So far researches have not differentiated between the various types of innovation when exploring the concept of absorptive capacity. If the features found in this study can be generalized, future literature on absorptive capacity has to take into account the type of innovation that is discussed.

On top of that this paper offers a detailed explanation on the rapid decrease of TomTom's share price commencing at the end of 2007. Generally the case of TomTom, which has only shortly been broached by Downes and Nunes (2014), is examined in more detail in this paper and, simultaneously, associated with the concept of absorptive capacity.

Before elaborating on the practical implications of this research, this section first summarizes the way TomTom has actually reacted on the iPhone threat. TomTom has adapted its strategy almost immediately after the dramatic drop in share price by shifting the focus on other business units (TomTom, 2008). It seems that TomTom has advanced this plan over the years. An intense restructuring program followed on the announcement in 2008, which reinforced TomTom's strategy (Cowan, 2011). TomTom CEO Goddijn has realized that the consumer unit might distort the real company value (Hijink, 2013).

Next to that, it has to be mentioned that TomTom has actually built up several absorptive capacity characteristics needed for big bang disruptions by now. For example, results have shown that TomTom reorganized its research and development department in order to decrease the total time to market. Furthermore the company's community has been invited to collaborate actively.

Nevertheless, this paper still reveals additional insights on TomTom's absorptive capacity. The practical recommendations can be divided into the four phases of absorptive capacity pointed out by Zahra and George (2002), namely acquisition, assimilation, transformation and exploitation. As for the acquisition phase, it can be recommended to TomTom to prospect experiments applying the company's core technology, which is the navigation software itself, on other platforms. While this paper has focused on the analysis of smartphones as such platform, there are currently also new platforms on the rise. Head-mounted display glasses can be taken as an example. In fact companies already experiment with navigation applications on data goggles like Google Glass (Fox & Felkey, 2013). At the same time information for other business models popular on certain platforms has to be assimilated.

As for the transformation and exploitation phase, it is most important to experiment directly in the market on a low-cost basis. The cost-effective experiments entail that it is not much of a problem if some experiments fail at first. However, it is of great relevance that managers do not directly move on from failed experiments, but gather the customer feedback. This can then be used develop further experiments.

Generally, TomTom is well advised to act proactively when it comes to big bang disruptions. Instead of waiting for information on failed experiments from other firms, TomTom can experiment itself directly in the market.

If TomTom aims at pursuing a big bang disruption innovation strategy, the company must pay special attention to those absorptive capacity characteristics that call for large-scale organizational conversions. To these belong, for instance the constant search for new business models. The fundamentals of a business have to be transformed in order to accomplish the challenges of this characteristic. A good change management capability is not to be underestimated at this point. Stakeholders need to be prepared for change to overcome potential resistance.

Next to the implications describing the extent to which this paper is meaningful for TomTom itself, this section also discusses the relevance for other companies. Concerning this matter, it has to be mentioned that Downes and Nunes (2014)

consider the phenomenon of big bang disruptions to be industry-overarching. Thus it can be speculated that the absorptive capacity characteristics for big bang disruptions discussed in this paper might be valid not only for other companies in the navigation industry, but also for other industries beside the one of navigation. However, the relevance of this paper for other companies and industries can only be suspected. The hypotheses remain unproven though.

7. LIMITATION AND FUTURE RESEARCH

This research is limited in multiple ways, which need to be discussed at this point. Potential restrictions are discussed based on the criteria of measurement quality pointed out by Babbie (2009). To these belong precision and accuracy as well as reliability and validity.

First of all the extent to which the attributes are explained detailed and precisely has to be considered. Some ACAP elements suggested to be necessary for big bang disruptions might lack precision. The collaboration with customers, suppliers and industry experts can be taken as an example. While previous, conventional radical innovations are also assumed to approve of such collaboration, the features of a big bang disruption are expected to increase the intensity of such partnerships. However, since it is not known to what extent the intensity of teamwork increases for big bang disruptions, this research only looks for general evidence for some development in this area. Generally the novelty of the big bang disruption theory complicates the elaboration of exact measurements, as many of them have not been scientifically recorded yet. Nevertheless it must be annotated that, although the measurements could be more precise, the level of detail satisfies the research requirements for now because differences in absorptive capacity have become obvious either way.

As for the accuracy of the data, it can be said that in this specific case secondary data gathered from independent sources can principally be assumed to be more correct than primary data gathered from TomTom itself. This is due to potential biased answers that could be given by TomTom. Beside the internal data gathered from press releases and annual reports, this paper also takes into consideration various external, independent sources. While many results found in this study are proved with the help of distinct sources, there are also multiple suppositions that are examined based on one source only. This is due to the scarcity of data on this specific case. Although this paper is limited with regard to its triangulation, it can still be assumed to be sufficiently accurate due to the variety of sources.

This is related to the reliability of this research. Regarding this matter, it can only be said that both internal and external data gathered for the results have confirmed the hypotheses. Despite that the question arises if primary data in form of a qualitative interview with TomTom representatives would confirm the results gathered in this paper.

Regarding the validity of a study, it can only be assumed that the measures in this study reflect the concept of absorptive capacity sufficiently. The measures are mostly adopted from existing research. The exact assignment of the different company characteristics to the phases of absorptive capacity ensures the validity of the measures to the greatest extent. All in all it can be said that the qualitative measurements used in this study have more validity but less reliability.

Finally the question for the extent to which this study is applicable on other cases remains widely unanswered. That is why this paper serves as a foundation for future research in every respect. Since Downes and Nunes (2014) have proven the theory of big bang disruptions to be valid for multiple industries, there are grounds to believe that the absorptive capacity characteristics noticed based on the TomTom case might also be applicable to other business and industries. However, this potential generalizability has to be proven first.

In this case the theoretical framework is tested by means of the TomTom case. It might be wise to retest the framework of absorptive capacity characteristics on similar firms that have experienced an equivalent drop in share price. TomTom's competitor Garmin seems to be useful for this retest. At the same time the test should also be carried out on firms in other industries to determine if the results found in this paper are valid in multiple industries. In addition a quantitative analysis with multiple firms and industries would be useful to increase the reliability of this study.

Additional future research concerning the theoretical framework proposed in this paper can be done by finding more organizational characteristics needed for big bang disruptions. This paper has only adopted the obvious characteristics that have already been found in existing literature. However, since the theory of big bang disruptions is only researched as of recently, it can be assumed that there are still some characteristics missing in this framework.

8. CONCLUSION

To conclude this paper, a very widespread intellectual approach can be reminisced: "If you keep doing what you're doing you'll keep getting what you get" (Anonymous according to Cameron & Green, 2012, p. 29). Organizations must overcome this thought and constantly try to change in order to survive. The case discussed in this paper illustrates that solely relying on the innovation of portable navigation devices would have been a fatal mistake for TomTom. Especially with the rise of big bang disruptions, companies have to be aware that entire markets can cease to exist all of a sudden.

This paper proposes a conceptual framework, with the absorptive capacity process proposed by Zahra and George (2002) as theoretical underpinning, to expose differences in firms' characteristics needed to launch conventional and big bang disruptive innovations. The results show that TomTom has to renew its absorptive capacity. The conventional absorptive capacity characteristics are not sufficient to launch big bang disruptions, which seem to be on the rise since the introduction of the smartphones.

It has also become clear that the changes coming with big bang disruptions are extensive. Organizations have to focus on many areas at the same time. Managers need to explore absorptive capacity characteristics that have not even been taken into account previously. For example the field of business model innovation has to be considered from now on.

From a scientific perspective, this paper adds substantially to the research area of absorptive capacity by proposing a new theoretical framework. However, further studies are needed to examine the generalizability of this theoretical framework and to complement it if necessary.

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