THE FUTURE OF CURRENT BUSINESS:

A research on the effect of temporal profile synchronization on product development in business-to-business relations for different industrial market segments of electronic bicycles

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"We must use time as a tool, not as a crutch."

John F. Kenney (1917 – 1963)

Bachelor Assignment

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Abstract

What is the relation between temporality and new product development? This important question has not been answered to date because the concept of temporality has been defined to broadly. To include the concept of temporality in organizational research, temporal profiles of network actors should be addressed. Only a few studies to date have emphasized the importance of temporal profiles in business networks. To date, no research has been conducted on the relation between temporal profiles and new product development.

The present study first emphasizes the importance of a contingency approach in general. Subsequently it argues that effective management of B2B new product development is a means of ensuring business. Based on these two statements, it is argued that management of new product development should be contingent with customers' wishes, which are defined by market segmentation. After that, the process of achieving exactly that contingency is called synchronization. That synchronization is regarded from a temporal approach, based on three temporal constructs, which are assumed to determine temporal profile of market actors: timing, duration, and stability. In other words; the study emphasizes the importance of temporal synchronization of business-to-business new product development with wishes of client companies in different market segments.

Data collection takes place from the Dutch industrial design office INDES and is focused on E-bike active assistance devices (AADs). AADs are supportive modules consisting of an electromotor, a battery, motion sensors, a control panel and wiring. Data is gathered by three different methods; interviews with current INDES client companies, participant observations at INDES itself, and a questionnaire that is sent to 181 E-bike producing companies in 15 countries. 54 Companies from seven different countries responded, providing a forthwith 30% response rate. Response rate in the Netherlands, the research's native country, is found to be more than 60%. All data regards the three temporal profile constructs; timing, duration, and stability. The three constructs have been developed for this research specific. However, they can be used for future research as well. With help of the gathered data, this study develops a method of contingent, proactive market orientation.

The study findings imply that (1) client companies can meaningfully be divided into market segments based on their temporal profile - formed by timing, duration, and stability - and (2) new product development decisions can be based upon temporal profiles. The segmentation base that is derived from the findings is product use. The two resulting target segments are: ordinary users and users with a physical disability. Findings also show that product management should be synchronized with a temporal profile that is determined by the characteristics: (1) end-user influence on timing, (2) number of dealer-ordered modifications, (3) economical timing, (4) capacity timing, (5) supplier relationship, and (6) influence of external factors.

These implications make logical sense. For if in new product development a firm grounds decisions merely on market segmentation bases as product use or customer size the changes of creating true value for customer are low. Such a business is vulnerable not only for guessing the base of product value for the customer but more so to competitors that do adjust their product to the customer's temporal profile. Synchronization of new product development and customers' temporal profiles is intuitively obvious though never examined. This study empirically supports its significance.

Moreover, the study findings provide INDES with practical recommendations. Recommendations include the advice for product development synchronization with two specific market segments (normal users and users with a physical disability), the advice for innovation focus on E-bike AAD battery and controller, and the advice for a more assertive contract negotiation with future client companies.

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1. Introduction

Staying in business is ultimately the core purpose of all organizations. Different roads lead to Rome, for this subject no different. A method to ensure sustainable growth is to anticipate on future scenarios. Only then organizations can make projections of future activities and strategies.

The range of possibilities for researching the desired development of current business is endless. Therefore one has to choose to be able to achieve academic valid statements. This study draws on a temporal perspective, describing the relation between the temporal profile of industrial customer segments and product development.

In this paper I discuss a specific case of an organization located in Enschede, the Netherlands. The remainder of this chapter will describe the organization, that is the initiator and subject company of this research, industrial design bureau INDES. After that, INDES' problem and the research purpose are explained. That explanation results in a research question with three attached sub-questions. To answer those questions, a theoretical framework will be presented and key terms will be operationalized to measurable indicators. Subsequently the paper will elaborate on the method of research, the analysis of research results, conclusion and recommendation.

1.1 INDES

Originally, INDES is an industrial design bureau. The organization's roots are in product design. However, next to that, the firm started actual production. There even is an INDES production facility in China now. All products are aimed at business-to-business (B2B) markets. The markets INDES is active in are: human care, medical cure and user comfort. Examples of products are: patient lifts, Braille terminals, donor organ transport systems, inhalers, GPS systems for motor cyclists, bicycle carriers and wheel chairs.

The focus of this research will be on Active Assistive Devices (AADs) for electronic bikes (E-bikes). AADs are supportive modules consisting of an electromotor, a battery, motion sensors, a control panel and wiring. These modules, also known as 'kits', are designed and produced in close cooperation with the client company. In the case of AADs for E-bikes the client company is the E-bike manufacturer. The E-bike manufacturer will subsequently market INDES' product as part of his end product.

INDES operates in niche markets, also with the AADs. The firm's goal, and slogan, is to create products people can rely on. Therefore the fact that the products aim at the high-priced, high-quality market segments will not be a surprise.

2. Problem & purpose statement

At INDES there is uncertainty about the correct configuration of the product AADs for E-bikes. To date, the company has designed and produced an AAD kit for high-segment E-bikes, which the company sells to three E-bike producers. After some start-up difficulties INDES now has a modern and high-quality product.

However, the E-bikes have emerged only ten years ago and have been gobbling market share ever since. The market has not stabilized yet (Sangani, 2009). With that fact in mind, INDES is interested in the future of its current business. In other words: how should the current product be developed to be contingent with a future market?

INDES has uncertainty about the focus that innovation should have. Next to that, the firm does not have enough information about industrial market segments to adjust product development activities. This is important because a desired market position can only be achieved if product or service characteristics are constantly aligned to customers' wishes (Plank, 1985).

Next to Plank's (1985) article, review of academic literature illustrates the importance of alignment of customer value and product development. In the late 1960s several contingency approaches were developed. In general these approaches suggest there is no one best way to organize a company. There is no one best way to lead a company, no one best way to make decisions. Instead of a fixed course, the optimal situation is contingent upon the company's

internal and external environment (Perrow, 1967); (Lawrence & Lorsch, 1967). There must be a fit (Thompson, 1967).

A decade after the introduction of the contingency approach Abell (1978) mentions several strategies to ensure sustainable business. One of those strategies is to shift a firm to segments where the fit between the market's requirements and the firm's own resources is optimal. E.g. a firm with few, high-skilled, flexible employees has a better fit with a complex-product niche market than a firm with many, one-skill trained employees. To achieve this fit, a firm needs the correct information to assess with which market(s) the fit is possible.

Driva ea. (2000) emphasize that effectively managing and measuring the product development process is widely seen as a means of ensuring business. A general company's goal is to ensure business, for INDES ensuring business was the reason for initiating this research. Ensured business can be reached through maintaining or improving the product's market position (Driva, Pawar, & Menon, 2000).

In a review of research in product development Krishnan & Ulrich (2001) describe product development as the transformation from market opportunity to salable product through assumptions about technology. They argue to "look inside the black box" (p. 1) by looking at the decisions in the production development process. The authors state that product strategy and planning involve decisions about the firm's target markets. Thus, they emphasize the significance on alignment of target markets and product development. On this statement is placed extra emphasis in this research for aligning product development and target market (segments) is a way of effectively managing product development (Krishnan & Ulrich, 2001) and effectively managing product development is a means of ensuring business (Driva ea., 2000). Consequently alignment of product development and target market (segments) can form a solution for INDES' problem. It can create ensured future business for the current E-bike AAD kits.

Probably the most convincing argument for INDES to adjust the product development to the customer value in the market segments is provided by Narver, Slater, & MacLachlan (2004). In a research on the influence of market orientation on new product success these authors demonstrate a positive relation between a proactive market orientation and new product success. Data from a sample of technologically diverse businesses implies that for any business to create and to sustain new product success, a responsive market orientation is not sufficient and, thus, that a proactive market orientation plays a very important positive role in a business' new product success.

Based on these five academic publications I draw the conclusion that the alignment of product development and market segments is essential for ensuring sustainable business for INDES.

Similar to clarification of importance of the alignment of product development and customer wishes, the choice for temporal perspective of to date's research must be reasoned. I argue that the temporal lens is the correct perspective in this specific case because strategic activities in product development should be timed to be compatible with the rhythm of other connected businesses. In other words, internal activities need to be in synch with the key processes of other firms in the network (Eisenhardt & Brown, 1998). Also, INDES must be sure to synchronize production development activities with client companies. For that reason I hereby refer to about Planck's (1985) term of alignment no more. From here on I will use the term 'synchronization'.

To be able to accomplish that synchronization, temporality (possible) client companies' key processes must be known. Perks (2005) and Ancona, Goodman, Lawrence, & Tushman (2001) agree with Eisenhardt & Brown (1998) by arguing that notions of timing and synchronization have been – maybe poorly, superficially at most - understood and conceptualized as central elements in organizational life. Timing norms govern many activities in new product management. Perks (2005) concludes by stating that co-ordinating the temporal patterns of behaviors is a significant challenge for new product development.

Next to that Andersson & Mattsson (2010) have recently produced a framework that advances our understanding of how actors construct temporality of resource adjustment activities to handle cyclical adjustment activities in business networks (Loohuis, von Raesfeld, & Groen,

2010). The relations INDES has with client companies forms a business network. The efforts spend in product development are resource adjustment activies. Thus, according to the recent publication of Andersson & Mattsson (2010), it would be interesting to investigate the influence of temporality on the interplay between targetted segments and product development processes.

Another way of expressing the significance of time is given by sociological research. Giddens (1979) points out the influence of time by concluding all patterns that excist are situated in time. Time is an essential dimension of organizational life (Bluedorn & Denhardt, 1988) because all social processes do not only stretch in time but are also lived in time (Sztompka, 1993).

INDES states that the firm is interested in the future of current business. I argue that INDES is interested in change. The firm wants to know how the E-bike AAD kit should be changed – innovated – in order to keep up with market change – development. Sztompka (1993) states that change apart from time is simply inconceivable. Second, the terms 'future' and 'current' represent two of the three possible timeframes: past, present and future. Apperently INDES is interested in – though perhaps not explicitely – temporality because accurate future projections and expectations of how to create value with customers depends on how well present exchange activities with customers in customer segments are synchronized.

A third argument for the neccessity of temporal perspective in this research is the phenomenon of customer's desired value change in a business-to-business context (Flint, Woodruff, & Gardial, 2002). The authors shed light on the nature of customers' desired value change and related contextual conditions. Change in customers' value provides a reason for customers to seek, maintain, or move away from relationships with suppliers. Also for this argument, change is the indicator for temporal involvement for change occurs over time (Sztompka, 1993). Flint et al. (2002) state that B2B customers change their wishes periodically, some more rapidly and extensively than others. The difference in speed and extensiveness of customer value change is related to a difference in market dynamics. Finally product characteristics are influenced. This demands that supplier companies – like INDES – recognize and understand the implications of changes and temporality in customers' desired value. If not, failure may account in part for the loss of key customers, failure of new products, and erosion of brand equity (Flint, Woodruff, & Gardial, 2002).

The purpose of this thesis is primarily to create knowledge about the problem at hand and provide INDES with an advice that enables the firm to anticipate on future product development (Saunders, Lewis, & Thornhill, 2003). Secondary, I attempt to contribute to existing literature on the relationship between product development and marketing strategies. More specific, I deal with marketing strategy from a perspective that aims at synchronizing temporal profiles of business partners. A temporal profile can be seen as "*a combination of four temporal characteristics: sequential structure, duration, localization in a wider sequences and repeatedness or uniqueness*" (Sztompka, 1993: p. 55); (Andersson & Mattsson, 2010: p. 918).

3. Research question

The essence of this research is the main question, which will be supported by three secondary questions. The four questions are presented in textbox 1.The main question originates from INDES' general objective to initiate this research: acquiring knowledge in order to prepare the current E-bike AAD kits for future business. The final phrasing of the main research question originated through preliminary qualitative research in the form of discussion sessions with an INDES industrial design engineer, an INDES account and product manager and a University of Twente researcher / lecturer with primary interests in the field of new product development in strategic alliances and teaching activities in the field of product development and marketing for industrial designers, and strategic marketing. Consequently, the resembled research objective is to be able to advice an aligned configuration of product and market with which INDES' E-bike AAD kits are prepared for the future.

The first secondary research question originates from the need of data about temporal profiles in different E-bike market segments. The description presented by these data would enable INDES to make a distinction between client companies with different temporal profiles. Data gathered by use of the second secondary research question presents information on the way

product development should be adapted to be contingent with the temporal profiles of client companies. The third secondary research question combines the information gathered by the first and second secondary research questions. The result is a specific advice on how to adapt the INDES product development process or product characteristics of E-bike AAD kits in order to create a fit with temporal profiles of client companies and prepare for the future. The four research questions follow from the theoretical framework that is presented in the next chapter.

How can INDES optimize the configuration of product and market for E-bike AAD kits?

1. What are the temporal characteristics that constitute the temporal profiles of each E-Bike target segment?
2. What are the consequences of these temporal profiles for product development?
3. How can INDES synchronize product development process in relation to target markets of E-bike AAD kits?

Textbox 1: Research questions

4. Theoretical framework & operationalization

The first paragraph of this section starts with an overview of academic theory discussing temporal profiles of industrial market segments. The second paragraph first adds academic perspectives on market segmentation to this study's theoretical framework. Then temporal profile synchronization of industrial market segments and product development processes is discussed.

4.1 Temporal profile of industrial market segments

In this paragraph temporal profile and industrial market segments are first discussed separately. The paragraph finishes with a description of their cohesive relations.

4.1.1 Market Segmentation

Market segmentation has attracted an immense interest in the marketing literature and is considered one of the most influential strategic marketing devices (Boejgaard & Ellegaard, 2010); (Plank, 1985). Market segmentation has been defined as "*an ongoing and iterative process of examining and grouping potential and actual buyers with similar product needs into subgroups that can then be targeted with an appropriate marketing mix in such a way as to facilitate the objectives of both parties"* (Mitchell & Wilson, 1998: p. 443), and as *"the subdivision of a market into distinct subsets of customers, where any subset may conceivably be selected as a target market to be reached with a distinct marketing mix"* (Plank, 1985: p. 80).

A market segmentation decision with huge significance is the determination of segmentation base. The base is indicator of the variables on which segmentation is made. In academic literature there is great dispute about the correct industrial segmentation base. Some authors argue segmentation should be based on customers' buying habits (Cardozo, 1980); (Schiff, Fernandez, & Winer, 1977); (Frederick, 1934). Frederick (1934) also emphasizes segmentation based on possible distribution channels, geographic location and industry. Another possibility for industrial segmentation base is end user (Assael & Ellis, 1976); (Unger, 1974); (Hummel, 1954); (Frederick, 1934). Segmentation based on environmental factors such as competition, demographic criteria, economy, technology or socioeconomic criteria is also an option (Johnson & Flodhammer, 1980); (Schiff, Fernandez, & Winer, 1977); (Cardozo, 1968). It is also possible to base industrial market segmentation on the purchasing strategy (Wilson, Mathews, & Sweeney, 1971); (Cardozo, 1968) or on market behavior criteria (Johnson & Flodhammer, 1980) (Schiff, Fernandez, & Winer, 1977).

From now on the focus in this paper will be on the industrial segmentation bases of Unger (1974); customer size and end products. These bases are applicable for industrial (business-to-business) markets of raw materials, processed materials, components and capital goods (Unger, 1974). This applicability makes the bases perfectly suitable for INDES' ADD kits

for they are components on an industrial (business-to-business) market. There is a clear distinction between INDES' customer size and the form and application of end products, so the bases are usable.

4.1.2 Temporal profile

"*Strictly speaking, there is no present, because social processes are continuous, and at every conceivable moment they are incessantly passing from the past to the future. They are already in the past, or no longer in the future. Even as I am writing these words, each sentence is already in the past before I completed it.* (Sztompka, 1993: p. 43)

Apperently, time is an omnipresent aspect of our lives. In daily life the synchronization necessity of temporal constructs is evident. Just imagine quasi routine activities e.g. drinking a cup of tea. Tea can only be drunk after the tea bag has been in the water. Before that the water should have boiled. After that, the time that the tea bag has been in the hot water must be contingent with one's personal flavor to prevent one from drinking wish-wash. Eventually one has considered sequencing, timing and duration – all temporal constructs – before being able to drink a cup of tea. Just imagine what temporal constructs are needed to watch a favorate television program or to meet some friends. Temporality is constantly linked to one's daily actions.

Identically, to date's publications link temporality to organizational practices; "*temporality is intimately linked with firms' strategic behavior*" (Andersson & Mattsson, 2010: p. 917). The authors argue that strategic behavior should be contingent upon the environment's temporality. I support this point of view and emphasize the significance of the influence of time in the conduction of contemporary business. For one, that influence results from the numerous temporal shifts and synchronization pressures present-day companies have to endure (Andersson & Mattsson, 2010); (Loohuis, von Raesfeld, & Groen, 2010). Next to that "*All social phenomena occur at some moment in time. All social processes stretch over time. In short, social life is lived in time. Time, like space, is a universal context of social life"* (Sztompka, 1993: p. 41).

In literature, there are different approaches to time (Das, 1987). In general, three themes divide the concept of temporality; (1) the time perception – or orientation of actors (Sztompka, 1993); (Loohuis, von Raesfeld, & Groen, 2010); (Andersson & Mattsson, 2010), (2) the temporal profile of activities (Bluedorn & Denhardt, 1988); (Sztompka, 1993); (Andersson & Mattsson, 2010), and (3) the temporal dimensions (Sztompka, 1993); (Loohuis, von Raesfeld, & Groen, 2010).

Loohuis et al. (2010) describe the time perception of people together with the cultural orientation on time and the relation between the two concepts in a dyadic business relationship. Subsequently the authors attend to the matter of influence of temporal perception towards a focal business' relations with respect to its past, present and future and temporal orientation on synchronization of businesses in a yet established business relationship after the development of a new activity. It was found that temporal orientation (i.e. differences in scope, speed and cultural interpretation of time) may long be unnoticed in buyer-seller business relationships but can become a burden once the organizations engage in joint new product development. Andersson & Mattsson (2010) unfold temporal orientation as the length in which actors are orientated in the past or the future. According to last mentioned authors actors' temporal orientation can differ to various extents as a result of differences in position in firm or market, experiences, cognitions, strategic intentions etc.

Temporal profile is the second approach that is extensively elaborated on in literature. It can be seen as "*a combination of four temporal characteristics: sequential structure, duration, localization in wider sequences, and repeatedness or uniqueness*" (Sztompka, 1993: p. 55); (Andersson & Mattsson, 2010: p. 918). Sequential structure is the pattern of specific stages, e.g. daily routines or economic growth. Duration is simply the time an action lasts. Localization in wider sequence is the actual moment the action occurs. Repeatedness or uniqueness of an action is indeed the fact whether there is a chance on repetition of the action or not (Sztompka, 1993). Six functions are recognized in this frame of temporality; synchronization, coordination, sequencing, timing, measuring, and differentiating (Sztompka, 1993); (Andersson & Mattsson, 2005); (Andersson & Mattsson, 2007). Of those six functions, timing and synchronization are aspects of interest in this research. The reason for this choice will be explained in paragraph 4.3.2.

The last temporal approach that is elaborated on in this paragraph is temporal dimension. This approach focuses mainly on the influence of time on (business) relations. Subjects as timeframe, tempo, synchronization and interdependent action are described (Loohuis, von Raesfeld, & Groen, 2010). Perks' (2005) study is concerned with the way firms identify, specify and temporally coordinate partner activities in a networked development context. Ultimately she states that pacing and synchronizing of partner activities have a positive effect on thrust of joint product development activities. Medlin (2004) focuses on the temporal influences on dyadic business relationships from a social and economic exchange point of view. Even though several authors wrote articles on temporal dimensions (Loohuis, von Raesfeld, & Groen, 2010); (Perks, 2005); (Medlin, 2004); (Halinen, 1998), academic knowledge on the subject still is not widespread.

This research does not regard time perception; rather it regards synchronization of temporal profiles in actual time. That is; it does not include the way individuals experience time but in tries to synchronize measurable time-aspects of different entities with different temporal profiles. In this research a temporal profile is created by the entity's timing, duration, and stability. The choice for those three constructs is elaborated on in paragraph 4.3.2.

4.1.3 Temporal profiles as market segmentation base

The cohesive relation between industrial market segmentation and temporal profile is subject of interest in this study. To date, little to no literature on this specific topic has been published. This research intends to monitor and expose the temporal profile of INDES, client companies, and possible client companies. Consequently a segmentation of the (possible) client companies – the market – can be based on their temporal profiles. After that, INDES can synchronize the internal temporal profile of products and processes correctly to the external temporal profiles of different target market segments. This way the temporal profiles serve as a market segmentation base.

4.2 Temporal profile of market segments & synchronization with product development processes

Although E-bikes are by no means a new phenomenon – when pedal cycles were invented in the 19th century, engineers were already experimenting by adding various motorized engines – product development in this sector has exploded in the last ten years. Competitors keep developing to improve battery weight, range and recharge time. The motor is also subject to many changes. Power, energy use, location and noise are important variables for the engine. Finally, the control panel is a part on which competitors try to differentiate (Sangani, 2009).

Next to the results, the methods of product development can form a competitive advantage too. Cooper & Kleinschmidt (1994) plead for a focus on timeliness in product development. According to them, speed enhances competitive advantage, speed enables firms to respond quickly to changing markets and technologies and speed means greater profitability. In their research they uncover six drivers of speed to market. The top three drivers that result from their research are: project organization, upfront homework and strong market orientation (Cooper & Kleinschmidt, 1994).

As stated before, product development can be seen as the transformation from market opportunity to a salable product through assumptions about technology (Krishnan & Ulrich, 2001). In the design and development community at least four common perspectives can be recognized; marketing, organization, engineering design and operation management. Krishnan & Ulrich (2001) discuss several aspects of product development for these four perspectives. Next to that the authors present a literature overview of product development decisions and emphasize the importance of decisions on supply-chain design, product design, performance testing, product launch, product strategy, planning, and product portfolio.

Other authors employ a contingency theory (Thompson, 1967) based perspective on product development (Calantone, Vickery, & Dröge, 1995). Calantone ea. (1995) state that no single set of product development activities or steps can be defined that will be appropriate for all firms. A best practice does not exist. Nevertheless the authors argue that it is possible to optimize a set of eight production development activities within the confines of one specific industry ("*original product development, product flexibility, design quality/innovation, new product development,*

new product introduction, product tech. innovation, product development cycle time, and product improvement", p. 220). When these eight activities are adjusted in a correct way – contingent with the industry's internal and external environment – they have a strong positive influence on return on investment, return on investment growth, strength of market share, market share growth, return on sales and return on sales growth (Calantone, Vickery, & Dröge, 1995). In other words, synchronization of product development with an industry's characteristics should result in ensured business.

Also from the resource-based view, perspectives on product development are presented (Eisenhardt & Martin, 2000). The authors demonstrate that product development is one of a firm's three dynamic capabilities. Eisenhardt & Martin (2000) define dynamic capabilities as "*The firm's processes that use resources – specifically the processes to integrate, reconfigure, gain and release resources – to match an even create market change. Dynamic capabilities thus are the organization and strategic routines by which firms achieve new resource configurations as markets emerge, collide, split, evolve and die"* (p. 1107). This definition is similar to the definitions given by other authors, for example by Floricel & Ibanescu (2008). Kogut & Zander (1992) use the term 'combinative capabilities' to describe organizational processes by which firms synthesize and acquire knowledge resources, and generate new applications from those resources. Henderson and Cockburn (1994) similarly use the term 'architectural competence' while Amit and Schoemaker (1993) use 'capabilities'. From this definition one can conclude that product development can be used as strategic routine to achieve new market configuration. The two other dynamic capabilities discussed by Eisenhardt & Martin (2000) are strategic decisions, and alliances.

Concluding, in this paragraph the need for synchronization of market and product development has been made plausible. Synchronization should be positively related to flexibility, profitability, competitive advantage, ROI (growth), market share (growth) and ROS (growth) (Eisenhardt & Martin, 2000); (Cooper & Kleinschmidt, 1994). It can be assumed that those positive effects assist in ensuring business. Now the need for synchronization of market and product with primarily the temporal perspective discussed in paragraph 4.1, secondary the contingency theory (Thompson, 1967) that has been discussed several times in this paper, and thirdly the theory about industrial market segmentation (Unger, 1974) can be combined. That combination results in the assumption that a synchronization of temporal profiles of industrial market segments and product development processes can be a means to ensure business.

In other words:

The better firms anticipate on temporal characteristics of industrial market segments and synchronize these characteristics to product development activities, the more successful a firm will be in ensuring future business.

4.3 Operationalization

This final chapter of paragraph four discusses the choices that are made in this research' operationalization of the concepts industrial market segments and temporal profiles. It shall conclude with figure 1, which gives a simplified representation of the theoretical framework.

4.3.1 Industrial market segments

Following Unger (1974) the industrial market of AAD kits is segmented by the use of two bases; customer size and end products. The number of employees active at the client company is the indicator defining customer size. For customer size there are three possible dimensions based on an ordinal level of measurement (Babbie, 2006). A small client company employs 1-50 people, a medium-sized client company 50-100 and a big client company 100 or more. The end product is divided into three dimensions based on end use (Assael & Ellis, 1976); (Unger, 1974); (Hummel, 1954); (Frederick, 1934) and the type of customer being dealt with (Roberts, 1961). A nominal level of measurement is used (Babbie, 2006). The first dimension is formed by the E-bikes produced for commuters. The second dimension is formed by recreational users. People with a disability form the third dimension.

4.3.2 Temporal characteristics that constitute temporal profiles of industrial market segments

In this research temporality is subdivided into three characteristics that constitute temporal profiles of industrial market segments, i.e. timing (Andersson & Mattsson, 2010); (Sztompka, 1993); (Moore, 1963), duration (Andersson & Mattsson, 2010); (Sztompka, 1993); (Bluedorn & Denhardt, 1988) and stability (Sztompka, 1993). After a literature study, the choice for these three characteristics is derived through two processes.

First, a selection of twelve temporal characteristics has been acquired from the academic literature. This selection is presented in table 1. Of this selection another selection is made. The four most cited characteristics (timing, duration, sequential structure, and synchronization) are selected. Based on personal interest and presumed significance in this research an extra characteristic is selected: stability (rate of change).

Temporal characteristics	Andersson & Mattsson (2010)	Sztompka (1993)	Moore (1963)	Bluedorn & Denhardt (1988)	Loohuis, Reasfeld & Groen (2010)
☑ **Timing**	p922	p51	p8		
● Speed/tempo	p922				p7
☑ **Duration**	p918	p55		p305	
☐ **Sequential structure**	p918	p51	p8	p301	
● Scale		p45			
☑ **Stability (rate of change)**		p44			
☐ **Synchronization**		p50	p8	p303	p13
● Measuring		p51			
● Differentiation		p52			
● Localization	p918	p55			
● Repeatedness	p918	p55			
● Long/short term orientation	p919				p6

Table 1: Temporal characteristics per author (•☐ = not selected ☐ = not selected ☑☐ = selected)

Second, the number of used temporal characteristics is narrowed down through discussion with an INDES industrial design engineer, and INDES account / product manager (the same two persons with whom I discussed the research questions). Two characteristics are dismissed: sequential structure and synchronization.

One reason to dismiss sequential structure is the fact that timing and duration combined, describe much of the sequential structure of internal processes. Despite that, it could have been interesting to research the sequential structure of the complete supply chain of E-bikes. However, this topic is rather off course from research subject. A second reason is the fact that an external process like a complete product supply chain is hard to influence. Therefore information describing it could hardly add value to a solution for INDES' problem. For those who state that INDES' should adjust temporal profiles of internal processes to sequential structures (other than customer processes) of external processes; this is true. Nevertheless this would be a research topic on its own.

Synchronization is removed from the list of temporal characteristics but has certainly not left the picture. The reason to remove it from the list is the fact that it would make little sense to research it as a temporal characteristic. E.g. in Sztompka's (1993) definition synchronization states: "*for collective action, people must be at the same place at the same time"* (p. 50). In our opinion, a more useful approach is to regard synchronization as a final goal. Therefore, in this research synchronization does not aim at collective action (Sztompka, 1993) but at alignment of market segments and production processes. This is supported by secondary research question #3 and paragraph 4.2.

After removal of sequential structure and synchronization, three temporal characteristics remain: timing, duration, and stability. More important than the argument why some characteristics have not been chosen is arguing why these three are.

Sztompka (1993) explains timing as: "*some activities can only be undertaken when specific facilities and / or resources are available"* (p. 51) and Andersson & Mattsson (2010) point it out as issue for further research in the relationship between temporality of the focal actor and the structures and

processes of market networks. This research includes timing as a temporal characteristic because I believe that it can contribute in stating a solution for INDES' current problem. Timing factors must be considered in product development. E.g. seasonality has demonstrated influence on new product introduction and dictates business strategy for nearly every product (Radas & Shugan, 1998). Another example is the moment of product introduction. Carrillo & Franza (2006) state that product introduction must be timed in such a way that marginal value of sales for old and new product is even.

Duration, Sztompka (1993) describes it as "*the length of time something lasts*" (p. 55). Well, that is not a rather new point of view. However, when looking at the right 'something', duration revaluates in an interesting issue. The length of time production lasts (time-to-market), the time that a product can last in the market (time-on-market / product-life-cycle), the time it takes to achieve maximal production capacity (ramp-up time) and the time business network relations last are all factors to consider in product development. Therefore duration should be researched.

Stability as temporal characteristic is an odd man out in this paper for it has been selected even though it was only cited once in academic literature (Sztompka, 1993: p. 43). Still, I think it should be included, because it does not exist. Stability is nothing but a handy convention; everything changes always and constantly (Sztompka, 1993). Therefore 'rate of change' is added to the characteristic. This rate of change implies temporal connection, for change apart from time is inconceivable (Sztompka, 1993). Also from practical perspective, INDES should have knowledge about external change and synchronize production development with it.

As announced at the start of this paragraph, figure 1 gives a simplified representation of the theoretical framework. Table 2 in paragraph 5.4 gives an overview of the operationalization of market segmentation and the three temporal characteristics.

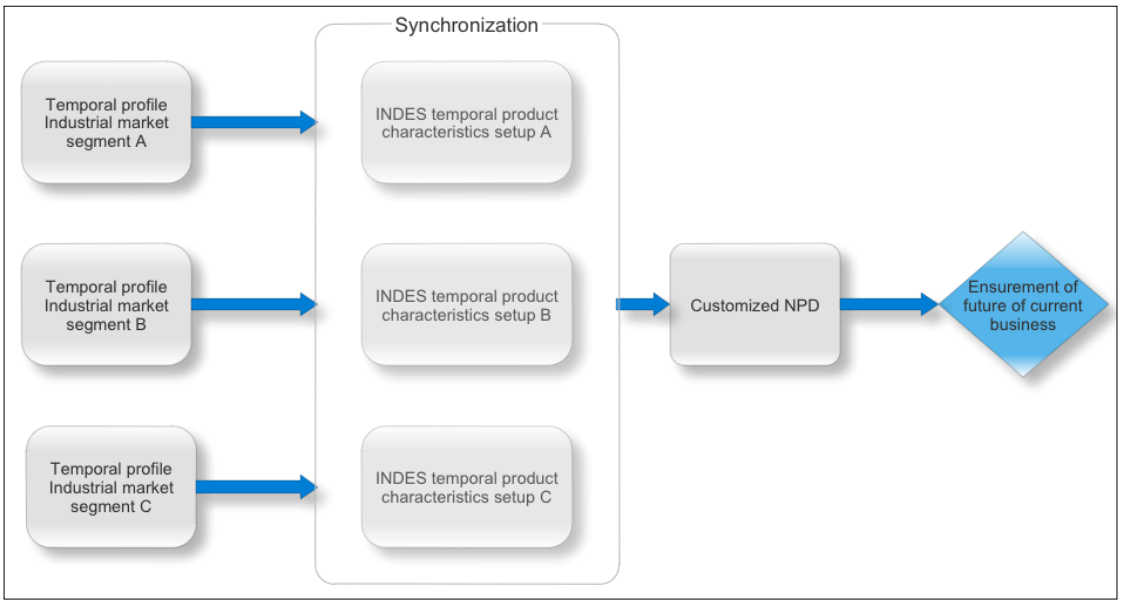

Figure 1: Theoretic framework: First, the temporal profiles of the different industrial market segments are investigated. Second, the consequences for INDES product characteristics are determined. Third, the consequences are translated to product development. This is the synchronization process. Synchronization will lead to customization of new product development, which is assumed to lead to ensurement current business in the years to come.

5. Research methods

This chapter will discuss the methodological method of this research. To collect data I chose to apply both qualitative and quantitative data collection techniques (Yin, 2009). I chose for a cross-sectional, multi-method analysis of product and/or sales managers of E-bike-manufacturing firms using open-ended in-depth tape-recorded interviews (Shadish, Cook, & Campbell, 2002), participant observation with an observer as participant role (Saunders, Lewis, & Thornhill, 2003), and on-line self-administered questionnaires (Babbie, 1990).

Participant observation is a qualitative research method in which the researcher participates in the activities of the unit(s) of analysis. It is a variation of ethnographic interview,

i.e. repetitive, open, and extensive interview aimed at achieving an account of organizational efforts (Czarniawska, 2004); (Spradley, 1979). This is achieved by getting close and intimate with a given group of individuals - in this case INDES employees - and their practices by intensive involvement in their natural environment - INDES office - over an extended period of time - November 2010 – March 2011 - (van Maanen, 1979); (Glaser & Strauss, 1967).

First the choice for the units of analysis is explained. Second the chosen variables are discussed. Third I elaborate on the design strategy. Fourth, the research design itself is argued. Finally, fifth, I elaborate on the procedures.

5.1 Units of analysis

The units of analysis in this thesis are the perceptions about the three mentioned constructs of product and/or sales managers of E-bike-manufacturing firms. There is no geographical restriction; product and/or sales managers of firms from every country can participate. For the distinction of E-bike-manufacturing firms there neither are many restrictions; both bicycle- and tricycle-producing firms apply. Next to that firms who buy an E-kit from a subcontractor or unrelated manufacturer and install it on a non-E-bike are seen as E-bike-manufacturing firms. E-bike importing or retailing firms cannot participate.

The choice perceptions of product and sales managers as respondents is made in accordance with an INDES industrial design engineer, and an INDES account & product manager. The reason for this choice is the knowledge about the E-bike market that a respondent must have to fill in the questionnaire. Product and sales managers are expected to have the essential and most accurate knowledge.

The choice not to apply a geographical restriction is based on the knowledge that INDES is an international operating company. INDES is able to order from and deliver to client companies on global level. Therefore it is relevant to gather data on global level.

The reason for not excluding tricycle-producing or E-kit-installing firms is the fact that INDES' AAD kits can be used for both products. A current INDES' client is already installing AAD kits on tricycles and companies that are installing E-kits could switch to installing INDES' kits. Therefore it is also relevant to gather data on those two company types.

The choice for excluding E-bike importing or retailing firms is based on the assumption that product of sales managers of companies of that kind do not have the essential knowledge. Evidently the firms do have market information about the sector. Nevertheless they miss the practical experience of producing an E-bike.

INDES processes are a unit of analysis too. To be able to describe the consequences of the temporal profiles of E-bike industrial market segments on INDES, information about the companies' processes is needed. My role as participant observer will provide for this information.

5.2 Variables

Five variables result from chapter 4. There are two independent variables; company size and product use (Unger, 1974). The other three are dependent variable constructs: timing (Andersson & Mattsson, 2010); (Radas & Shugan, 1998); (Cooper & Kleinschmidt, 1994); (Abell, 1978), duration (Nadeau & Casselman, 2008); (Carrillo & Franza, 2006); (Driva, Pawar, & Menon, 2000); (Radas & Shugan, 1998); (Klepper, 1996); (Cooper & Kleinschmidt, 1994), and stability (Golder, 2000); (Paladino, 2008); (Floricel & Ibanescu, 2008). The choices for these variables are already discussed in chapter 4. On the next page, table 2 presents an overview.

5.3 Design strategy

When applying exploratory research one must be extremely prudent to make general statements because it's results are not typically generalizable to populations at large. This is a huge disadvantage. Another downside of exploratory research is the fact that substantial numeric conclusions are hard to make. On the other hand exploratory research results can answer why, how, and when a certain point of interest occurs (Babbie, 2006).

This research is exploratory. There are several reasons for this design choice. First the problem was not clearly defined initially. INDES wanted a research to describe 'the product's future' in order to maintain sustainable business. This is a rather ambiguous and broad problem

definition. Exploratory research helps to determine the best research design, data collection method and selection of subjects (Babbie, 2006). A second reason to choose for exploratory research design is the fact that research temporal synchronization of business processes is a considerably new research field. Third reason for exploratory research design choice is the fact that applied research in Business Administration is often exploratory because there is need for flexibility in approaching the problem (Babbie, 2006).

5.4 Research design

Data for this research is gathered by a cross-sectional multi-method analysis. Cross-sectional research is a research method often used in social science. It utilizes respondents who differ on many variables but share one characteristic. Cross-sectional research differs from longitudinal research in that cross-sectional studies are designed to look at a variable at a particular moment in time. The use of routinely collected data allows cross-sectional studies to be made at little or no expense. This is a major advantage over longitudinal study. Longitudinal study does give much stronger evidence, which is the disadvantage of cross-sectional research. For this research limited time and means are available, therefore the choice is made for a cross-sectional design (Yin, 2009).

In multi-method research design, multiple methods are used to gather data. In this research I chose for three methods; qualitative investigation by use of open-ended interviews, quantitative investigation by use of questionnaires and qualitative data collected as participating observant. In this approach, the qualitative investigation helps to clarify the nature of the issues under investigation (Saunders, Lewis, & Thornhill, 2003). The proof is presented in the statistical analysis of the quantitative data. As stated in paragraph 5.3 the problem was not clearly defined. Multi-method research is well fitted in situations with an ambiguous problem definition (Babbie, 2006). That is the main reason I chose to use a multi-method research design. Nevertheless there are more advantages of multi-method analysis.

Construct Name and Items	References	Indicator
MARKET SEGMENTATION		
Company size	Unger (1974)	Number of employees.
Product use	Unger (1974)	Medical / practical use.
TIMING		
Influence of seasonality	Radas & Shugan (1998)	Division of sales.
Influence of customers (end users)	Andersson & Mattsson (2010), Cooper & Kleinschmidt (1994)	Question with 7-points Likert scale.
Influence of competitors	Andersson & Mattsson (2010), Abell (1978)	Question with 7-points Likert scale.
Influence of environment	Andersson & Mattsson (2010), Walsh (2005)	Question with 7-points Likert scale.
Economical timing	Carillo & Franza (2006)	Marginal sales value comparison.
Capacity timing	Carillo & Franza (2006)	Production and demand maxima.
DURATION		
Time-to-market	Carrillo & Franza (2006), Driva, Pawar, & Menon (2000), Radas & Shugan (1998), Cooper & Kleinschmidt (1994)	# Months between concept approval and first sales.
Ramp-up time	Carrillo & Franza (2006)	# Months before maximal production.
Time-on-market	Nadeau & Casselman (2008), Klepper (1996)	# Months market PLC E-bike model.
Duration of supplier relationship	Loohuis, von Reasfeld, & Groen (2010)	# Months.
Duration of customer relationship	Loohuis, von Reasfeld, & Groen (2010)	# Months.
Length of investment period	No references found	# Months.
(IN)STABILITY		
Market turbulence	Paladino (2008), Floricel & Ibanescu (2008)	*Q1, *Q2, & *Q3 with yes/no answers.
Position challenges by competitors	Floricel & Ibanescu (2008)	Question with 7-points Likert scale.
Market share stability	Golder (2010)	Question with 7-points Likert scale.
Number of modifications	No references found	# Modifications asked by customer.

Table 2: Constructs and indicators

**Q1: Do external factors force unpredictable transformations in your sector?* (Floricel & Ibanescu, 2008) p. 467.
**Q2: Are the boundaries of your sector undergoing a major redefinition?* (Floricel & Ibanescu, 2008) p. 467.
**Q3: Is your sector going through significant developments that nobody anticipated?* (Floricel & Ibanescu, 2008) p. 467.

First, narrow views of the world can be misleading. Approaching a subject from different perspectives can help to gain a holistic perspective. Second, different methodologies have particular strengths and weaknesses (Yin, 2009); and (Saunders, Lewis, & Thornhill, 2003). E.g. an issue in qualitative research through open-ended interviews is the validity threat by influence of the interviewer on the interviewee. This threat does not go for quantitative research through questionnaires. On the other hand, questionnaires threaten validity for respondents are influenced and limited by the ended questions. This threat does not go for open-ended interviews. This way, multi-method research design reinforces the data collection.

As stated earlier the three methods of data obtaining I chose for are: interviews, participant observations, and questionnaires. The following three subsections explain why.

5.4.1 In-depth interviews

The choice for interviews is due to the nature of the approach to research, the significance of establishing personal contact and the nature of the questions. Nature of approach to research was an argument to choose for interviews for *'where you are undertaking an exploratory study, or a study that includes an exploratory element; it is likely that you will include qualitative research interviews in your approach.* (Cooper & Schindler, 2001)' (Saunders, Lewis & Thornhill, 2003: p. 250). Paragraph 5.3 clearly states that this research is exploratory. Therefore interviews are appropriate.

Another reason for use of interviews is significance of personal contact. Managers are more likely to agree to be interviewed than to fill in a questionnaire. Especially when the interview topic is seen to be interesting and relevant to their current work. (North ea., 1983); (Healey, 1991); and (Saunders, Lewis & Thornhill, 2003). They may feel that it is not appropriate to provide sensitive and confidential information to someone they have never met. The use of personal interviews, where appropriate, may therefore achieve a higher response rate than using questionnaires.

My last argument for using interviews is the nature of the questions. According to Saunders, Lewis & Thornhill (2003) *'an interview will undoubtedly be the most advantageous research approach to attempt to obtain data in the following circumstances: (1) where there are a large number of questions to be answered, (2) where the questions are either complex or open-ended and (3) where the order and logic of questioning may need to vary'* (p. 251). In this research the number of questions is huge, because of the exploratory character. The questions are open-ended because of the in-depth, non-directive design of the interviews. Finally the logic of the questions needs to vary for the questions need to be adjusted for different organizational types.

Although there is a fit between this research model and the use of interviews, the use of interviews has its disadvantages. These disadvantages can be formulated as threats to data-quality. There are three evident threats; interviewer bias, response bias and lack of generalizability. Interviewer and response bias will not be hugely influential in this research for I applied the key measures to overcome bias in qualitative interviews (Saunders, Lewis, & Thornhill, 2003). The lack of generalizability will keep its influence on data quality. Fortunately a multi-method research design is used to meet with objections of this problem.

5.4.2 Participant observation

Participant observation is the second method I use to obtain qualitative data. In this method *'the researcher attempts to participate fully in the lives and activities of subjects and thus becomes a member of their group, organization of community. This enables the researcher to share their experiences by not merely observing what is happening but also feeling it'* (Gill & Johnson, 1997: p. 113). Participant observation has its roots in anthropology but is used more and more in social research (Saunders, Lewis, & Thornhill, 2003). It is a useful method when the research context is not clear. For me, this has been a reason to employ the method.

The main reason for participant observation is the need to discover the temporal profiles of INDES. Perhaps it would have been better, from statistical point of view, to let the INDES product manager fill in the standard questionnaire. However the possibility of participating in the company for four months can provide more and more valuable information. In my opinion this information is more valuable than questionnaire data for it is considered in context.

Next to that; when one is participating in an organization for forty hours per week the organization unveils itself. Company culture shows, the people show. The interaction and communication with INDES employees during the months I work at the company give me the chance to get to the bottom of the companies' problems and wishes, to place them in a personal context too and to search for solutions with more than purely academic or financial value. Solutions which are contingent with more than standard company data, solutions that have a fit with intangible details such as company culture.

5.4.3 Questionnaires

The choice to add questionnaires to this multi-method research design is based on the need of quantitative data, the characteristics of the respondents from whom I wish to collect data, the importance of reaching a particular person as respondent, the importance of respondents' answers not being contaminated or distorted, the size of sample I require for the analysis (taking into account the likely response rate), and the type and number of questions I need to ask to collect data. I chose for a self-administrated on-line questionnaire. Using this type of questionnaire there is a high probability that the right respondent responds, there is a low likelihood of contamination of answers, and the sample size can be huge and geographically dispersed. Threats to validity and reliability are present, dependent on the type, form and formulation of the questions (Saunders, Lewis, & Thornhill, 2003). The actions I took to protect validity and reliability of questionnaire results I describe in paragraph 5.5.

5.5 Procedures

First two different procedures for qualitative research are discussed. Second I will elaborate on the procedure for quantitative research.

Ideally I would have done more external open-ended in-depth interviews. Unfortunately this was not possible. Because of confidentiality I could only interview current client companies. There currently are three client companies. However, with one of the client companies there was relational trouble of some sort. Therefore I was not able to contact that firm's product manager.

The firms I did go to differ hugely on independent variables; company size and product use. Firm 'A' is an organization that originated in 1900 and has 65 employees. It makes customized E-bike transport solutions for people with a physical disability. It produces with a computerized lean manufacturing system and welding robots. The company is currently spending effort in optimizing lean manufacturing. Firm 'B' has less than ten employees and has only recently market-launched their first E-bike. This company produces a high-segment bicycle that is aimed for commuters and recreational use. The production is has only recently passed the trial-and-error phase. The company is currently spending effort conquering and creating market demand for their product.

To protect the interview results from interviewer and response bias I applied the key measures to overcome bias in qualitative interviews (Saunders, Lewis, & Thornhill, 2003). First, I extensively prepared myself on the interviews through a literature research of one and a half month and several discussion sessions about needed information with INDES employees, university lecturers and fellow students. Second, I carefully monitored equality of the level of information and opening comments I supplied to the different interviewees. Third, the approach to my questioning maintained uniform by using table 2. Fourth, I tried to keep the impact of my behavior during the interview equal. Fifth, the approach to recording the information was equal; digital tape-recording by use of my BlackBerry-Smartphone.

According to Saunders, Lewis & Thornhill (2003) there are some (dis)advantages of tape-recording an interview. Positive aspects are that it allows the interviewer to focus on the conversation, it allows formulated questions to be used in future research when appropriate, it allows interviewer to re-listen the interview, it allows for unbiased recording, and it allows direct quotes to be used. Possible downsides of tape-recording are the situation where there is a focus on the recording device, where the recorder inhibits some interviewee responses, where there is a technical problem or where there is disruption to discussion when the tapes are changed. Fortunately, in the interviews I did not notice a focus on the recording device. By clearly stating that the recordings would only be re-listened by me and that all data would remain anonymously,

I assume the recorder did not inhibit interviewee responses. Moreover, using a digital recording device made technical error unlikely and changing tapes unnecessary.

Whereas the interviews are used to obtain data from client companies, participant observations are used to obtain data from INDES itself. According to Saunders, Lewis & Thornhill (2003) there are four types of participant observation. Whether the researcher takes part in activity or not and whether the researchers' identity is revealed or not defines what type of participant observation is applied. I did not take part in INDES activities but my role as researcher surely was revealed. This makes me an observer as participant (Saunders, Lewis & Thornhill, 2003: p. 224). That role enables me to concentrate on my research project, on discussions with the participants (INDES employees) and to be emotionally involved. To obtain data I worked full-time at the INDES office for almost the entire research period, I had lots of formal meetings with INDES employees with different task descriptions, I had even more informal conversations ranging from small talk to discussion of serious organizational problems, and I have been able to absorb much information from conversations that took place in the same rooms I was in.

5.5.2 Quantitative procedure

For this research I try to obtain quantitative data through on-line self-administered questionnaires. The questionnaire is based on operationalization of constructs as they are presented in table 2. In the appendices, paragraph 10.1, the questionnaire is presented. The questions are result of extensive literature research, discussion with INDES employees, university lecturers and experts on the global E-bike market. After seven revisions the final Dutch questionnaire is uploaded on-line.

The final Dutch version is translated into English, German, Italian, Spanish, French and Chinese. The translation method used is *'direct translation'* (Saunders, Lewis & Thornhill, 2003: p. 301). I.e. source questionnaire to target questionnaire. I would have preferred to use back-translation or parallel translation but I did not have the means to do so. The English version I translated myself without a check by a native speaker. The German, Italian, Spanish and French version I translated myself too. However, native speakers have checked these versions. I was fortunate enough to have them in my personal network. A Chinese INDES employee from the Dutch office has translated the Chinese version.

When the seven versions are finished, my search for respondents starts. As stated before, the questionnaire is sent to product and/or sales managers of E-bike-manufacturing firms. Hence I have created a list of E-bike-manufacturing firms. Initially I have based this list on E-bike-manufacturing exhibitors on the Eurobike fair that takes place in Friedrichshafen, Germany, from 31 August to 3 September 2011. After I collected all contact details of those firms I added E-bike-manufacturing exhibitors of the Fietsvak fair that takes place in Rosmalen, the Netherlands, from 23 January to 25 January 2011. I chose to do so because both interviewees and INDES employees emphasized on the importance of the fairs' exhibitors for E-bike business.

This way I have created a list of 213 E-bike-manufacturing firms. My next step has been checking these firms' websites. As I anticipated, I still found some importing and retailing firms. Those firms have been removed from the list. The list is confidential and consequently not included in the appendices.

When all websites were checked, I have contacted all the 181 remaining companies by phone (Skype). I chose to do so for prior notification should increase response rate with an average impact of 19% (Saunders, Lewis, & Thornhill, 2003). This could also have been done by e-mail, however Saunders, Lewis and Thornhill (2003) comment on page 311 that personal contact raises the perceived importance of the study. In my opinion, e-mail is no true personal contact.

In most cases I am given the opportunity to speak with a sales or product manager. If so, I have explained my thesis and I have asked whether the manager would have time to fill in my on-line questionnaire. After the manager agreed, most did, I have send them an e-mail that explained my research once again, emphasized on anonymity and confidentiality - which should increase external response rate by 10% (Saunders, Lewis, & Thornhill, 2003) once again and provided a link to the questionnaire. To further increase the response rate I gave opportunity to

receive the research results as non-monetary incentive (Saunders, Lewis, & Thornhill, 2003). Next to that I have considered to provide respondents with a small monetary incentive or a small gift. However, this would have been rather complicated, costly and time-consuming with respondents all over the world. Moreover I doubt the stimulating effect it would have had on product or sales managers.

In paragraph 5.4.3 I announced to deal with threats to validity and reliability of the questionnaire. This subsection deals with that topic. The first threat that is encountered when making a questionnaire is the threat to content validity. Pilot testing is the appropriate method to secure the questionnaire for this threat. For most student questionnaires this means that the minimum number for a pilot is 10 (Saunders, Lewis, & Thornhill, 2003); and (Fink, 1995). The number of people that helped me with pilot testing is 17. This has been a mixed group of INDES employees, university lecturers, former employers, and fellow students. The pilot test has also been used to check the questionnaires face validity, time it took to complete the questionnaires, clarity of instructions, clarity of questions, the degree to which questions are appropriate, and whether the layout was clear.

Saunders, Lewis & Thornhill (2003) outline three methods to assessing reliability. They are: (1) test re-test, (2) internal consistency, and (3) alternative form (Mitchell, 1996). I have chosen for option two. Option one, the test re-test, estimates reliability by correlating data collected with those from the same questionnaire under as near equivalent conditions as possible. The questionnaire therefore needs to be administered twice to respondents. In this research there was no time for that. Moreover I assumed product or sales managers would not appreciate this. Option three assesses reliability through comparing responses to alternative forms of the same question. I chose not to do so because it is difficult to ensure that alternative questions are substantially equivalent (Saunders, Lewis, & Thornhill, 2003) and because I am advised to make a short questionnaire. Therefore I chose to assess reliability by assessing internal consistency. Internal consistency involves correlating the responses to each question in the questionnaire with those to other questions in the questionnaire (Saunders, Lewis, & Thornhill, 2003). The most frequently used method to assess internal consistency is Cronbach's Alpha (Mitchell, 1996). This is the method I chose since the application of it is possible without costs and in a rather short time frame. Chapter six shall comment on it.

6. Analysis

First, this chapter describes the analysis results of data resulting from the quantitative procedure. The description includes discussion of respondents to the questionnaire, reliability assessment of constructs and validation of the relation between dependent and independent variables. Second, a brief analysis of qualitative procedure's results is given. In this brief analysis the most important and/or outstanding interview statements are presented.

6.1 Respondents

As stated earlier, in paragraph 5.5.2, 181 product and sales managers are contacted and are send a link to the online questionnaire. 54 Of those managers submitted the questionnaire. Consequently the response rate is — or 29,83%. Babbie (2006) regards this as a low response rate.

However, I disagree with Babbie (2006). The argument of that disagreement has two sides. Firstly, I argue that this research' response rate of nearly 30% is not that low. Especially not when one considers the indisputably high response rate in the native country, the Netherlands, of 63%

Secondly, a questionnaire's response rate was regarded as a key indicator of questionnaire quality for many years. High response rates were measures for accurate questionnaire results (Rea & Parker, 1997); (Aday, 1996); (Babbie, 1990); & (Backstrom & Hursh-Cesar, 1963). However, more recent literature indicates otherwise. Visser, Krosnick, Marquette, & Curtin (1996) are considered to be first to show that surveys with lower response rates – near 20% - generated more accurate measurements than did surveys with higher response rates – near 70 %. In another study Curtin et al. (2000) tested the effect of lower response rates. The authors did test the effect of excluding respondents on estimates of consumer sentiment. After excluding

over 75% of the respondents, no effect was found. Keeter et al. (2006) compared results of a 25%-response-rate-survey with results of a 50%-response-rate-survey. The two surveys turned out to be statistically indistinguishable. Considering these results one can assume that low response rate does not assure low statistical quality. However higher risk of lower accuracy remains.

The following table specifies per country: the number of questionnaires send, the number of respondents, the percentage the country's respondents resemble in the total dataset, and the country specific response rate.

Countries	Questionnaires send [#]	Respondents [#]	Respondents [% of total]	Country specific resp. rate
The Netherlands	64	34	63.0%	67.2%
Germany	27	6	11.1%	22.2%
Taiwan	21	4	7.4%	19.0%
China	14	4	7.4%	28.6%
Spain	4	2	3.7%	50%
Canada	**2**	**2**	**3.7%**	**100%**
United Kingdom	6	2	3.7%	33.3%
Italy	15	0	NA	NA
Austria	8	0	NA	NA
France	6	0	NA	NA
Belgium	6	0	NA	NA
Korea	2	0	NA	NA
Switzerland	4	0	NA	NA
Australia	1	0	NA	NA
Hungary	1	0	NA	NA
Total	181	54	100%	29.8%

Table 3: Respondent assessment per country

Unambiguously most respondents are Dutch product or sales managers. The Netherlands provide over 60% of the data. Statistically, this is a threat for global generalizability caused by sampling bias. However, this response rate spreading does resemble the situation for Indes to some degree. The firm itself also has more Dutch than foreign contacts. Germany and China, which are INDES business partners, are included in the dataset too. Therefore, in my opinion, this division is more an advantage than a threat. Other facets that stand out are (1) the low German response rate compared to the Dutch one, (2) the non-response of Italian managers, and (3) the outstanding Canadian response rate.

Numerous possible causes for cross-national response rate differences could be ventilated. However, I believe that possible respondents in all countries are treated equally. This would suggest that the differences in response rates are geographically and/or culturally related. Anne-Will Harzing (2000) conducted research to find a reason why response rates differ between countries. Her results are based on a cross-national industrial mail survey in 22 countries. Response rates are shown to vary considerably across countries. Part of Harzing's (2000) conclusion is: (1) the Netherlands have a higher response rate than Italy, Belgium, Austria, UK, Spain, Germany, and France, (2) North American countries have a higher response rate than European countries, and (3) the country from which a questionnaire is send has a higher response rate than foreign countries (Harzin, 2000). These findings correspond perfectly to my research' results. Apparently the response rate spreading is – at least partially – predetermined by a proven trend. Harzing (2000) suggests several causes for cross-national response rate differences. First geographical and cultural distances influences response rate. Second, the respondents' international orientation is influential when it comes to international surveys. Language, especially incomprehension of language (English), is suggested as the third reason. The first two explanations are applicable in this research. Language comprehension cannot have been an issue for I translated all questionnaires to local speech.

6.2 Construct validity & reliability

Construct validity is broadly defined as the extent to which an operationalization measures the concept it is supposed to measure (Cook & Campbell, 1979). Establishing construct validity of a scale is a process of collecting evidence about what the scale measures. Specifically,

construct validity is typically evaluated by looking at patterns of correlations of the used construct scale with other items.

Construct Name and Items	References	Indicator
MARKET SEGMENTATION		
Company size	Unger (1974)	Number of employees.
Product use	Unger (1974)	Medical / practical use.
TIMING		
(Cronbach's α = 0.720)		
Influence of seasonality	Radas & Shugan (1998)	Division of sales.
Influence of customers (end users)	Andersson & Mattsson (2010), Cooper & Kleinschmidt (1994)	Question with 7-points Likert scale.
Influence of competitors	Andersson & Mattsson (2010), Abell (1978)	Question with 7-points Likert scale.
Influence of customers (dealers)	Andersson & Mattsson (2010), Cooper & Kleinschmidt (1994)	Question with 7-points Likert scale.
DURATION		
(Cronbach's α = 0.655)		
Time-to-market	Carrillo & Franza (2006), Driva, Pawar, & Menon (2000), Radas & Shugan (1998), Cooper & Kleinschmidt (1994)	# Months between concept approval and first sales.
Time-on-market	Nadeau & Casselman (2008), Klepper (1996)	# Months market PLC E-bike model.
Length of investment period	No references found	# Months.
(IN)STABILITY		
(Cronbach's α = 0.886)		
Market turbulence	Paladino (2008), Floricel & Ibanescu (2008)	*Q1, *Q2, & *Q3 with yes/no answers.
**Q1: Do external factors force unpredictable transformations in your sector?*		(Floricel & Ibanescu, 2008) p. 467.
**Q2: Are the boundaries of your sector undergoing a major redefinition?*		(Floricel & Ibanescu, 2008) p. 467.
**Q3: Is your sector going through significant developments that nobody anticipated?*		(Floricel & Ibanescu, 2008) p. 467.
STRATEGICAL TIMING		
Economical timing	Carillo & Franza (2006)	Marginal sales value comparison.
Capacity timing	Carillo & Franza (2006)	Production and demand maxima.
Ramp-up time	Carrillo & Franza (2006)	# Months before max. production.
Number of modifications	No references found	# Modifications asked by customer.

Table 4: Constructs: re-composition, and reliability assessment after statistical analysis

Correlation of items also provides evidence that a scale measures consistently, i.e. reliably (Bagozzi, Yi, & Philips, 1991). Therefore I apply the Cronbach's α to assess correlation of items within a construct. The Cronbach's α is used to measure internal consistency of the items. The value of alpha is an indicator for the extent to which several items measure the same concept. When comparing groups, constructs are considered valid when $\alpha \geq 0.70$ (Bland & Altman, 1997). SPSS 16.0 analysis of this research' data made me reconstruct. The new constructs are presented in the table 4.

Compared to table 2 of paragraph 5.4 there are several differences. Two types of adjustments have been made. First, some items are repositioned. Second, some items are discarded. The items 'economical timing', 'capacity timing', 'ramp-up time', and 'number of modifications are repositioned from their former constructs to a separate scale. This new scale, strategical timing, should not be seen as a construct measuring one phenomenon. All items are aiming at different points of interest. They gather extra information that is needed in this exploratory research. Therefore there is no Cronbach's alpha given for the items. They need no correlation. Obviously the same goes for the items of market segmentation.

The discarded items are: 'influence of environment', 'duration of supplier relationship', 'duration of customer relationship', 'position challenges by competitor', and 'market share stability'. These items are discarded because construct alpha, thus also construct validity, per construct was higher without them. Chapter 8 will deal with 'duration's' low Cronbach's alpha.

6.3 Correlation

This paragraph presents an analysis of quantitative results from the questionnaires. In other words; it is the validation of the relation between dependent and independent variables. The table 5 presents the numeric analysis. For all possible relations the Pearson correlation coefficient and probability value (P value) are given. The Pearson correlation coefficient is the

	Independent Variable			
Dependent Variables	**Company Size**		**Type of Product Use**	
	Pearson Correlation ρ	P value (2-tailed)	Pearson Correlation ρ	P value (2-tailed)
Seasonality (T)	-0.14	0.32	-0.11	0.42
End user influence (T)	-0.16	0.25	0.25	0.06*
Competitor influence (T)	-0.07	0.61	0.20	0.14
Dealer influence (T)	-0.31	0.02**	-0.09	0.49
Time-to-market (D)	-0.24	0.08*	-0.18	0.20
Time-on-market (D)	-0.05	0.70	0,10	0.46
Length of investment period (D)	-0.08	0.57	0.06	0.65
External factors (iS)	-0.06	0.65	-0.16	0.25
Sector boundaries (iS)	-0.26	0.06*	-0.45	0.0006***
Sector developments (iS)	-0.18	0.18	-0.04	0.75
Economical Timing (sT)	-0.02	0.87	0.32	0.02**
Capacity Timing (sT)	0.07	0.60	-0.27	0.048**
Ramp-up time (sT)	-0.42	0.002***	0.13	0.36
Dealer ordered modifications (sT)	0.28	0.04**	-0.06	0.65
End-user ordered modifications (sT)	-0.06	0.67	-0.06	0.68
(Length of supplier relationship)	-0.07	0.64	0.35	0.008***

*=10%, **=5%, and ***=1% significance
T=timing, D=duration, iS=(in)stability, sT=strategic timing

Table 5: Data analysis

most frequently used measure for strength of linear correlation between two stochastic values of a quantity. It can be used when both variables are measured on interval or ratio scale. In this research that is the case. The coefficient value can vary from -1 to 1. A coefficient value -1 or 1 indicates a linear correlation between the variables. The coefficient value 0 tells us there is no linear correlation between the variables. Thus, the closer the coefficient value approaches -1 or 1, the stronger the linear correlation is. The P value is used to assess whether the relations are significant.

The P value shows that there are five significant relations between independent variable 'company size' and dependent variables. The Pearson correlation coefficients four of those relations are reverse for they have a negative coefficient.

There is a negative, significant relation between company size and (1) dealer influence on timing of the launch of a new E-bike model, (2) time to market, (3) flexibility of the boundaries of the sector, and (4) ramp-up time. There is a positive significant relation between company size and (5) the number of dealer ordered modifications.

There is a negative, significant relationship between type of product use (from commuter to disabled transport) and (1) flexibility of sector boundaries, and (2) production capacity compared to market demand. There is a positive, significant relationship between type of product use and (3) end user influence on timing of the launch of a new E-bike model, (4) the marginal sales value of an old E-bike model compared to a new model, and (5) the length of supplier relation.

However, there is more. The way different E-bike target groups (commuters, recreational cyclist, and people with a physical disability) relate to the dependent variables is also rather interesting, especially for practical use for INDES. The following table shall give an overview. All values presented are mean values. Unfortunately the dataset is too small for correct significant statements (n=6 for people with a disability). Nevertheless the results do assist in stating practical solutions for INDES for they answer an important question; how do the different industrial market segments vary on temporal profile? Adjacent to it, the insights from the interviews and participant observations help to place the following results in the correct

context. Hence I dare to claim that the data presented in table 6 strongly resembles the actual situation, even though the statistical significance is very low.

Dependent Variables		E-bike target group		Chi Square
	Commuters N=18	Recreational cyclist N=30	People with disability N=6	P-value (2-tailed)
Seasonality (T) (max 7)	Above average 4.63	Strong 5.53	Below average 3.67	.010**
End user influence (T) (max 7)	Below average 3.44	Below average 3.27	Very strong 6.00	.007***
Competitor influence (T) (max 7)	Above average 4.44	Above average 4.27	Very strong 6.33	.158
Dealer influence (T) (max 7)	Average 4	Below average 3.87	Below average 3.33	.022**
Economical Timing (sT) (max 3)	M.S.V. new ≥ M.S.V. old 1.22	M.S.V. new ≤ M.S.V. Old 1.87	M.S.V. new < M.S.V. old 2.67	.004***
Capacity Timing (sT) (max 7)	Production capacity ≈ market demand 4.11	Production capacity ≈ market demand 4.2	Production capacity < market demand 1.67	.001***
Influence of external factors (S) (max 7)	Above average 4.44	Above average 4.93	Below average 2.66	.006***
Fluctuations of sector boundaries (S) (max 7)	Average number of fluctuations 4.22	Above average number of fluctuations 5.2	Above average number of fluctuations 5	.05*
Unexpected changes (S) (max 7)	Below average number of changes 3.89	Above average number of changes 4.53	Low number of changes 2.67	.028**
Time-to-market (D)	14.9 months	10.9 months	12 months	0.013**
Time-on-market (D)	29.7 months	21.2 months	46 months	.000***
Investment period (D)	11 months	14.6 months	12 months	.114
Ramp-up time (sT)	4.8 months	5.5 months	4.7 months	.304
Dealer ordered modifications (sT)	4.9 per model	5.7 per model	3 per model	.008*
End-user ordered modifications (sT)	2.2 per model	3.3 per model	0.3 per model	.433

*=10%, **=5%, and ***=1% significance
T=timing, D=duration, iS=(in)stability, sT=strategic timing
M.S.V.=marginal sales value

Table 6: Relation between E-bike target groups and dependent variables

Table 6 shows the greatest differences per target group are for (1) end user influence on timing, (2) economical timing, (3) capacity timing, (4) influence of external factors, and (5) time-on-market. Because of the low statistical value of the data I shall elaborate on the practical significance.

First the table shows end user influence on timing of a new model is very strong for an E-bike made for people with a disability (6.0 on a 7-points Likert scale) and below average for both commuters and recreational cyclists (respectively 3.4 and 3.3). This difference is also discussed in the interviews and also noticed in participant observations. It is, most probably, caused by the fact that people with a disability need a custom made bicycle to fill the need for transport. The moment this need starts is not determined by seasonality or dealers but by the moment their mobility problems start.

Economical timing scores are different for all three target groups. For commuters the marginal sales value of a new model is a little bigger than the marginal sales value of an old model. For recreational users the m.s.v. of a new model is a little smaller than the m.s.v. of an old model. For people with a disability the m.s.v. of a new model is much smaller than the m.s.v. of an old model. Interview results confirm these findings, see paragraph 6.4. The findings indicate that both commuter and recreational targeted E-bike producers plan there model launches rather well (Carrillo & Franza, 2006) and that E-bike producers targeting at people with a disability introduce their new model too soon (Carrillo & Franza, 2006). This difference can be explained by the grants or subsidies that are given to people with a disability to buy an E-bike. Because of these grants, cost reduction is less important for the producer. For the government pays, price has little influence on the purchase by the end user.

Table 6 also shows that production capacity equals market demand for commuter and recreational user targeted E-bikes. For people with a disability the market demand is much bigger than the production capacity. This situation also resembles the situation described by the interviewees. In my opinion, the difference is caused by the fact that making E-bikes for people with a disability is more custom production than making E-bikes for commuters or recreational users is.

External factors slightly have an above average influence on transformations in the sector of commuter and recreational E-bikes. There is only a small influence in the market of E-bikes for people with a disability. This is caused by the fiercer competition and lower entrance barriers in the sector of commuter and recreational E-bikes. The subsidy-structure and town councils influence create entrance barriers in the sector of E-bikes for people with a disability.

The last great differences that table 6 shows is time-on-market. The data is also resembled by the information resulting from the interviews. Time-on-market is shortest for recreational user E-bikes, just slightly longer for commuter E-bikes, and much longer for E-bikes for people with a disability. Once again I expect that this difference is due to the subsidies for people with a disability. The dependence of the subsidy makes the customer less capable of buying a new bicycle. Due to that the time-on-market increases. The difference between time-on-market of recreational and commuter E-bikes I expect to be due to the budget differences of the target group. I expect recreational users to have a greater budget that allows them to earlier re-buy a new E-bike.

6.4 Interview results

This paragraph presents the interview results. First the values of dependent variables are presented in Table 7. Second some interesting off-track interview outcomes are discussed.

From the interview with the technical director of company A on 2 February 2011 some interesting off-track outcomes can be presented. When the topic timing of production capacity was being discussed, he explained an important (E-)bike-producing problem. *"The crux of our production capacity is the combination of summertime peak in production need and employee holiday wishes. We need double workforce, yet we work on half force."* This remark is interesting for it shows seasonality in production capacity. Moreover it resembles a problem that INDES could help to solve with an optimized AAD kit.

	Company A	**Company B**
Company description	65 employees E-bikes for people with a disability	<10 employees E-bikes for commuter or recreational use
Seasonality (T)	Small	Enormous, peak March-June
End user influence (T)	Huge	None
Competitor influence (T)	Average, mainly for fairs	None (apart from timing: huge)
Dealer influence (T)	Average	None
Time-to-market (D)	One year (two years by student)	1,5 year
Time-on-market (D)	Up to ten years	5-6 years
Length of investment period (D)	2 years	1 year
(in)Stability	Low competition High dealer power High barriers because of subsidies	Enormous competition Different for European countries Dutch market saturated (30% E-bike)
Economical Timing (sT)	Old model > new model	Old model < new model
Capacity Timing (sT)	Variable throughout the year	Higher than market demand; new product
Ramp-up time (sT)	+/- Three months	Not Available
Dealer ordered modifications (sT)	2 – 6 dependable on project's success	4
End-user ordered modifications (sT)	Endless (customized product)	0
(Length of supplier relationship)	Flexible price competing strategic partner	Firm and semi-infinitive

Table 7: Interview results

Another contradiction is discussed during this interview. *"We do not calculate economical timing of a new product. Officially we do not even take it into account. Market launch timing is based on gut feeling. Our old model still is a huge cash cow at the moment of market launch of the new model. Thus, in fact we should continue selling the old model before introducing a new one. However, once competition introduces a new bicycle, one must follow."* This implies that much profit is lost by premature market launches. Once again, this is a problem that INDES could help to solve with an optimized AAD kit.

In the other interview with the technical director of company B on 11 February 2011 E-bike market development, market segment development, and innovation are discussed. *"An European bicycle market is saturated when the E-bike share is approximately 30%. This only goes for relatively flat countries. In the Netherlands this market share is almost achieved. In other flat European countries the market share is approximately 15-20%. There, much market development is possible."* However, according to the technical director of company B it is possible to create a new market segment for E-bikes. *"A consumer can already use an E-bike till the end of his life. Therefore a new market segment will not be developed for people beyond 55 years old. One should consider younger people, especially commuters traveling 10-15 kilometers to work – commuters who need to travel more than 15 kilometers will probably keep using a car. For all people are lazy (!) only financial incentives will force commuters on the E-bike. From corporate perspective reimburse of traveling expenses already provides this incentive. Next to that governmental financial incentives are expected. For this target group, commuters, an E-bike is nothing more than a product for transport. Therefore price is all that matters. Consequently, upgrading the action radius over 80 kilometers is nonsense for people shall not cycle that far."* We spoke about possible innovations too. *"There have only been two true innovations in the bicycle sector past twenty years; the mountain-bike and the E-bike. All other developments have been incremental. For that reason one should not expect or aim for radical innovation on E-bikes. Nevertheless there still are interesting possibilities for incremental innovation of E-bikes: decrease of recharge-time of the battery, stackable batteries, or GPS-functionality on controller. The last innovation would be an interesting project for INDES."*

6.5 Participant observations

Because of confidentiality I do not elaborate on my observations.

	INDES
Company description	27 employees AAD kits for E-bikes
Seasonality (T)	Great
End user influence (T)	Small
Competitor influence (T)	Small
Dealer influence (T)	None
Time-to-market (D)	One year
Time-on-market (D)	Up to ten years
Length of investment period (D)	1 year
(in)Stability	Average competition High customer power Barriers through expertise and technology
Economical Timing (sT)	Variable
Capacity Timing (sT)	Variable
Ramp-up time (sT)	9 months
Dealer ordered modifications (sT)	Various
End-user ordered modifications (sT)	None
(Length of supplier relationship)	Depends on product type. For important parts there are long strategic relationships up to the level of co-development.

Table 8: Participant observations

6.6 Relatedness

Chapter six dealt with statistical data resulting from the questionnaires, qualitative data resulting from interviews, and qualitative data resulting from participant observations. In the second part of paragraph 6.3 I used the findings from the interviews and participant observations to underpin the statistical findings. Participant observations are also used to describe the current INDES temporal profile. Thus, the multi-method analysis has yielded multi-checked statements that fit in the practical context in which INDES operates.

7. Conclusion

In this chapter all parts shall come together. First the research questions of chapter three will be answered. Second I shall describe the scientific significance of the findings. Third the ethical aspects are discussed.

7.1 Research questions answered

This paragraph answers the three sub questions that are formulated in chapter three. First, it states what temporal characteristics constitute the temporal profiles of each E-bike target segment. Second, it describes the consequences of the temporal profiles for product development. Third, it elaborates on how INDES can synchronize product development in relation to target markets of E-bike AAD kits.

The following table gives the temporal characteristics that vary for different market segments. All characteristics that vary for either one or both market segmentation bases (company size & product use) are included. It should be regarded as the answer to sub question one.

		Company size	Product use		
	Construct	Relation	Commuter	Recreational	Disabled people
Dealer influence	Timing	Negative	Average	Below average	Below average
End-user influence	Timing	Negative	Below average	Below average	Strong
Time-to-market	Duration	Negative	14.9 months	10.9 months	12 months
Ramp-up time	Duration	Negative	4.8 months	5.5 months	4.7 months
Dealer-ordered modifications	Stability	Positive	4.9 per model	5.7 per model	3 per model
Sector boundaries	Stability	Negative	Average # fluctuations	Above average # fluctuations	Above average # fluctuations
Influence of external factors	Stability	Negative	Above average	Above average	Below average
Economical timing	Strategic Timing	Negative	M.S.V. new ≥ M.S.V. old	M.S.V. new ≤ M.S.V. Old	M.S.V. new < M.S.V. old
Capacity timing	Strategic Timing	Positive	Production capacity ≈ market demand	Production capacity ≈ market demand	Production capacity < market demand
Supplier relationships	-	Negative	30 months	21 months	46 months

Table 9: Temporal characteristics that constitute the temporal profiles of E-bike target segments

Now that it is clear which temporal characteristics constitute the temporal profiles of E-bike target segments and in what way they do, it is possible to determine how product development is influenced by these temporal characteristics. In other words; what are the consequences for product development? The next table gives an overview of the characteristics and their consequences and should therefore be regarded as the answer to sub question two. Some of these consequences come from literature, some from this research' interviews and (participant) observation.

Temporal characteristic	Value	Consequence for product development
Dealer / end user influence on timing	Small	Find the influential timing variable and adjust supply timing and quantity to it.
	Great	1. Discuss or investigate the desired supply timing and quantity and adjust it. 2. Include as risk on risk analysis. (Froot, Scharfstein, & Stein, 1993)
Customer's time-to-market	Short	Invest in own speed or co-develop with customer. (Driwa, Pawar, & Menon, 2000); (Radas & Shugan, 1998)
	Long	Watch for overstressing own resources and for creating unnecessary stock. (Driwa, Pawar, & Menon, 2000)
Customers' Ramp-up time	Short	Invest in own production capacity or create stock. (Carrillo & Franza, 2006)
	Long	Watch for overstressing own resources and for creating unnecessary stock. (Carrillo & Franza, 2006)
Dealer-ordered modifications	Few	Reward development team. (results from participant observations)
	Many	1. Invest in more field-testing. (results from participant observations) 2. Include as risk on risk analysis. (Froot, Scharfstein, & Stein, 1993)
Sector boundaries	Fixed	Focus on segmentation. (Porter M. E., 1997)
	Changing	1. Invest in differentiation; innovative, out of the box development. (Porter M. E., 1979)

		2. Include as risk on risk analysis. (Froot, Scharfstein, & Stein, 1993)
Influence of external factors	Small	Focus on standardizing product and process. (Porter M. E., 1979)
	Great	1. Create flexible product and / or process. (Floricel & Ibanescu, 2008) 2. Learn from aftermath of turbulent events. (Floricel & Ibanescu, 2008) 3. Include as risk on risk analysis. (Froot, Scharfstein, & Stein, 1993)
Economical timing	New < old	Introduce next product earlier. (Carrillo & Franza, 2006)
	New = old	Keep up the good work.
	New > old	Introduce next product later. (Carrillo & Franza, 2006)
Capacity timing	C < D	Increase production capacity and/or product price. (Carrillo & Franza, 2006)
	C = D	Keep up the good work.
	C > D	1. Decrease production capacity and/or product price. (Carrillo & Franza, 2006) 2. Give more attention to customer's wish. (Carrillo & Franza, 2006)
Supplier relationships	Short	Consider component-prices in development process. (results from interview A)
	Long	Co-develop. (results from participant observation)

Table 10: Consequences of temporal characteristics for product development

The last two tables made clear what the temporal characteristics constituting temporal profile are and in what way they influence product development. Through combination of this information it is possible to determine how INDES can synchronize product development process in relation to target markets of E-bike AAD kits.

The market segmentation base is the first choice that is made in stating the way to synchronize the product development process with temporal profiles. All findings considered, a choice is made for counter-segmentation (Resnik, Turney, & Mason, 1979). A form of counter-segmentation is the fusing of market segments. The reason to choose for the fusing of market segments is the loss of benefits and cost advantages in a situation with too much focus on market segmentation (Resnik, Turney, & Mason, 1979). In this research there now is a fuse of the market segments 'commuter' and 'recreational use'. The reason for combining commuter and recreational use is the low difference in scores both user groups have for the temporal profile; see the first table of this paragraph. Focus of this research is to adjust product development to temporal profiles. Because the temporal profiles of commuter and recreational use show low variance, there is no need for different market segments. The fused market segment shall be called 'ordinary users' from now on.

Another form of counter-segmentation is the choice to drop 'company size' as segmentation base. The focus will be on product use. The reason for dropping company size as a segmentation base is (1) the weak statistical correlation it has with the temporal characteristics - see paragraph 6.3 – and (2) the practical objection of adjusting product development to different sizes of client companies.

Thus, now question is how INDES can synchronize product development process with target markets defined per user group; ordinary use and use by people with a disability. The next step is to assess what characteristics constitute temporal profile in this new segmentation base. To do so, characteristics are judged on their values in table 9. When the values for commuter and recreational use is comparable and when there is a difference with the value for use by people with a disability, the characteristic is included in the temporal profile. Consequently INDES product development should be synchronized with a temporal profile that includes the following characteristics:

(1) end-user influence on timing
(2) number of dealer-ordered modifications
(3) economical timing
(4) capacity timing
(5) supplier relationship
(6) influence of external factors

After this conclusion it is possible to describe the industrial market segments based on their temporal profile. In the segment of ordinary users, the end-users have a low influence on the timing of a new E-bike model. There are relatively many dealer-ordered modifications. The economic and capacity timing is very good since the marginal sales value of a new product is approximately equal to the marginal sales value of the replaced product and the production

capacity is approximately equal to the market demand. The average relationship with a supplier is 25.5 months, which is relatively short. The market is not stable. External factors force many unpredictable changes.

In the sector of users with a disability the end-user influence on the timing of a new E-bike model is rather strong. There are relatively few dealer-ordered modifications. The economic

	Temporal profile of INDES target segment	
	Ordinary user	**Disabled user**
1 End user influence [timing]	Low	High
2 Dealer-ordered modifications [stability]	Relatively many	Relatively few
3 Economical timing [strategic timing]	Good (equality)	Too fast
4 Capacity timing [strategic timing]	Good (equality)	Too slow
5 Supplier relationship [-]	Relatively short (25.5 months)	Relatively long (46 months)
6 Influence of external factors [stability]	Great	Small

Table 11: Target segment's temporal profiles

and capacity timing is not good. The marginal sales value of a new product is much lower than the marginal sales value of the replaced product and the production capacity is much lower than the market demand. The average supplier relationship is 46 months, which is shorter than expected. The market is rather stable. External factors do not force many unpredictable changes. A summary of the target segment's temporal profiles is presented in table 11.

When the temporal profiles of table 11 are compared to the consequences of temporal characteristics for product development as are presented in table 10, consequently the course of action is:

For the ordinary user market segment:

- Find the influential timing variable and adjust supply timing and quantity to it.
- Invest in more field-testing. (results from participant observations)
- Consider component-prices in development process. (results from interview A)
- Create flexible product and / or process. (Floricel & Ibanescu, 2008)
- Learn from aftermath of turbulent events. (Floricel & Ibanescu, 2008)

For the people with a disability-segment:

- Discuss or investigate the desired supply timing and quantity and adjust it.
- Introduce next product earlier. (Carrillo & Franza, 2006)
- Increase production capacity and/or product price. (Carrillo & Franza, 2006)
- Focus on standardizing product and process.

These recommendations seem to fall from the sky, though when one looks back to table 10 the logics shows. I must note, however, that because this study is the first research in synchronization of temporal profiles defined by the constructs timing, duration, and stability, there is no fixed theory on how to synchronize temporal profiles with new product development. However, there already is elaborate theory on optimization of business success through correct management of new product development. Therefore general optimization measures will now be discussed. Together with above-mentioned recommendations, literature expectations about E-bike market developments (Sangani, 2009) and interviewee expectations about E-bike market developments they form the final recommendations. I must put forward that not all of the following literature is linked to temporal profiles. However, in my opinion, they are preconditions to correct new product development. And since new product development an sich is an important part for this research and INDES, I include following literature.

According to Cooper & Kleinschmidt (1994) speed to market – low time-to-market – is a compelling objective in new product management since "*speed enhances competitive advantage*" (p. 381). The authors suggest several measures to increase speed to market. Creating one accountable team is the most appropriate measure for INDES because responsibility shifts internally at INDES during a project.

Calantone, Vickery & Dröge (1995) state that customization and new product innovation in new product development add more to ROI, ROS, and market share growth than

technical innovation or product improvement do. This is relevant since I noticed during participant observations that these are questions INDES has.

Ali (2000) measured the influence of over 20 variables within new product development on corporate revenues. The aspects with the biggest positive relation are: short cycle time, product innovativeness, and relative price. This is relevant for INDES for it can be assumed that increase in revenue is a method to ensure sustainable business.

Sangani (2009) mentions E-bike market developments in battery and control units. This is in line with interviewee expectations and my opinion as participant observer. Therefore the recommendations are specified for these two product-components. Concluding one can state that the following measures in general new product management have a positive effect on firm performance. They are used to give the final recommendations for INDES, which are firstly derived from the temporal profile of target segments, extra context.

- Fixed accountable team
- Customized product
- New product
- Short time to market
- Low relative price

Final recommendations for INDES

Literature shows the significance of temporal profiles in doing business. This research shows there are significant differences in temporal profiles for two market segments. Products should be synchronized with these profiles. For the ordinary users segment this means that the product should be more flexible. This flexibility can be achieved in various manners. I would advice flexible functionality of the kit. An option is to offer different battery packs. Flexibility can also be implemented in the control units, e.g. by providing choice in features. The time-to-market should be minimized, but not at all costs. In my opinion INDES currently invests too little time in field-testing of the products. This might result in shorter time-to-market but increases cost and frustration. That frustration did not go unnoticed during my participant observations. Attention should be aimed at developing new product features, not on product improvements. I would advice to develop GPS navigation capability for the control unit. Moreover, cost reduction should and can be achieved while keeping quality equal by standardization of processes. In this sector supplier-changes are common. There should be a continuous focus on the components' market prices.

The other market segment, E-bikes for people with a disability, there should be more field-testing as well. Also flexibility is an issue for this market segment, though in another manner. Here the flexibility should be in adjustment to different frame-types. Business relations are much tighter in this market segment. Respect those relations. There should be a continuous focus on the quality of the AAD kit because the consequences of losing a customer in this sector are more severe.

Batteries are the biggest limitation of the E-bike. Do not invest any further in increasing the action radius. Most people do not need a bigger action radius. Decreasing recharge time, increasing lifespan, and securing the battery packets against theft should be development targets.

The last recommendation for INDES is a more assertive attitude towards client companies considering timing. In the current product development process a client company has huge influence in the timing of INDES' process. One could say this is a characteristic of the client's temporal profile in both target segments. INDES should gain influence in the determination of product development timing and timeframes. To date, there is often not enough time for proper field-testing. Another problem that can be solved by more assertive timeframe negotiation is workload. Currently INDES' workload is rather variable. By use of more strategic planning of assignments this workload can be spread.

7.2 Theoretical contribution

In my opinion this research is conducted in logic positivistic tradition. I do share Auguste Compte's (1798-1857) principles that the logic of inquiry is the same across all sciences, that scientific knowledge should be testable, and that the goal of scientific knowledge is to

explain and predict. However I disagree with the traditional positive principles that only quantitative research is good research. I agree with Moritz Schlick's (1882-1936) principle that observational evidence – qualitative – is indispensable for knowledge of the world. For that reason I hope this research can add some value to late Schlick's school of philosophy.

This research should be regarded in light of the contingency theory stand (Thompson, 1967); (Perrow, 1967); & (Lawrence & Lorsch, 1967) as well. I am of the opinion that conducting business is finding a correct fit. This paper suggests there should be a fit between temporal profiles of market segments and product development. Of course, many other fits should be considered in conducting business.

As stated earlier in chapter four, literature on temporal profiles is not rather exhaustive yet. This research tries to add data and insights to the understanding of temporality as well. More specific; this research tries to add data and insights to the understanding of the practical use of temporality as strategic management tool. For "We must use time as a tool, not as a crutch." (Kennedy, J.F., 1917-1963). And that practical and strategic use of temporal profiles in organizations is an underdeveloped topic. In light of that statement, this research is just a start. Many hypotheses should be tested to narrow down the topic and to make it more profound. For that reason I will make suggestions of future research in chapter eight. With those suggestions this research also tries to pursue other business researchers to think about the topic.

Concluding; the scientific significance of this research is the definition of new temporal profiles and the suggested link to new product development.

7.3 Ethical aspects

In quantitative data gathering by questionnaire for this research the privacy of possible and actual participants has been slightly invaded for I have phone-called all participants on a phone-number published by a third party, a fair. However, all participants have agreed to have their number published. Actual participation has been completely voluntary. Possible participants who were not interested in participation were contacted no more. Non-responders were contacted maximal three times. All received data is included anonymously in one dataset to ensure confidentiality of respondents' data and identity. Moreover, based on the reactions I received I dare to state that the data collection has been ethically responsible.

During the qualitative research by interviews and participant observations I also paid attention to ethics. All respondents cooperated voluntary, and confidentiality is maintained. No names of persons or organizations are included in this paper. Once again, reactions have been positive.

There has been one ethical dilemma though. The respondents I approached were employees of direct competitors of INDES client companies. Some of the INDES client companies have supported INDES product development with time and money for their specific products. For that reason they might not be delighted that INDES has contacted their direct competition, asking about the product they compete on. I discussed this issue with INDES' CEO. With his approval I contacted the respondents.

8. Discussion

This chapter will discuss two substantial parts of the research. First, it will elaborate on the potential limitations of the research. This should be regarded as a critical reflection on the strengths and weaknesses. The possibilities for generalizability are discussed as well. Second, this chapter elaborates on suggestions for future research. Those suggestions aim at creating more scientific knowledge and practical use.

8.1 Potential limitations

There are several research weaknesses, which can be limitations to statistical quality and to generalizability. First, there is the low Cronbach's alpha for the construct duration. A valid construct should have an alpha > 0.70. Unfortunately this alpha (0.655) has been the highest possible with this dataset and construct definition. Another statistical problem is the total number of respondents. For valid statements N = 50 is a requisite, though one should not forget

this is a reporting limit. This research' N = 54 holds no margin. Moreover the data spreading used to compare the different market segments was useless from statistical point of view. The spreading is disproportionate and for the smallest respondent group N = 6 (people with a disability, table 6). Also in the interview setting a statistical error occurred. The interviewees resembled firms that differed enormously on **both** independent variables (company size and product use). For this reason the findings cannot be used to make valid statements about any of the dependent variables. Despite the fact that I knew this in advance, there was no choice. There were only two client companies.

On the other hand there are several strong aspects of research that I want to emphasize as well. First, there is the international dataset, giving access to global temporality data. This aspect is even more a strong characteristic of research for the response rates per country correspond with an international trend (Harzin, 2000). Second there are the two other constructs' Cronbach's alpha, respectively 0.720 and 0.886. Third I emphasize the multi-method analysis as a strong aspect of this research. The use of interviews, and questionnaires, and participant observations enabled me to put the data in a rather broad context.

In spite of these strong aspects the research' generalizability is doubtful. One must note the limitations mentioned above, the fact that this research involves a very specific niche product, is based on quantitative inquiry of two types of employees (product or sales managers) and qualitative inquiry at only three companies. The influence of trends as shorter time-to-market and product life cycle (Floricel & Ibanescu, 2008) can also form a threat to generalizability. Findings could be generalized to other AAD products made by INDES and perhaps to comparable industrial designers. The operationalization of temporal profiles with the constructs timing, duration, and strategy could be generally applicable. Any further generalizability would be doubtful.

8.2 Suggestions for future research

As stated earlier there is not much literature on this research topic yet. Surely this paper does not give all the answers. In fact it may raise more question than it answers. Therefore future research is needed.

1. Measurement scales for temporal profiles need to be investigated. This way consistent constructs can be created. The scale I created for timing is consistent enough, the scale for duration is not. The scale for stability surely is. However, this scale was already developed by Floricel & Ibanescu (2008).
2. The optimal segmentation bases should be further investigated. When choosing for the segmentation bases used in this research I could not find academic consensus regarding the correct industrial market segmentation bases. For they have huge influence in the research design, consensus is needed. (Krishnan & Ulrich, 2001); (Cardozo, 1980); (Johnson & Flodhammer, 1980); (Schiff, Fernandez, & Winer, 1977); (Assael & Ellis, 1976); (Unger, 1974); (Wilson, Mathews, & Sweeney, 1971); (Cardozo, 1968); (Roberts, 1961); (Hummel, 1954); and (Frederick, 1934).
3. To date's research is done with certain restrictions; time and money. With more time and incentives one can probably gather more data to support validity of the results. Next to that a divers dataset is needed. Divers on as many aspects as possible; cultural, geographical, product-type, organization-type, age, sex, etc. Target should be to find other variables that have influence on temporal profile and to rule out variables that do not.
4. The correct synchronization method of temporal profiles and new product development should be investigated. A firm should precisely know how to adjust new product development once the temporal profiles of the market segmentations are known. I based the consequences I use on semi-related literature and gut feeling.
5. Driwa ea. (2000) emphasize that effectively managing and measuring product development process is a means of ensuring business and Narver ea. (2004) prove a positive relation between proactive market orientation and new product success. Next to that there should be research about the effect that synchronization of temporal profiles and new product management has on organizational success. In this research I assumed it is a way of proactive market orientation to synchronize product development to a client's temporal profile. Eisenhardt & Martin (2000) do state that synchronization of market and product should be

positively related to business performance. They do not speak about temporal synchronization though.

6. The causal sequence should be investigated. In this research I assumed that new product development should be influenced by temporal profiles of client companies. However, the reverse situation is possible too.
7. Finally the influence of sequential structures (Andersson & Mattsson, 2010); (Sztompka, 1993); (Bluedorn & Denhardt, 1988); and (Moore, 1963) in business processes as part of temporal profile should be investigated. It is not include in this research because it was too far off-track. However I expect it to be of great significance within this specific research field.

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10. Appendices

10.1 English questionnaire

Hello,

This is a research in the bicycle sector, specifically aiming at E-bikes. My name is Bram van de Veerdonk, I am a student at the University of Twente in the Netherlands. For my Bachelor business administration I am researching the E-bike market.

Would you be so kind to invest 15 minutes of your time to fill in this questionnaire?

Thank you in advance,

Bram van de Veerdonk

---

1. What is your age?

☐

2. What is your function

☐

3. How long are you employed at your company?

☐ 0 – 1 year
☐ 1 – 5 years
☐ 5 – 10 years
☐ 10 – 20 years
☐ > 20 years

4. What is the number of employees at your company?

☐ 0 – 10
☐ 10 – 50
☐ 50 – 100
☐ > 100

5. What is the most important customer group of your E-bike?

☐ Commuters
☐ Recreational cyclists
☐ People with a disability

6. Fill in to what extent the next contradictions resemble your situation:

E-bike sales are not influenced by seasonality.	☐ ☐ ☐ ☐ ☐ ☐ ☐	E-bike sales are strongly influenced by seasonality.
Customers (dealers) have no influence on the moment of the market launch of a new E-bike model.	☐ ☐ ☐ ☐ ☐ ☐ ☐	Customers (dealers) have a strong influence on the moment of the market launch of a new E-bike model.
Customers (end users) have no influence on the moment of the market launch of a new E-bike model.	☐ ☐ ☐ ☐ ☐ ☐ ☐	Customers (end users) have a strong influence on the moment of the market launch of a new E-bike model.
Competitors have no influence on the moment of the market launch of a new E-bike model.	☐ ☐ ☐ ☐ ☐ ☐ ☐	Competitors have a strong influence on the moment of the market launch of a new E-bike model.
Our production capacity is smaller than the market demand of E-bikes.	☐ ☐ ☐ ☐ ☐ ☐ ☐	Our production capacity is larger than the market demand of E-bikes.

Marginal Sales Value (question 7) =
Sales price – cost price

7. **The marginal sales value of a new E-bike model is:**
   ☐ higher than the marginal sales value of an old E-bike model.
   ☐ equal to the marginal sales value of an old E-bike model.
   ☐ lower than the marginal sales value of an old E-bike model.

8. **What is the average duration of the period between idea creation and first sales of an E-bike model? [in months]**

9. **What is the average duration of the period between first production and maximal production? [in months]**

10. **What is the average duration of the period that an E-bike model is on the market? [in months]**

11. **What is the average duration of the relationship with your supplier? [in months]**

12. **What is the average duration of your budget plans for the development of an E-bike model? [in months]**

External factors (question 13)
With this I mean factors like: crisis, technological development, law & legislation, etc.

13. **Fill in to what extent the next contradictions resemble your situation:**

External factors do not force any unpredictable transformations in our sector.	☐ ☐ ☐ ☐ ☐ ☐ ☐	External factors force many unpredictable transformations in our sector.
The boundaries of our sector are not undergoing a major redefinition.	☐ ☐ ☐ ☐ ☐ ☐ ☐	The boundaries of our sector are undergoing a major redefinition.
Our sector is not going through developments that nobody anticipated.	☐ ☐ ☐ ☐ ☐ ☐ ☐	Our sector is going through significant developments that nobody anticipated.
Turnover from current E-bike customers is very stable.	☐ ☐ ☐ ☐ ☐ ☐ ☐	Turnover from current E-bike customers is very unstable.

14. **How long has your most recent E-bike model been on the market? [in months]**

15. **How many times have you received a modification demand from your customer (dealer) for your most recent E-bike model?**

16. **How many times have you received a modification demand from your customer (end user) for your most recent E-bike model?**

17. **Have you got any personal comments?**