Drivers and barriers for innovation in Chinese and Dutch seed and food & beverage companies

An empirical study of 70 Chinese and 67 Dutch companies using the company part of the Wageningen Innovation Assessment Toolkit company database

Jing Xiao

February 2012 – August 2012

Management study group

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Abstract

This study aimed to investigate the drivers and barriers for innovation in Chinese and Dutch seed and food & beverage company. Data including 137 companies (70 Chinese and 67 Dutch companies) was gathered with the company part of the Wageningen Innovation Assessment Toolkit (WIAT). The statistical tools SPSS, SmartPLS, and Excel were used to analyze the data. A structural model was built based on the classic innovation input-throughput-output model, and then tested in a PLS model. Moderating effects were used to analyze possible country effects. The results show no difference between Chinese and Dutch companies.

Through the model, we found that the business environment significantly influence the innovation focus. While in the input-throughput stage, innovation focus improved innovation and business performance, via improving the R&D communication and internal coordination, as well as the level of innovativeness.

Based on the descriptive results and the model results, market orientation is proved as one of the drivers for innovation in both Chinese and Dutch seed and food & beverage companies. New entrants threat is also a driver for innovation. The high costs and risks involved in innovation is the main reason for lot of small and medium sized enterprises (SMEs) in agri-food supply chains favor incremental innovation. Thirdly, innovation is highly associated with business performance. As a result, it is advised to managers who of SMEs to improve the innovativeness level in their efforts to attain superior business performance.

Keywords: Agri-food, China, Netherland, seed, food & beverage, WIAT, input-throughput-output model, PLS model, R&D communication, innovation drivers and barriers

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1 Introduction and research design

1.1 Introduction

As a consumer, nowadays we see "NEW" everywhere. In TV commercials and other advertisements we can see diverse products from high-tech automobiles to small yogurt drinks having in common that they are being advertised with terms such as "NEW", "new design", "new formula", and so on. In a supermarket, we again see "NEW" everywhere on the packages of a lot of commodities. This phenomenon can be seen all over the world. One could wonder what the story is behind this big "NEW"? It's innovation!

As long ago as 1930s when the term innovation was not been used extensively, Schumpeter (2003) argued that organizations should innovate in order to renew the value of their asset endowment. Coming to recent decades, innovation has wildly spread into almost every discipline. No businessman or researcher doubts the importance of innovation. In the review of Baregheh et al. (2009), they concluded that innovation is multi-stage process whereby organizations transform ideas into new/improved products, service or processes, in order to advance, compete and differentiate themselves successfully in their marketplace.

The agri-food sector is of great importance as food is a basic and essential demand of mankind. Undoubtedly, the activities of innovation in the sector are eloquent not only to businessmen who make profit out of it, but it is also beneficial to customers. Especially nowadays, the big challenge of "how to feed the world in the future" is gaining more and more attention globally. A successful breakthrough in agri-food will partially release the burden of the threat. On the country level, in some countries agri-food sector plays an important role on the economic scale. In the Netherlands, the agri-food industry is distinguished as one of the top sectors by the government which means that it constitutes an essential part of the Dutch economy, i.e. with a contribution of almost 10% to the GDP (Tepić, 2012).

The level of innovation varies from country to country. In China, the government started to put more attention to stimulate innovation from the late 1990s. This fact depicts that there exists a differences at the starting point of innovation in China compared to that of other developed countries like the Netherlands. Besides the different evolving experiences of innovation in developing and developed countries, the background and culture of the country also leads to the differentiation on processes and results in innovation (Freeman, 1995). It is interesting to study the differences on innovation between companies in a developed country namely the Netherlands and a developing country namely China. This study can be valuable for Chinese companies to learn from the experience of the Netherlands by using and developing managerial theories on innovation to shorten the gap of innovation level with companies in developed countries. As for Dutch companies, facing the emerging strong competitors like Chinese companies, it is worthwhile to study the weak and strong points of the emerging competitor in order to maintain the competitiveness in the global market.

In this study, the companies investigated belong to agri-food industry and are known in two sectors, seed company as in agri sector, food & beverage company as in food & beverage sector.

1.2 Research design

1.2.1 Conceptual Design

In the conceptual design, questions of what, why and how much we are going to study in this study are listed (Verschuren, Doorewaard et al. 2010).

1.2.1.1 Research Objective

The research objective provides an overall idea of the knowledge the research project will generate in order to contribute towards a solution (Verschuren, Doorewaard et al. 2010).

The objective of this study is to explore the drivers and barriers for innovation in Chinese and Dutch seed and food & beverage companies.

The data from the company part of the Wageningen Innovation Assessment Toolkit (WIAT) database were used in this study, which contains forty-nine Chinese seed and twenty-one Chinese food & beverage companies, and ten Dutch seed and fifty-seven Dutch food & beverage companies.

1.2.1.2 Research issue

After the research objective is defined, a research plan will be designed to answer the question posted in the research objective. As the key in the research objective is to find the differences, therefore the research question comes down to a simple form of how to find these differences? The first step is to find parameters which describe all the cases we want to compare. Then a way must be found to measure the cases with the defined parameters. Finally, a designed method to process the data obtained from the measurements will be used to be able to compare the differences of the cases. To follow the routine described above, sub questions are generated.

1) What model can be used to examine innovation process in this study?
   a) What is innovation, and what are the key elements of innovation?
   b) What are the drivers and barriers of innovation?
   c) What kind of model can be used to examine innovation process?
2) What kind of tool can be used to prepare the building blocks in the model?
   a) What is WIAT?
   b) What is PLS model, and how to use it to test the theoretical model?
3) What are the innovation barriers and drivers for Chinese and Dutch company?
   a) Are there differences on innovation between Chinese and Dutch company?
   b) Is innovation improving business performance in seed and food & beverage company?
   c) What are the influential factors for innovation in seed and food & beverage company?

1.2.1.3 Research Framework

In this research framework, a visualized schematic representation of the research design is shown in Figure 1.1. (Verschuren, Doorewaard et al. 2010).

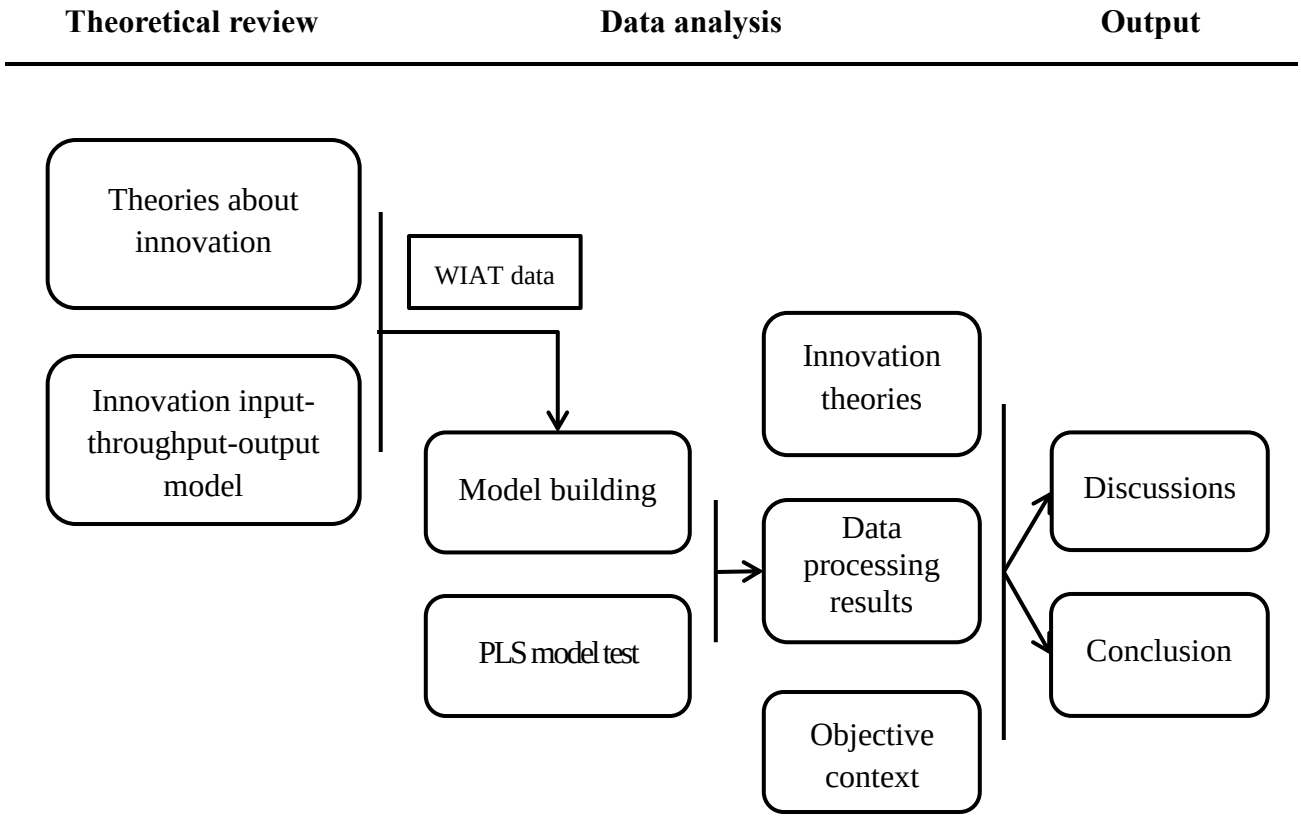


Figure 1.1 Research framework

1.2.2 Technical research design

The second part concerns what technical ways will be used to realize the objective of the study.

1.2.2.1 Research material and strategy

In the theoretical study part, a desk research is applied to gather necessary theories on building the model. Plenty of scientific literatures will be reviewed in order to answer the sub questions one and two. The research materials used at this stage are mainly scientific papers and books on innovation. Moreover, the basic theory of WIAT is studied at this stage. This step is crucial for the whole study since it provides the theoretical foundation of the study.

In the data processing stage, the main research strategy is statistical analysis. Research materials are the 137 samples from the WIAT database. Programs like SPSS[i], SmartPLS[ii], and Excel are heavily used at this stage.

In the end, results will be explained and linked with the theoretical basis. Additionally, objective context information will be used to explain the results. Thus, literature study is also needed in this stage. Besides scientific literatures on innovation aspects, various media like newspapers, internet, and reports will be used to review the information in the agri-food sector in both Chinese companies and the Dutch companies in the study.

2 Literature synthesis

The sub questions one and part of the sub question two will be answered in this chapter. Firstly, basic theories about innovation are studied. Then the classic innovation of input-throughput-out model was viewed. In the end, there is a review of innovation in agri-food industry.

2.1 Innovation

In order to be able to build the model which can illustrate innovation processes in the agri-food sector, knowledge about innovation is required. This section starts with defining what innovation is, then a detailed explanation of the innovation process is provided, followed by the introduction on different types of innovation, as well as different types of new products, and ended with a review of the factors which influence innovation from both external and internal sides.

2.1.1 What is innovation

Innovation has been vastly studied in the recent decades. As long ago as 1950 when the term innovation had not been used extensively, Schumpeter argued that organizations should innovate in order to renew the value of their asset endowment. With the passing of time, studies on innovation were spread out among a diverse range of businesses and disciplines. This topic is of big interests to practitioners and researchers in all fields study. As Damanpour and Schneider (2006) state: "Innovation is studied in many disciplines and has been defined from different perspectives."

Innovation has been defined from many different perspectives. All of the various definitions of innovation made an emphasis on the issue, that the complete innovation contains development and exploitation aspects of new knowledge not just its invention. It not only stops at the invention phase but also includes making ideas to work technically and commercially continuously after the invention. In the study by Baregheh et al. (2009), they viewed 60 definitions of innovation collected from the various disciplinary literatures, and a generic definition of innovation they concluded in the end is

> *"Innovation is the multi-stage process whereby organizations transform ideas into new or improved products, service or processes, in order to advance, compete and differentiate themselves successfully in their marketplace."*

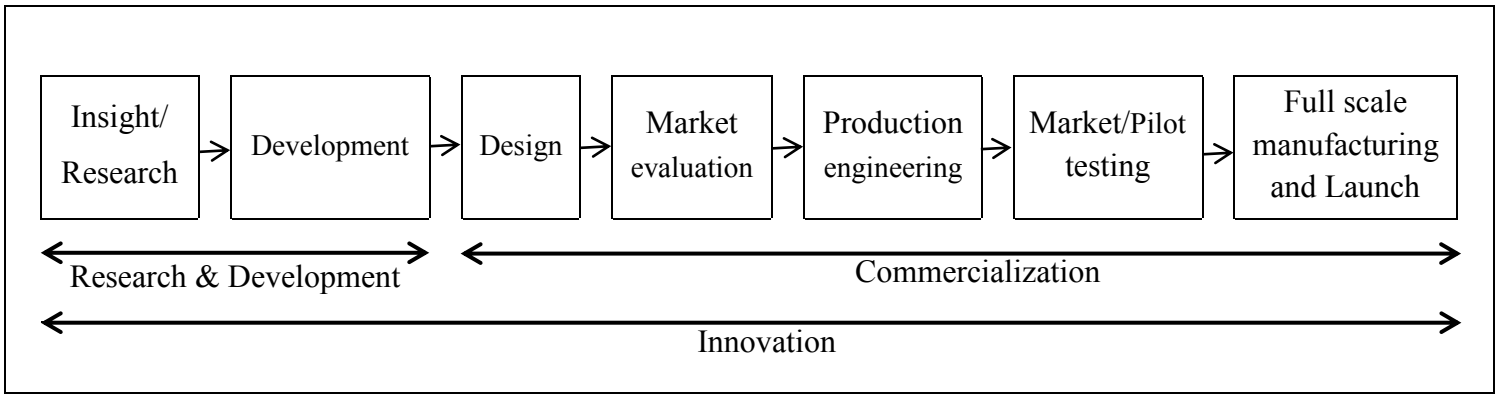
Innovation is easily mixed up with invention. The relation between these two is that invention can be the starting point of innovation and it can be considered as a key element in the complete innovation (Smith, 2010). But by the definition of innovation, innovation processes do not stop after the invention, it also involves activities that facilitate the introduction of the invention onto the market to make it a complete process.

Innovation is a complex process, and it involves a lot of elements in it. Apart from the tangible investments like finance, human resource, and facilities, it is also affected by the intangible investments like experiences, environment and entrepreneurship. Managing innovation is a multifarious and enduring task. It is about learning to find the most appropriate solution to the

problem of consistently managing this process and doing so in the ways best suited to the context of the organization (Tidd et al., 2005).

2.1.2 The innovation process

As it is clearly stated in the definition of innovation, innovation not only involves the starting point of invention but also includes bringing the idea commercially to the marketplace. In the book of Smith (2010), it was stated that innovation processes involves a number of activities that are linked together to form a process. Smith (2010) also provided a generic model of innovation process which is shown in Figure 2.1.



Source: Smith (2010)

Figure 2.1 A generic-model of the innovation process

Of the seven steps, the beginning two are particularly associated with invention. The remaining five steps turn the invention into a complete innovation, which is labeled as "commercialization". As Smith (2010) wrote in his book, the seven steps are explained as follow:

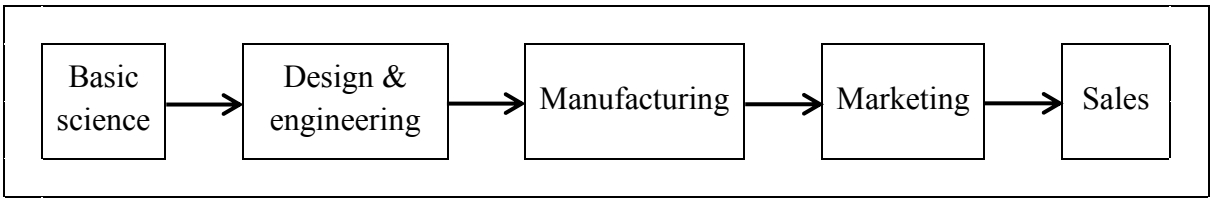
- Insight/Research. It is easy to understand that innovation starts with a comprehensive insight into the market where you want to enter, and then gives rise to an idea. On the other hand, innovations which are closely related to technological breakthroughs are normally originated from labs, namely from the results of researches. Sometimes the laboratories are located in universities, research institutions, or the national labs funded by the government.
- Development is aiming to give the invention a tangible body, which means to transfer the ideas or technologies into real products or processes.
- In the design step, a lot of adjustments will be embedded in the products or process in order to fit the marketplace and meet customers' needs.
- Market evaluation is a vital step in the innovation process. If the new product or service is not accepted by the market or the sales are poor then this possibly leads to the failure of innovation.
- When the new invention passed the market test, it is time to consider how to produce the final product or services on an industry scale. It could be a very complex step, since it involves a number of challenges, from the beginning of how to get the sources to produce the goods,

until the end of the production process of how to deal with the wastes to have sustainable manufacturing.

- Having ensured that the product or service will be appealing to consumers, further testing has to be carried out to ensure that it is fit to enter the marketplace. The test normally has two functions. One is to make sure the distribution system is functioning effectively, the other is from the commercial point of view to gather data from which it will be possible to construct sales forecasts and budgets, and of course to see the reactions from the competitors as well.
- Finally, the product or service can be fully manufactured and brought to the market. The most important point in this step is to make sure each part of the supply chain is ensured and secured to work properly and efficiently together.

In the research of Rothwell (1994), he studies the rapid rates of technological change over the last half-century and identifies four models of the innovation process. Of which, two models are extensively adopted and studied by researchers, namely technology push and demand pull.

The technology push model is very much like the traditional perspective on the process of innovation (Figure 2.2). In the 1950s, innovation started to play an important role in the economic growth. A Lot of inventions were successfully commercialized on the market. Most of the inventions were triggered by research breakthroughs, thus the innovation process model was categorized as technology push model (Smith, 2010). This model mostly takes place in the high level of innovative industries, for example the pharmaceutical industry.

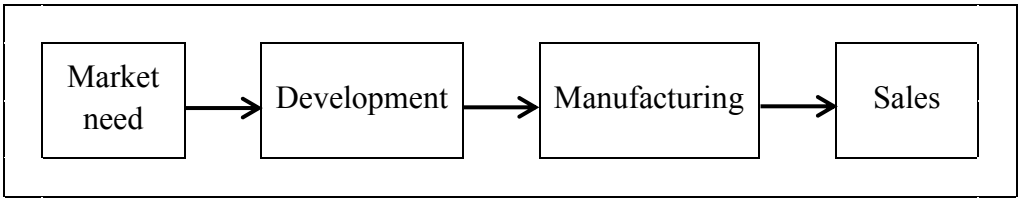


Source: Smith (2010)

Figure 2.2 Technology push process

The Demand pull model is relatively new compared to technology push model which was arisen in the late 1960s and early 1970s (Smith, 2010). In the demand pull model, market plays the central role (Figure 2.3). According to Rothwell (1994), the move of innovation process from a technology centered type to a more market-centered type reflected the maturing of many technology-based industries, and it also indicated the consumer requirements were becoming more sophisticated. Thus, this model is appropriate for mature industries that the firms' main innovation effort is devoted at better meeting consumers' requirements.

Market orientation is important for innovation in food & beverage industries. As the food industry was recognized as a low innovative industry (Traill and Grunert, 1997), fundamentally new innovations are scarce in food industry. Many product innovations are dominated by customer demands from the market. In this way, demand pull process occurred very often in food industry. However, in the research of Traill and Meulenberg (2002), they carried the research of



Source: (Smith, 2010)

Figure 2.3 Demand pull process

12 European food & beverage companies, the results they gave from the case studies suggested that innovation process for food & beverage manufacturers are more complex than those represented by the traditional theories of "demand-pull" versus "technology-push" versus combination of the two, and they suggested that firms have a dominant product, process or market orientation that determined company culture, the types of innovation, and the way in which innovations are organized.

2.1.3 The types of innovation

As mentioned in the definition, innovation can happen in the forms of product, service, and process. Each of the form can take place within different types of innovations.

In the research of Henderson and Clark (1990), by the novelty of innovation, there are four types of innovation (Figure 2.4), which is a development by the theory of dichotomy incremental verses radical innovation stated by Dewar and Dutton (1986) as well as investigated in the research of Ettlie et al. (1984).

		Components / core concepts	
		Reinforced	Overturned
System / linkages	Unchanged	Incremental innovation	Modular innovation
	Changed	Architectural innovation	Radical innovation

Source: (Henderson and Clark, 1990)

Figure 2.4 Typology of Innovations

Incremental innovations are minor improvements or simple adjustments to the existing product or services in order to exploit the potential of the design (Smith, 2010). This is perceived as the most common and safe type of innovation. Instead of changing the system, minor changes are taken place to the components of the goods in order to maximum the acceptance of consumers to the new products. Smith (2010) also conclude the incremental innovation favors mostly existing incumbents in the market, mainly because it helps them to reinforce the position in the market or enter a new market segments rather than create a new market field.

In contrast, radical innovations are fundamental changes that represent revolutionary changes in technology (Smith, 2010). It introduces brand new products to customers and the market. What comes with radical innovation is the high degree of uncertainty. The most challenging question lays on radical innovation is if the radical innovation would provide products or services with characteristics that consumers wanted (Chandy and Tellis, 2000). Thus radical innovation is both difficult and risky. On another note, it is worth to mention that radical innovation is rare (Chandy and Tellis, 2000) and it is always associated with big technology breakthroughs.

Architectural innovation leaves the core technological concepts of components intact but changes the way they are designed to work together (Smith, 2010). In a word, the new product was introduced by reconfiguration of the existing system and linking the components in a new way. The theory of architectural and modular innovation are proposed by Henderson and Clark (1990) years after incremental and radical innovation were accepted by the researchers.

Modular innovation is innovations that change a core design concept without changing the product's architecture (Smith, 2010). The use of new or different components is the key feature of modular innovation. Take an example of modular innovation; in diet candy sugar is replaced by sweetener to lower the calorie. The structure of the candy does not changed, but one key component was replaced.

Even though the four typologies are defined clearly above, the distinction between these different novelties of innovations is not easy to clearly define or measure. For example managers are likely to judge an innovation based on their level of familiarity and experience with the innovative entity so that different answers would be given by different judges. Furthermore, innovations may change their classifications over time (Dewar and Dutton, 1986). An example could be that steam locomotives were a radical innovation in the 1800s, but today they are merely a historical curiosities in the museums. However, each of the three forms of innovation product, process, and service can take place within these degrees of novelty running from incremental through to radical change.

In the agri-food sector, generally the majority of innovations are of incremental type. As Linnemann et al. (2006) summarized in their research that in 2002 the most successful food & beverage introductions on the Dutch market with approximately 65% were the new products had been new variants of a well-known product which was called line-extension products (more details in next session). However, based on firm size, companies can be distinguished as big innovators and small innovators (CIAA, 2006). Big innovators refers to large and medium sized companies which invest many resources in R&D and frequently introduce new products also including radical innovative products; while small innovators represent small size companies in agro-food business that rarely introducing radical changes (Dewar and Dutton, 1986).

2.1.4 Success of innovation

Innovation success seems quite simple on the surface. If the innovation does not provide profit to the company successfully, then it has failed. However, innovation success is a rather diffuse concept. Mainly due to the reasons that different measures, level of analysis, and for research investigations, also the source of data and the different data collection method were applied

(Craig and Hart, 1992). In the book of Traill and Grunert (1997), they proposed to measure innovation in two dimensions. The first is market acceptance: to what extent do customers perceive a product as innovative, and to what extent does this lead to purchase intentions, to trial purchases and to repeat purchases? The other dimension refers to the extent to which the innovation has contributed to a realization of the company's goal for example financial goals, patent numbers, and strategic position. To make it simple, in this study, the success innovation refers to innovation which enhances performances in companies. And the performances were scored on a 1 to 7 scale in the questionnaires which the higher the score the better the performance.

2.1.5 Influencing factors in innovation for company

In the principle of profit maximization, it states that businessmen always tend to pursue the maximum profit. In economics, maximum profit can be achieved either by increasing the sale revenue of the product or/and by decreasing the cost of the product. To apply this theory, on the marketplace, it is not easy to simply achieve increasing the sales revenue, as there are lots of influencing factors such as competitor reaction, seasonal reasons and ability of the salesmen. Since increasing the sales revenue is not an easy way to achieve, a lot of companies try to innovate themselves in order to decrease the cost of their products, as well as deliver good quality which consumers wants. In other words, on firm level, companies maintain or even increase the competitiveness among the other competitors by innovation (Clark and Guy, 1998).

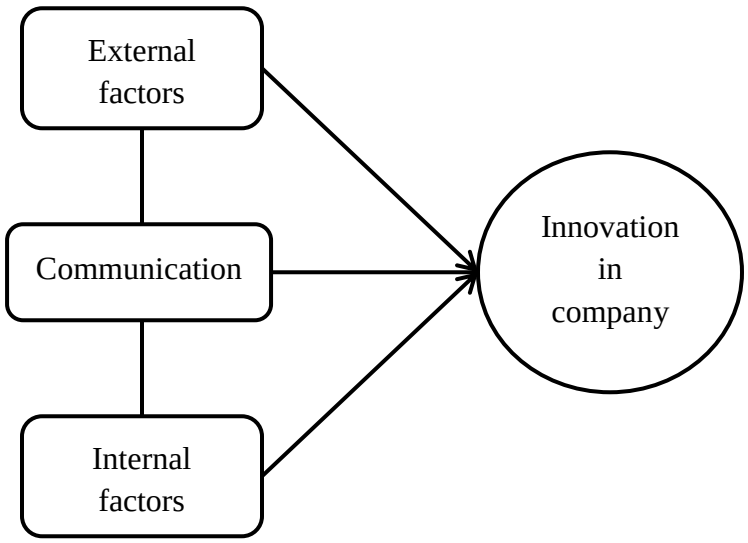


Figure 2.5 Type of influencing factors on innovation (self-generating)

Innovation in companies is influenced by external and internal factors (Figure 2.5). Most of the factors can have both positive and negative effects on innovation.

2.1.5.1 External

The environment is a very influencing factor for innovation since it is an uncontrollable variable. When talking about business environment, there are three layers on top of company environment, which are macro-environment, industry/sector environment, as well as the competitor and market environment (Johnson et al., 2008).

The macro environment can be analyzed by the PESTEL model. PESTEL stands for Political, Economic, Social, Technological, Environmental, and Legal. Political highlights the role of governments; Economics refers to macro-economic factors such as exchange rates, business cycles and differential economic growth rates around the world; Social influences include changing cultures and demographics; Technological influences refer to innovations on technological improvements; Environmental stands specifically for sustainable and green issues; and finally Legal embraces legislative constraints or changes such as safety legislation of restrictions on company mergers and acquisitions. PESTEL factors are uncontrollable by companies. It is important to analyze how these factors are changing now and how they are likely to change in the future. PESTEL factors can be instrumental for companies in providing opportunities and imposing threats (Johnson et al., 2008). Thus helping the companies make the right long-term strategic decisions.

Innovation is influenced by the macro environment from both positive and negative sides. Speaking of economic which is one element in PESTEL, availability of venture capital and subsidies result in an increase on innovations. But on the other hand, take politics for example massive government regulation is generally believed to have negative impacts on innovation. Government bureaucracy acts as an inhibitor to innovation because regulatory agencies tend to be risk averse by nature (Hlavacek and Thompson, 1973; Thompson, 1965).

Social aspect also plays a role influencing innovation. Once a new technology is obtained, the acceptance by local people is one of the determinants on the successfulness of the innovation. Some cultures are more conservative, risk averse and change resistant than others. Successful innovations which favor the environment are perceived as non-threatening (Ahmed, 1998). When the situation of innovation resistant phenomenon happens, the customer orientation is assumed to be even crucial in the successfulness of innovation. In many cases, the introduction of new products or services to a new country or new market is achieved by alliance with local competitors. In this case, the culture background and mutual trusts from both sides play an essential role in the successfulness of the innovation process (Omta, 2002).

The industry/sector environment can be analyzed by Porter's five forces framework (Porter, 1998). This framework displays the major factors which influence the competitive strategy of companies (Figure 2.6). These forces also play a role in influencing innovation and related activities in companies. The threat of entry depends on the extent and height of barriers to entry. High barriers are good for existing competitors, because they protect them from new competitors. The threat of substitutes refers to the threat of products or services that offer a similar benefit to an industry's products or services, but by different process. Customers are essential for the survival of any business. But sometimes these buyers can have such high bargaining power that their suppliers are hard pressed to make any profits. The same as the threat of buyers, the threat of

suppliers is sometimes crucial for companies. The four mentioned threats all impinge on the direct competitive rivalry between an organization and its most immediate rivals. The more competitive rivalry there is, the worse it is for existing competitors within the industry.

Innovation is effected by this layer of environment as well. For example, with the fast changing customer demand and growing requirement variation, the market power has long been shifted from manufactures to customers. This phenomenon is known as "chain reversal" (Linnemann et al., 2006; Omta, 2009). Innovation is stimulated by the presence of a need from the customers. The introduction of a new product is closely linked to consumer innovativeness.

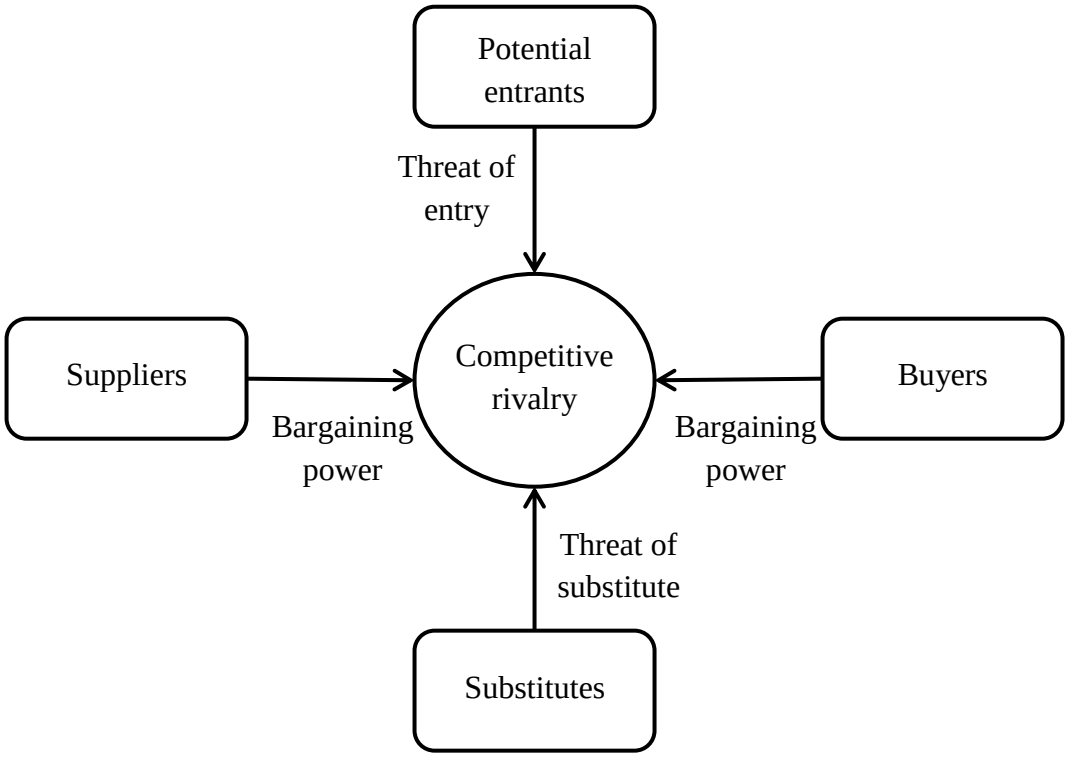


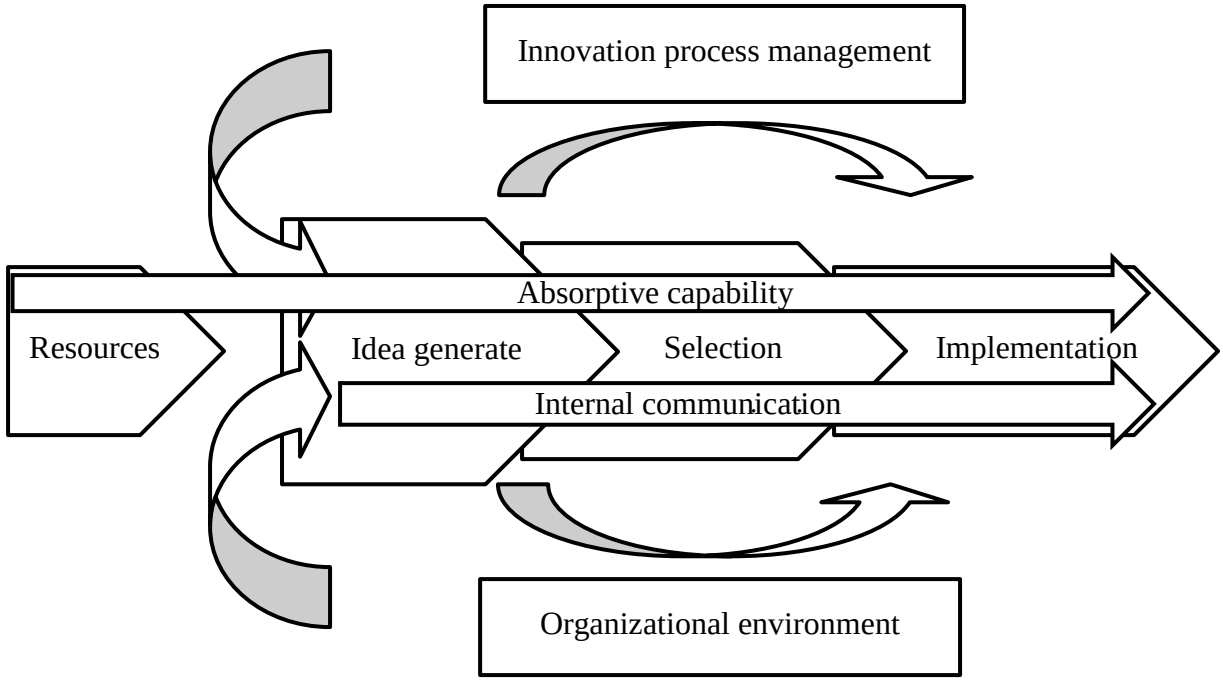
Figure 2.6 Porter's five forces framework

In the layer of competitor and market environment, within the company the ability to innovate is proportional to the degree of competitiveness in the market. It is easy to understand that the more competitive the market is, the higher the tendency will be to innovate by the firms in order to maintain the competitiveness on the market (Ahn, 2002). Competition gives pressure to innovate and thus organizations are forced to innovate in order to survive in the competition. Another noticeable phenomenon in this layer is "business clusters". It is a geographic concentration of companies that linked and perform business in the same field. As Porter (2001) summarized, business cluster has three advantages of enhancing innovation in companies, which are a better ability to perceive innovation opportunities; presence of multiple suppliers and institutions to assist in knowledge creation; ease of experimentation given by locally available resources. The most famous example of a business cluster is the Silicon Valley located in northern California. Nowadays, an emerging business cluster of agri-food business called Food Valley which is located in Wageningen in the center of the Netherlands is gaining its importance in its sector.

2.1.5.2 Internal

Innovation does not happen in a vacuum, it is subject to a range of internal factors (Figure 2.7) which are controllable variables for companies.

"Innovation is an expensive process" as stated in the *Oxford handbook of innovation* (O'Sullivan, 2004). Because the need of resource companies to provide for innovation can be expensive. In terms of resources in innovation it refers to people and knowledge (Smith, 2010). In the innovation process, knowledge is one of the fundamental elements of invention, and it provides the bases of technological ability for companies to deliver new products or processes. A good knowledge base and management of it increases innovativeness and competitiveness (Carneiro, 2000). People are essential in the whole process as the main body that takes actions in the process as well as managing the process at the mean time. Finance is of great importance for innovation as well. Because its high uncertainty and long timing feature, it requires a high standard of financial input (Smith, 2010).



Source: based on Bessant and Tidd (2007), the original model is shown in Appendix 6

Figure 2.7 Internal influencing factors on innovation

A good environment context within the company can inspire and trigger innovation occurrence, while on the contrary a poor innovation environment would definitely hamper innovation or lead to the failure of innovation. As stated by Batterink et al. (2006), the innovation process is embedded in the firm's environment. Personal capabilities relate to the competencies within innovation teams which also are proven to be the influencing factor to innovation (Smith, 2010; Tidd et al., 2005). A suitable internal innovation environment can be an incubator for individuals to explore their capabilities, hence bring more sources for innovation.

Internal communication has been suggested to play a critical role in promoting innovation as well (Kivimäki et al., 2000). For example, communications between work units participating in the innovation process provide the flow of information inside the organization, in this way communication contributes to the success in the implementation stages of innovation.

Management is always a key issue for innovation. Clear strategic leadership and direction is a great advantage for any innovative company to become a success. A lot of researches highlight the concept of success routines on innovation process (Tidd et al., 2005). For examples, successful innovation correlates strongly with how a firm selects and manages projects, how it coordinates the inputs of different functions, how it links up with its customers. The other critical point emerged from the researches is managing innovation in a dynamic context. Innovation is heavily influenced by both internal and external factors, it is meant for the dynamic features of innovation. The capability of a firm to innovate in a dynamic model is statistically proved to be linked with the innovative performance (Utterback and Abernathy, 1975).

In the research of Tsai (2001), the author argue that organizational units can produce more innovations and enjoy better performance if they occupy central network positions that provide access to new knowledge developed by other units. This effect, however, depends on units' absorptive capacity, or ability to successfully replicate new knowledge. Proposed initially by Cohen and Levinthal (1990), and further defined by Pavitt (2002), absorptive capacity is the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends.

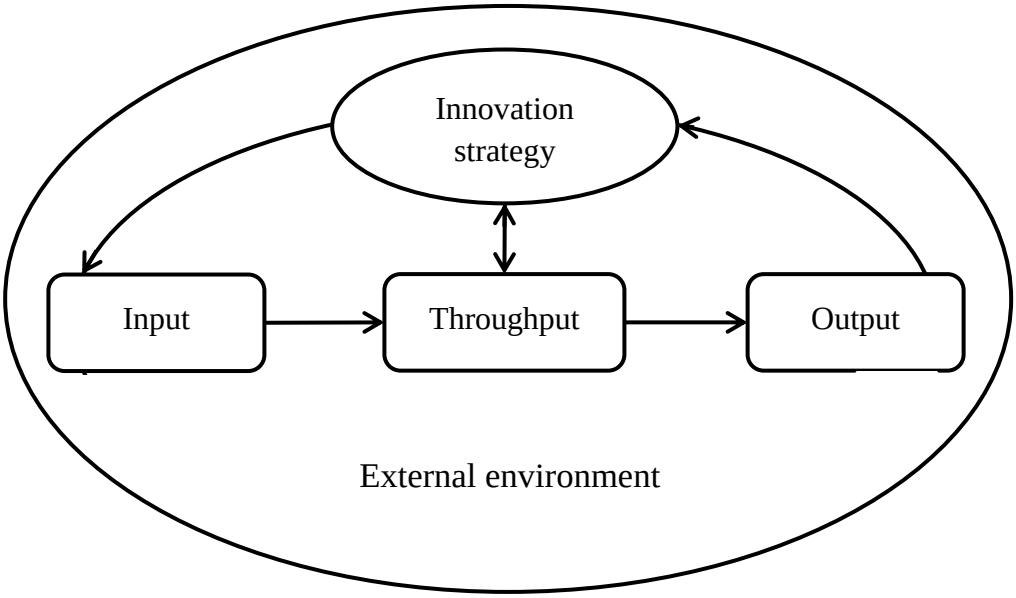
2.1.5.3 Communication

Between external environment and the internal side of the company, a bridge is needed in order to link these two sides. Communication of R&D from companies to the external side is proven to be related to innovation performance in companies (Kivimäki et al., 2000). Communication and interactions with outside the company can import more sources for innovation. For example, in the research of Cohen et al. (2002), they found that public research in government and university labs is critical to industrial R&D in a small number of industries and importantly affects industrial R&D across much of the manufacturing sector. In the current market, customer satisfaction is defined as a key indicator of business performance of a company. External communication with customers is essential to companies in predicting the market trend (Damanpour, 1991). Additionally, the new trend of open innovation brings the importance of external communication with other firms, suppliers, distributors, universities and research centers to companies. On the other hand, the risk of divulgence is accompanied with the open communication process (Omta, 2002). In this controversial situation, it turns back to the topic of how to manage innovation, especially how to manage open innovation.

2.2 Input-throughput-output model theory

A large body of literature on innovation can be found on the innovation input-throughput-output model (Brouwer and Kleinknecht, 1999; Fortuin et al., 2007; Keizer et al., 2002; Vermeulen et al., 2003). This traditional conversion model has proven to be a valuable research instrument helping

to increase our understanding of the innovation cycle. The model contains three stages as indicated in the name, innovation input, throughput, and output. Before the flow starts, the pre-request for companies is to first make a strategic decision whether to innovate or not, and if yes, in what manner. As indicated in Figure 2.8, above the main flow, innovation strategy acts as guideline in each stage of the main flow. On the other hand, strategy also gets feedbacks from the main flow. In the throughput stage, internal and external environment factors can influence innovation, decisions need to be made to adjust or adopt the changes in the environment accordingly. In the final stage, output of the innovation gives reflections on the strategy itself (Batterink et al., 2006; Kemp et al., 2003). The innovation itself is embedded in the firm's environment. As Batterink et al. (2006) described, environment can be divided into controllable environment, such as network with supply chain partners and competitor; and incontrollable environment like economic, political and social factors. As a result, it is known that environment has an influential role in the whole innovation process (Batterink et al., 2006; Johnson et al., 2008).



Source: based on Batterink et al. (2006), the original model is shown in Appendix 7

Figure 2.8 Innovation input-throughput-output model

2.3 Innovation assessment

Because of the high levels of uncertainty associated with innovation, the high incidence of innovation failure has been acknowledged decades ago (Cooper, 1979; Crawford, 1977). The necessity of assessing innovations has become a priority for many organizations. Even though nowadays, the success rate of innovation is much higher than it was decades ago, the high cost and risk of innovation still make it a live or death transition to companies.

The first milestone in the innovation assessment was when Rothwell (1972) introduced the project SAPPHO (Scientific Activity Predictor from Patterns with Heuristic Origins) to identify a successful or failed innovation by examining the establishment of innovation in the market. In

SAPPHO, successful innovations are those that managed to establish a worthwhile market or profit. In contrast, less successful innovations are those that failed to establish a worthwhile market or profit even though technically they had been successes. In essence, SAPPHO demonstrates that successful innovations are based on successful coupling of technology and market needs.

Another direction of the research on innovation in the 1970s is the investigation on new product failure (Crawford, 1977) studies. Data from different sources shows the failure rate of innovation varies from 50% to 82%, Crawford (1977) arguers that the big differentiation in the numbers is due to the un-normative standard of innovation failure in the researches. But still this controversial high innovation failure rate did indicate the fact of a lot of failed innovation products and services cases. The high rate of innovation failure provides lessons for further innovations to avoid the same failures cause. Besides, it also gives a starting point from where prescriptive solutions can be generated. These were what triggers researchers focus on innovation failure.

Further researches favor the discovery of successful innovation. A lot of case studies are carried out aiming to find out the success factor in innovations (Cooper, 1999; Fortuin and Omta, 2009; Rothwell, 1972; Rothwell and Robertson, 1973). These researches tend to uncover the key to successful innovation, helping to establish a complete and comprehensive innovation process.

Recent researches in innovation have a wider scope. Besides the direction described in the previous studies, comparisons of successful innovation and failed innovation are also significant research topics in the innovation discipline (Boer and During, 2001; Roper, 1997). Another feature of the recent researches is that innovation not only focuses on the industry level, but more and more attentions have been paid to companies, even small and medium enterprises, on the individual level (Tonnessen, 2005).

The number of literature on product development has been growing for decades. Researches are varied and vibrant, yet large and fragmented. Brown and Eisenhardt (1995) organized the empirical literature from authority of North American and European journals on product innovation into three streams: product development as rational plan, communication web, and disciplined problem solving. First of all, in product development as rational plan where the emphasis was laid on good planning and implementation, as well as on appropriate and sufficient support to innovation activities as key to success of innovation. A second stream of product innovation research was centered on communication. It showed that communication among the project team members, and between the team members and outsiders, is one of the key factors which stimulate the performance of the innovation. The third stream disciplined that problem solving was seen as a balancing act between relatively autonomous problem solving by the project team and the discipline of a heavyweight leader, strong top management, and an overarching product vision. The comparison of the three streams can be found in Table 2.1 below.

We will give detailed information of WIAT in next chapter.

Table 2.1 Comparison of three research streams

Concepts	Rational plan	Communication web	Disciplined problem solving
Key idea	Success via superior product, attractive market, rational organization	Success via internal and external communication	Success via problem solving within discipline
Theory	Mostly a theoretical	Information and resource dependence	Information including problem solving
Methods	Bivariate analysis; single informant many independent variables	Deductive and inductive; multivariate; multiple informants	Progression from inductive to deductive; multiple informants; single industry, global studies
Product	Product advantage: cost, quality, uniqueness, fit with core competence	-	Product integrity: product vision that fits with customers and firm
Market	Size, growth, competition	-	-
Senior management	Support	-	Subtle control
Project team	X-functional, skilled	-	X-functional
Communication	High cross-functional	High internal, high external – various types and means	High internal
Organization of work	Planning and effective execution	-	Overlapped phases, testing, iterations and planning
Project leaders	-	Politician and small group manager	Heavyweight leader
Customers	Early involvement	-	-
Suppliers	Early involvement	-	High involvement
Performance (dependent variable)	Financial success (profits, sales, market share)	Perceptual success (team and management ratings)	Operational success (speed, productivity)

Source: Brown and Eisenhardt (1995)

2.4 Innovation in the agri-food industry

Innovation is of great importance in the agri-food sector, as sustainability in agriculture and the growing demand in food is a big challenge for mankind in this century. Other problems like the growing ageing population in the world and increasing competition for scarce resources are also problems urgently need to be dealt with. As studied by Graham and Senge (1980), each long wave cycle starts with a new ensemble of technologies, which means that innovation could be a key leading to a new revolution in the industry. To put it concrete to the problems in the agri-food sector, innovation can also be one of the solutions to the challenges we are facing nowadays.

In different industries innovation level varies. According to the taxonomy by Pavitt (1984), the agri-food industry is classified as a combination of a scale-intensive (especially food & beverage), and supplier-dominated (especially agriculture) industry (Batterink et al., 2006). Scale-intensive firms normally have a relatively high proportion of their own process technology as well as own independent production engineering departments. In this way scale-intensive firms are relatively big firms, more emphasized on product innovation. In contrast, firms in supplier-dominated industries have a strong linkage with suppliers. This also means these firms easily get limitations from the suppliers. Supplier-dominated firms are generally small and have relatively weak in-house R&D and engineering capabilities, and most of its innovations come from suppliers' equipment and materials. Moreover, in supplier-dominated industries a relatively large proportion of innovative activities are dedicated to process innovation in terms of cutting costs (Pavitt, 1984).

The agri-food sector is categorized in the low innovative group compare to the fast developing industry like electronic industry and pharmaceutical industry. According to the OECD report (2011) combined with Eurostat's Community Innovation Survey (2004 & 2006), the innovation intensity of agriculture sector was ranked 12th among all sectors which were investigated in the research. Agri-food industry is a relatively a young player in the arena.

2.4.1 Drivers and barriers in agri-food industry

As mentioned, agri-food industry is not as innovative as the high tech industries. Technology push is less influential compared to customer demand as drivers for innovation. The willingness of consumers to use new products and the process of adaptation towards these products is crucial for the success of innovation (Goldsmith et al., 2006). In an empirical research, Fortuin et al. (2007) identified that customer orientation is one of the main critical success factors for innovation in the agri-food company by a comparative study of over 80 innovation projects in 12 multinational agri-food prospector companies in the Netherlands and France.

In another empirical research of Batterink et al. (2006), they studied on firm level of the factors related to innovation in Dutch agri-food companies. The conclusion they draw from the research was that the Dutch agri-food companies are proven as a scale-intensive type, and in order to be successful in product innovation firms must have a strong market orientation. This finding is in line with what Song and Parry (1997) found in Japanese firms.

Along with the identification of success factors, Batterink et al. (2006) also found that economic considerations and insufficient innovation competencies were the main barriers to innovation in

the Dutch agri-food companies. This is in line with the finding by Martinez and Briz (2000) in their research of innovation in the Spanish food & drink industry.

Costa and Jongen (2006) carried out a study on the market pull driven new food products, the major barriers to food innovation they found were 1) a lack of concrete guidelines for the effective implementation of consumer oriented food development, 2) the sequential approach of the innovation process, 3) and the lack of intra- and inter-organizational coordination or integration of R&D and marketing activities and know-how.

2.4.2 Comparison of agri-food industry in China and the Netherlands

After the Second World War, most of the European countries welcomed the post war economic expansion, also known as the postwar economic boom, and the Golden Age of Capitalism. It was a period of economic prosperity in the mid-20th century and lasted until the early 1970s. During this time, under the peaceful global environment, most of the European countries' economies were recovering in a high growth rate even exceeding the level before the Second World War. While across half of the hemisphere, the new founded country China was facing a huge challenge to rebuild the country on the devastated ruin by wars. Compared to Europe, China not only suffered the Second World War battled with Japan for eight years, prior to this, there was the eight years of Chinese civil war. Obviously, from the starting point, China is lagging behind the western world. Even though China tries to reduce the distance to developed countries by its open policy and the other series of movements and actions, still there is a long way to go to eliminate the gap, especially on the technology and innovation level.

The world's human population has increased near fourfold in the past 100 years. Based on the United Nation Population Division (2007) estimation, the world population will increase from 6.7 billion (2006) to 9.2 billion by 2050. How to feed this enormous population is the biggest question for the agro-food sector. Especially, in China, the world's most populous country, the challenge is tremendous. The agri-food industry is one of the largest industries in China and has generated an unprecedented level of growth. The gross industrial output value of the agri-food sector increased 250% from 2001 to 2007 (Wei, 2008). According to the China statistical book in 2011, the agri-food sector comprised about 34000 firms that employed 5.4 million persons and generated 0.57 trillion Euro industrial output value which represents 9.6% of China's GDP. However, the energy consumption for this dramatic growth is two times higher than in Germany while the labor productivity in agri-food sector was only 1/12 of the American's (Wei, 2008). The innovation in the agri-food sector is desired to end this 'extensive way' of economic growth. During the 17th National congress of the communist party of China, Present Hu Jingtao underscored the task of enhancing China's capacity of independent innovation. He said: This (innovation) is the core of our national development strategy and a crucial link in enhancing the overall national strength." Although China has been grown to the world's second-biggest economy, the innovation capability of China is only ranked as 64th in the world (López-Claros, 2010). The low innovation capability may be caused by 1) lacking the market regulations such as ignoring the intellectual property 2) low R&D expenditure which is about 1.34% GDP and 3) lag in the experience of managing growth processing (López-Claros, 2010; Wei, 2008).

However, in the Netherland, the country with the total land area of only 0.4% of China's land area, the innovation capability was ranked 8th in the world. This is all thanks to the high investment in R&D (1.82% GDP in 2008) and mature management in innovation process ((全博), 2011). The high innovation capability accelerates the technology transfer efficiency which helped the Netherlands to become the third agri-food exporter in the world. In the Netherlands, the agri-food sector is one of the most important sectors of the Dutch economy which contributed 10% of the GDP. For example, in food & beverage industry, the innovation performance is relatively strong compared to other industries in the Netherlands (Enzing, 2009). The Dutch F&B industry shows the highest level of innovative activity among all EU 25 country based on three indicators: an index of patenting activity, total factor productivity and an index of market advantage (Enzing, 2009). Finding the key factors for successful innovation comparing seed and food & beverage companies in the Netherlands and China is the purpose of this study. In the next chapter an attempt to identify these factors will be made using the Wageningen Innovation Assessment toolkit (WIAT).

3 Methods

3.1 WIAT

Wageningen Innovation Assessment toolkit is a tool developed by Wageningen University management study group to assess innovation for agri-food related company and project by using a questionnaire. The WIAT consists of two parts, the company part and project part. The WIAT project part is aiming to diagnose strengths and weaknesses in the innovation project, to predict the success potential at an early stage of its development (Omta et al., 2008). For the WIAT company part, it is a tool help company to find out how important innovation is to the company and how good or bad the company is at innovation. In this study, only the company part is used for the data gathering and analyzing.

The company part WIAT consists of several constructs. In practice, the number of construct and content of the constructs can be tailored made for specific type of company. Each construct has different number of statements. All the statements used seven-point Likert scales, ranging from strongly disagree (value=1) to strongly agree (value=7). Accompanied with the use of the questionnaire, a follow up interview was scheduled with the CEO, CTO and or R&D director of the company. The structured interviews were used to crosscheck the information as well as to gain deeper insight in the innovation management issues covered by the research questionnaire. In this research, five same constructs were selected in both questionnaires which were used in gathering data.

Business environment. Two sub-concepts were operationalized in the concept of environment.

1) Threats: threat of new entrants and substitutes (one question).

2) Competitive forces: power of suppliers among existing firms (one question).

Innovation strategy. Strategy acts as guidance in the innovation process.

3) *General business strategy:* operationalized as the importance of innovation in maintaining competitiveness (one question).
4) *R&D strategy:* how R&D is organized in the company (one question).

Innovation input. What types of sources were introduced at the beginning of innovation. There is only one statement operationalized for this concept.

5) *Market orientation:* the prediction of customer needs and trends (one question).

Innovation throughput. Two sub-concepts were addressed. One is the tangible part, like where innovation is taken place; and the intangible part of how good the R&D is, e.g. the level of innovativeness.

6) *Cross-functional communication:* questions on communication of R&D with customer, distributor, manufacturing and marketing, together with the involvement of senior managers (six questions).
7) *Innovativeness:* operationalized as the respondent's subjective assessment of the company's innovativeness in the fields of marketing, product design, product quality, distribution, and manufacturing (six questions).

Output and performance. Three sub-concepts were operationalized in this concept. The two layers of output are listed which innovation as the first layer and the rest two as higher level performance related to the first layer.

8) *Innovation performance:* operationalized as what comes out from innovation, e.g. return of R&D investment, new product first enters the market and protections received by patents (four questions).
9) *Completive position:* operationalized as the financial position, reputation and response rate to the market as compared to the main competitors (three questions).
10) *Business performance:* operationalized as total revenues and operating profit margin in the past three years; sales; growth rate, sales volume and profitability (four questions).

3.2 Theoretical model

Based on the classic innovation input-throughput-output model, the constructs extracted from the factor analysis were structured as follow (Figure 3.1).

As mentioned in the previous section, the influencing factors of innovation can be analyzed from three parts, the external and internal and the communication between them. In this model, due to the limiting condition of the existing dataset, only 31 indicators were not sufficient to investigate in all the three parts. As a result, these three types of factors are partially analyzed.

From the beginning of the model starts with the business environment, the three layers of environment, as mentioned in the literature synthesis section, macro-environment, industry/sector environment, and the competitor and market environment all have impacts on company performance. Especially when talking about individual company, the two lower lays have more direct power on it. In the research of Ahn (2002), the author found out that the intensity of

innovation within companies is influenced by the competitive level in the industry. In another words companies tend to focus more on innovation to maintain their competitiveness in the stressed industry environment. Company takes innovation as strategy, so that chains of decisions will be made based on the innovation strategy.

1. A more competitive business environment encourages the innovation focus.

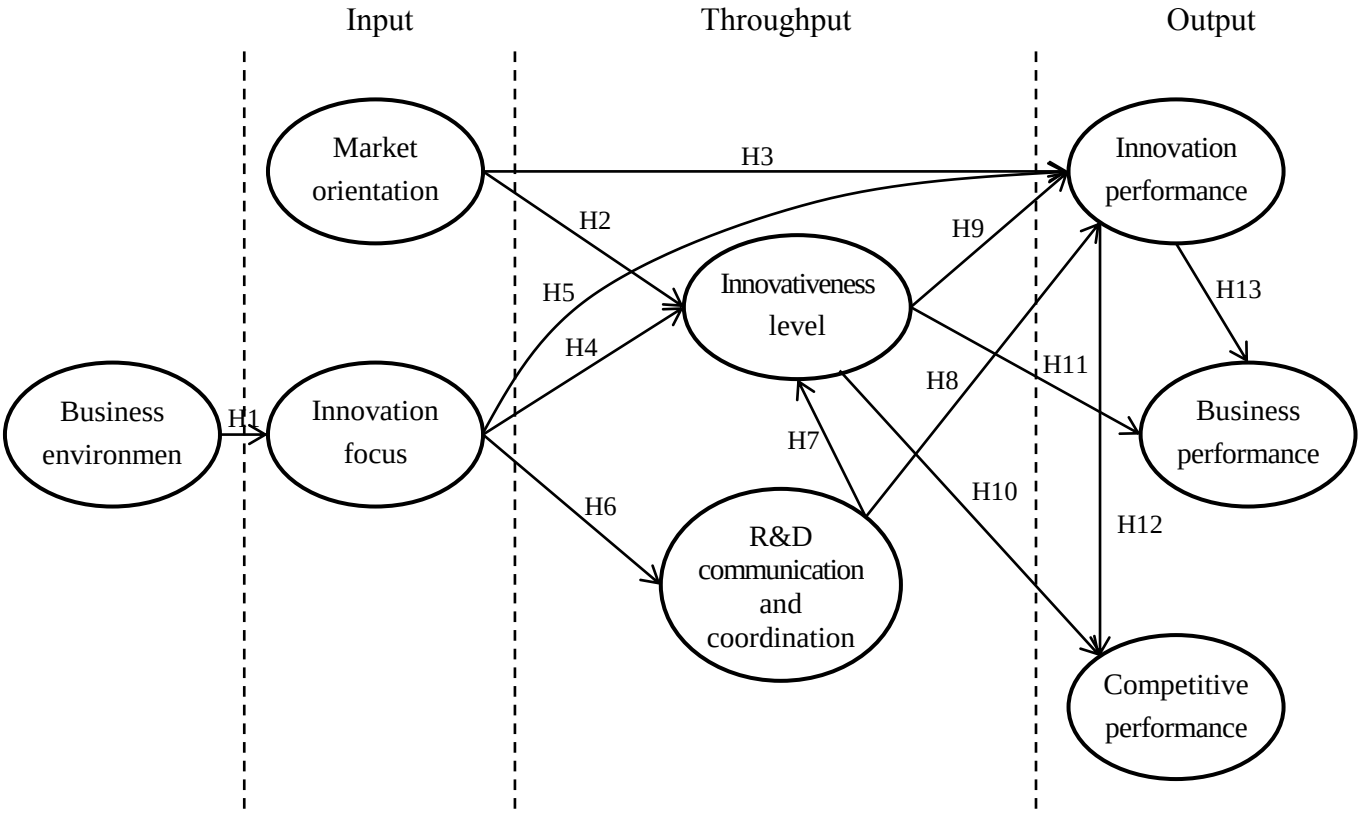


Figure 3.1 Theoretical model

Market orientation was studied as one of the key factors of successful innovation in the food & beverage processing industry (Batterink et al., 2006; Fortuin et al., 2007). Especially nowadays, in food & beverage industry, the power has long been shifted to the market demands from manufactures. A good prediction on market orientation provides company the right insight on customer needs, hence helps R&D improving innovative level on innovativeness level to guarantees a high potential on the new product designs. Apart from that, market orientation would help companies to make quick response to the market demands. In this way, innovation performance would be improved. So the lines from market orientation were linked as:

2. Market orientation helps to improve the innovativeness level.
3. Market orientation enhances the innovation performance.

Once the company made a decision of strategic innovation, it meant that the company put more focus on innovation. More investments would be located in innovation, and consequently the innovativeness level was expected to be improved. Thus, the business performance would be

enhanced finally (Ahn, 2002; Kemp et al., 2003). R&D as the crucial role would be more active in the innovation process.

4. A higher innovation focus has positive effect on the innovativeness level.
5. A higher innovation focus helps to enhance the innovation performance.
6. A higher innovation focus leads to better R&D communication and coordination.

A good communication of R&D with external action brings more knowledge and sources to the innovation process, which will improve the product innovativeness (Enkel et al., 2009; Omta, 2002). An excellent coordination provides consistency of the innovation process which helps to improve the innovativeness. As a result, the innovation performance will be enhanced as well.

7. R&D communication helps to improve the innovativeness level.
8. R&D communication helps to improve the innovation performance.

With high innovativeness level, companies can deliver better output of new products and services. Hopefully, the innovation performance would be enhanced. At the meantime, it gives more strength for companies to compete with rivals' products. In this way, business performance would be improved accordingly. In a word, good innovativeness level helps company to gain a better performance.

9. A higher innovativeness level enhances the innovation performance.
10. A higher innovativeness level enhances the competitive position.
11. A higher innovativeness level enhances the business performance

Having a good innovation performance provides companies with the strength to compete with the rivals, which leads to better business performance as well as competitive position. So between these performances the lines are drawn as:

12. A higher innovation performance enhances the competitive position.
13. A higher innovation performance enhances the business performance.

The correlation lines were drawn on one hand, based on the theoretical outcomes from previous studies; on the other hand, also the particular factors of each construct were considered.

3.3 Methodological note

In innovation studies, three levels of analysis can be identified (Cobbenhagen, 1999): the sector, the firm, and the project. This research is done at a firm level. Five steps are processed in analyzing the data.

1. Questionnaires screening and data pre-check

   137 samples were used in the research. Data was collected using different questionnaires, mainly two versions. The first screening step was to pick the same questions from both questionnaires and then integrated the data from two questionnaires.

2. Validation of grouping

Of the 137 respondents, 70 were from Chinese company respondents with 49 seed company respondents and 21 food & beverage company respondents; and the rest were 10 Dutch seed and 57 Dutch food & beverage company respondents. The first aim here is to check if the seed companies and food & beverage companies can be grouped together as representing country type of companies. The second check is aiming to exam if there were significant differences between Chinese companies and Dutch companies.

3. Factor analysis

   SPSS was used in this step. All the questions selected from step one were identified as either independent variables or dependent variables. Different type of variables were performed the factor analysis separately. Based on the results from the factor analysis, the questions were grouped into several constructs as preparation for the further model building step.

4. Model building

   Partial Least Squares (SmartPLS) program was used in this step. The grouped constructs were given descriptive names and placed in the correct positions of the structural model. The theoretical model was tested and adjusted until all the parameters meet the minimum requirements.

4 Results

4.1 Questionnaires screening and data pre-check

Two versions of questionnaires had been used for the data collection. Both questionnaires were built up based on the WIAT. All questions in the questionnaire had a Likert of 7 scales. Of the two questionnaires, one was specified for seed companies (Appendix 1) and the other was tailored for food & beverage companies (Appendix 2).

All of the 41 Chinese seed companies are characterized as small sized in terms of both the number of employees and turnovers, while the rest of the 8 Chinese food & beverage companies can be grouped as small and medium sized. All of the Chinese companies are domestic orientated, and they do not participate in global market. On the contrary, 6 out of 26 Dutch food & beverage companies investigated are international firms which have business center in the Netherlands while for the rest they are also categorized as small and medium sized companies; the 10 Dutch seed companies are mostly known as world leading players in the vegetable seed industry.

At first, 36 same questions were extracted from two questionnaires. Further in the later step, 5 out of 36 questions were realized had many missing values in Dutch company samples. As a result, these 5 questions were withdrawn from the list. In the end, 31 valid questions (indicators) were selected for further steps.

4.1.1 Descriptive results analysis

The descriptive information e.g. means and standard deviations of the 31 questions were calculated to gain a general idea of the differences between the groups. Means of 31 questions on Chinese, Dutch and overall respondents are shown in Figure 4.1.

In general, most questions shared similar means for both Chinese companies and Dutch companies. Mean of each factor were compared using nonparametric test since none of the item is normally distributed. The detailed results of each construct were listed accordingly to the order in the construct structure (Table 4.1 - 4.9). Questions marked with "*" were questions which did not have the scale from 1=strongly disagree to 7=strongly agree.

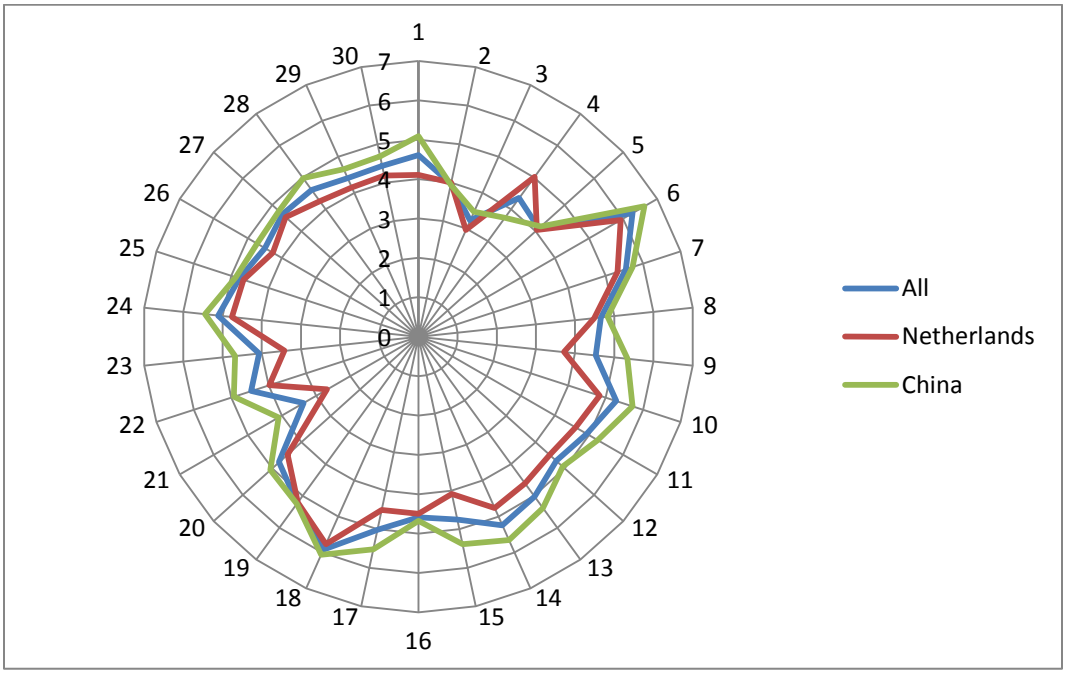


Figure 4.1 Descriptive results of questionnaires

In general, Chinese companies marked higher than Dutch companies do. Culture differences played a role in the gap between the results. China traditionally has conservativeness in its sprit. But when talking about business, most businessmen abandon the traditional sprit. They always exaggerate of what they are doing and what they had achieved. On the contrast, Dutchmen are consistently subjective and honest on evaluating and answering questions. So the answers from Dutch companies are relatively conservative than Chinese companies' answers.

4.1.1.1 Business environment

As discussed in the previous section, there are three layers need to be checked when analyzing the external environment. In the fixed questionnaire, not all the layers of environment factors were involved. In the 31 questions, only two questions can be used to describe business environment which were two elements described in Porter's five forces (Table 4.1).

The differences between two country companies are not big since the scores both fell on the same level, and the mean comparing results shown non-significant between two country types. Both country types of companies gave medium score on question 3, which indicates that the agri-food industry in both countries is rather a steady industry. The competition status of this industry has achieved the equilibrium, as a result it is not easy for new entrants to break even (Rugman and Collinson, 2009). Secondly, it indirectly depicts the low innovativeness of the industry in both countries. On the firm level, it happened that a big threat was introduced by company which brought novel technology to the market, for example Apple Inc. in the electro consumer goods. In a low innovative sector, it is not easy for new entrants to bring big threats to the existing competitors. On the contrary, question 5 had the score above average 4. It means both country type agri-food companies are experiencing big influence from suppliers. Agri-food industry is a fast-moving consumer goods industry, and it heavily relays on the sources and materials because of the special properties of food & beverage ingredients, for example limited lifetime, high hygienic standard, restrict requirement in logistics. Even though most suppliers in food & beverage industry are not concentrated suppliers mean that for food & beverage companies it is not difficult to find substitute suppliers from the market, the high switching cost and risk are always the limitations. Food & beverage materials are mostly natural type of sources, as a result it brings along the problem of un-consistent quality in the raw materials. Switching suppliers may increase the risk of uneven quality in the final products, as well as involve extra check and selection procedure which require labor source, time and financial cost for companies. The relatively high score on question 5 confirmed the high power of suppliers in agri-food industry.

Table 4.1 Descriptive results of "Business environment"

Q nr.	Text	Mean ± S.D. CN	Mean ± S.D. NL	Compare mean
3	New entrants in our sector have strong influence on the business results of our company	3.5 ± 1.7	3.0 ± 1.6	-
5	The bargaining power of suppliers has a strong influence on the business results of our company	4.2 ± 1.6	4.0 ± 1.3	-

- no significant differences found

4.1.1.2 Innovation focus

Both country companies marked high scores on innovation focus (Table 4.3). The lowest standard deviations among all the constructs in both country types of companies invested in the research indicates the high level of agreement on this statement. To explain the results, why Chinese companies give high scores on question 6 can be listed as follows. From the consumer side, from 2001 when China became a member in the WTO (world trade organization) till now, consumers are much more familiar and confident when facing the various choices in the rich and complex market. With the increase of incomes, more and more people are willing and able to try new products in China, which creates the atmosphere that encourage companies to pursue innovation in their products. From the historical point of view, China started to focus on innovation later than Western countries, and the benefit and profit which was introduced by innovation was just

tasted by Chinese companies. As a result, companies put even more attention on innovation than before in order to obtain more out of innovation.

Innovation can play a vital role for the survival of companies. Cefis and Marsili (2006) studied the relationship of innovation and survival probability of manufacturing firms in the Netherlands, the results shows that innovation has a positive and significant effect on the probability of firms 'survival. Additional to that, Basile (2001) proved in the empirical study that innovation is a very important competitive factor and helps explain the firm level heterogeneity among Italian export firms. Furthermore, Thomas and Slater (2006) pointed out in their study that agriculture remain the central element in developing countries and innovation acts as the key to the sustainable agricultural growth. In a word, innovation is important for companies, and it is worthy for companies to put focus on it which was proved by the high scores in Table 4.3.

Table 4.3 Descriptive results of "Innovation focus"

Q nr.	Text	Mean ± S.D.		Compare
		CN	NL	mean
6	Innovation is important to our company in maintaining competitiveness	6.6 ± 0.8	5.9 ± 1.1	-
8	Generally, we use cross functional innovation teams to organize our work	4.8 ± 1.5	4.5 ± 1.5	-

- no significant differences found

4.1.1.3 Market orientation

The proclamation that a business increase its market orientation will enhance the market performance has been issued by both marketing academics and marketing businessmen in the last few decades (Narver and Slater, 1990). The empirical results of Narver and Slater (1990) study showed that market orientation is relevant in every market environment. Furthermore, it was studied that market orientation is one of the key success factors in food processing companies (Fortuin and Omta, 2009). Addition to that, in the study of Zhang and Duan (2010), they carried an empirical study of 227 manufacturing companies, found out that the market orientation has a positive effect in improving product innovation performance in mainland China. That is to say, it is of importance for companies to accurately get the information about the consumer trends and desires from the market. In this way, companies can effectively and efficiently response to the market.

Agri-food industry had developed relatively long compare to other industries, and the communication with customers had evolved along the time. Customer behavior towards agri-food type product was well studied compared to the new emerging industries. Thus, make it possible and easier for companies to forecast the consumer trends and desires which were reflected in the result shown in Table 4.2. Apart from that, the improved education level of buyers gives the bases for them to make choices wisely and no longer like blindly follow. Thus, leave space for suppliers to set the agenda in the market. For example, healthy, sustainably and functional are always the highlighted words in new agri-food products which are promoted partly by the producers.

Table 4.2 Descriptive result of "Market orientation"

Q nr.	Text	Mean ± S.D. CN	Mean ± S.D. NL	Compare mean
2	Consumer trends and desires are easy to forecast	4.0 ± 1.5	4.0 ± 1.4	-

- no significant differences found

4.1.1.4 R&D communication and coordination

Again, both country companies marked relatively high scores on this construct (Table 4.5). For Chinese companies, all the questions in this construct constantly obtained scores above 5.0 and the slightly differ between each other. On the contrary, for Dutch companies, the scores varied. However, on the questions about communication of R&D and other functional divisions, the consistent similar scores in both country companies imply that the intensity of communication from R&D was equally divided among different functional divisions.

An efficient and effect communication flow in companies is of great importance. As (Clark and Fujimoto, 1991) conclude in the study that intense communication flow between firms and their suppliers reduces the product life cycle and improves product quality. Both Chinese and Dutch companies marked the highest score on the communication between R&D and marketing & sales among the four communication questions. It showed that a large amount of information input in R&D is coming from the marketing & sales point of view, which again confirmed the important role of market for innovation. The lowest score on communication between R&D and distributor might be that, in the supply chain, distributors have intense direct connection with sales and marketing. But when it mentions to R&D, the connection could be indirect via sales and marketing. Significant differences were detected in three communication related questions which Chinese companies are doing better than Dutch companies according to the non-parametric test. The possible reason could be that Chinese respondents are much more progressive when giving the answers than the Dutch respondents do.

Table 4.5 Descriptive results of "R&D communication and coordination"

Q nr.	Text	Mean ± S.D. CN	Mean ± S.D. NL	Compare mean
7	Senior managers are actively involved in the early stage of the innovation projects	5.7 ± 1.5	5.3 ± 1.2	-
9	We consistently codify the 'lessons learned' at the end of innovation projects	5.3 ± 1.6	3.7 ± 1.3	-
12	There is an excellent communication of R&D and customer	5.3 ± 1.5	4.6 ± 1.3	**
13	There is an excellent communication of R&D and distributor	5.0 ± 1.5	4.5 ± 1.2	-
14	There is an excellent communication of R&D and production	5.4 ± 1.5	4.6 ± 1.0	***
15	There is an excellent communication of R&D and marketing & sales	5.6 ± 1.3	4.8 ± 1.5	***

- no significant differences found
** significant different at 5 % level
*** significant different at 1 % level

4.1.1.5 Innovativeness level

Both country companies indicated scores on innovativeness level above the average level (Table 4.6). On question 10, both countries marked the highest score which indicated the close link between innovation and customer orientation in food & beverage industry. The biggest differences laid on question 21. For Chinese companies, education level of employees was considered as an obvious advantage when comparing with competitors; while Dutch companies do not hold the same opinion. Instead, they gave same scores on questions 21 and 28 which show the idea that compare to Chinese companies, Dutch focus on the practical productivity of employees rather than the level of diploma. On the other hand, this phenomenon is also a reflection of some Chinese business culture that people always take seriously consideration of prestige and chase for reputations and higher titles. Another outcome can be draw from Table 4.6 is in Chinese companies, innovation level was marked higher on product production and logistics than product design; which in Dutch companies is verse vise. Dutch consumers perceive quality considerably more important than price (Steenkamp, 1989). It requires the companies to provide qualified products to the consumers; as a result it is understandable that Dutch companies would rather pay more attention to product design than processing innovation. While for most common Chinese consumers, price is still the priority consideration when purchasing (Wu（吴垠）, 2004). So that for companies, developing the product itself is one thing, but how to promote and introduce the product to its customer is of significant importance as well. The different consumer behaviors between Chinese and westerner consumers actually were concluded as one of the common reasons why lots of western type of enterprises failed in entering Chinese market because they wrongly assumed Chinese customers have the same perception as their local customers (Shi（诗涵）, 2009; Xue（薛涛）, 2003).

Table 4.6 Descriptive results of "Innovativeness level"

Q nr.	Text	Mean ± S.D. CN	Mean ± S.D. NL	Compare mean
10	We monitor on a regular basis the extent to which our products and processes align to our customers'' needs	5.7 ± 1.3	4.8 ± 1.2	-
21	Our company distinguishes itself positively compared to our main competitors by: The education level of our employees	5.1 ± 1.3	4.5 ± 1.2	**
28	How innovative would you consider your company to be in the following? Product design	4.8 ± 1.3	4.5 ± 1.1	-
29	How innovative would you consider your company to be in the following? Product production and logistics	5.0 ± 1.3	4.2 ± 1.1	***
30	How innovative would you consider your company to be in the following? Marketing	4.7 ± 1.5	4.1 ± 1.4	-
31	How innovative would you consider your company to be in the following? Distribution	4.7 ± 1.5	4.1 ± 1.3	-

- no significant differences found ** significant different at 5 % level *** significant different at 1 % level

4.1.1.6 Innovativeness performance

Surprisingly, Chinese companies gave good scores on question 22. Possible reason would be in the Chinese context, laws and regulations on patents and licenses were not complete in the past. From the perspective of development, the protection by patents and licenses indeed improved. On the other hand, Chinese companies have high interests in chasing certificates such as "outstanding top ten brands in China" which is well accepted concept by most Chinese consumers, so that they could gain better reputations among customers. In this way, Chinese companies benefit more from the protections licenses. On questions 18 and 23, Chinese companies are significantly doing better than Dutch companies do. This is because in China, most innovation type is incremental or mimic. On the market, it can be easily observed in that once a new product is launched, when customers start to widely accept the product, within a very short time, the analogous product, also known as me-too product from other brands can be found in the market. For example, years ago a small regional food company developed a new flavor instant noodle, only when early this year a big Taiwan food company successfully promote this product to the market, and after one moth almost all food companies who have instant noodle production lines start selling this flavor of instant noodle (Wu（吴旦颖）, 25-05-2012). In this way, from the perception of some Chinese companies, the new product launch speed is indeed fast. In the end, the scores of question 27 indicate the confirmations the payback of innovation by both country companies.

Table 4.7 Descriptive results of "Innovativeness performance"

Q nr.	Text	Mean ± S.D. CN	Mean ± S.D. NL	Compare mean
18	Our company distinguishes itself positively compared to our main competitors by: An effective R&D process	5.5 ± 1.3	4.5 ± 1.2	***
22	Our company distinguishes itself positively compared to our main competitors by: The protection that our products and processes receive by patents, licenses, etc.	4.1 ± 1.7	2.7 ± 1.5	-
23	Our new products enter the market faster compared to our main competitors' products	5.0 ± 1.4	4.0 ± 1.2	***
27*	The returns from R&D relative to the R&D investments are	4.7 ± 1.7	4.3 ± 1.2	-

* 1=Very unsatisfactory and 7=Very satisfactory
\- no significant differences found
*** significant different at 1 % level

4.1.1.7 Competitive position

Questions under this construct are to a certain extent reflections of previous questions. For example, the flexible market response is a performance which leads by close communication with the market as well as the excellent R&D process. Both country companies provided analogous answers to the three questions, and no significant difference was found (Table 4.8). The highest scores on question 19 imply that good reputation is considered as a strong point for the competitiveness of companies. Furthermore, result of question 17 shows that have a strong

financial position is definitely important for a company, but this is not the decisive factor for company leaders to take in to the marketing strategic plan for lead the company to win the competition in the market.

Table 4.8 Descriptive results of "Competitive position"

Q nr.	Text	Mean ± S.D. CN	Mean ± S.D. NL	Compare mean
17	Our company distinguishes itself positively compared to our main competitors by: A strong financial position	4.7 ± 1.9	4.5 ± 1.4	-
19	Our company distinguishes itself positively compared to our main competitors by: Our good reputation in the market	6.1 ± 1.0	5.9 ± 1.0	-
20	Our company distinguishes itself positively compared to our main competitors by: Our flexibility of market response	5.2 ± 1.4	5.2 ± 1.1	-

- no significant differences found

4.1.1.8 Business performance

In general, Chinese companies again gave rather good scores on this construct. The relatively high score of question 16 indicates respondents positioned themselves as ahead of competition, which on the financial side was proved by the answer of question 24. In question 25, Dutch companies gave lower scores, could be that due to the macro environment, the economic condition still affected by the economic crisis, and of course the food & beverage industry was also affected. On the contrary, China as a world known emerging market with the expanding customer demand , it's not difficult to understand o Another reason can be used to explain the differences are the diverse food culture and habit between the two countries in food & beverage consumptions. In Dutch market, ready to eat meals and microwave food take a large part of food

Table 4.9 Descriptive results of "Business performance"

Q nr.	Text	Mean ± S.D. CN	Mean ± S.D. NL	Compare mean
16*[a]	The current position of our company compared to our main competitors can be characterized as	5.4 ± 1.5	4.0 ± 1.5	-
24*[b]	Compared to our main competitors, our sales (in euros)is	4.7 ± 1.5	3.4 ± 1.5	-
25*[c]	We expect the sales volume of our current products in the coming three years to	5.4 ± 1.1	4.8 ± 1.1	***
26*[c]	Compared to our main competitors, our yearly growth rate (average percentage over the last 3 years) is	4.9 ± 1.3	4.7 ± 1.0	-

*a: 1=follower and 7=ahead of competition
*b: 1=much lower and 7=much higher
*c: 1= Strongly decrease and 7=Strongly increase
- no significant differences found
*** significant different at 1 % level

expense, and these type of food are always more expensive than buying raw materials. As for Dutch consumers, there are always alternatives when they want to spend less on food. But in China, from the tradition, people in general do not mind spend more time in the kitchen, as well as the price being one of the reasons that pre-processed products are always more expensive, most Chinese consumer always go for raw materials. In this way, for Chinese consumer food & beverage expense will not change very as there is no alternative way to lower the food & beverage cost compare to their current consumer habit. As a result, in the Table 4.9, Dutch companies indicated less score than Chinese companies do.

4.2 Validation of grouping

4.2.1 Can seed and food companies be grouped together?

Before checking the differences between the two sets, 49 Chinese seed company respondents and 21 Chinese food & beverage company respondents, a test was performed to check the normality of the 70 samples. Because as Field (2009) explained in his book, different comparison methods would be applied in certain cases which depend on the number of groups needed to be compared, as well as the normality of the indicators. As the statistic results given by SPSS showed, only one indicator gave a normal distribution among all the indicators. Accordingly, the nonparametric test was applied for checking the differences between the two sets. The results showed that only one indicator had significant differences between Chinese seed and food & beverage companies, which is "The bargaining power of our customers has a strong influence on the business results of our company." For the rest of the 30 indicators, no difference was found. The conclusion here is that Chinese seed and food & beverage companies can be grouped together representing Chinese companies in this research.

The same type of test was processed with Dutch type companies. The results showed seven indicators had significant differences between seed and food & beverage companies, which was less than a quarter. As a result, the Dutch seed and food & beverage companies can be grouped together.

4.2.2 Do Chinese and Dutch companies have differences?

The same principle as the previous check applied here as well. The normality test showed none of the indicator was normally distributed. Accordingly, nonparametric test also was applied for the comparison of the two groups. In the end, 17 indicators showed significant differences among the two groups which mean less than half of the 31 indicators didn't have differences between the two groups tested. The conclusion here is there are significant differences between Chinese and Dutch agri-food companies.

4.3 Factor analysis

The aim of this step is from the statistic calculation, indicators which share a common sense will be grouped in the same subset with high scores. Based on the separation of subsets, the main constructs in the model can be identified. As explained in the methodology note, in the analysis independent and depend variables would be processed separately. This is because if all the

Table 4.11 Factor analysis of independent variables

	R&D communi-cation and internal coordination	Product innova-tiveness	Process innova-tiveness	Innova-tion focus	Business environ-ment
Q14	**0.81**	0.18	-0.08	0.08	-0.09
Q12	**0.79**	0.19	0.20	-0.04	0.16
Q13	**0.75**	0.07	0.05	-0.01	-0.04
Q15	**0.69**	0.03	0.44	0.22	0.01
Q7	**0.53**	0.20	0.18	0.39	0.03
Q9	**0.40**	0.30	0.33	0.24	0.15
Q28	0.21	**0.74**	0.14	0.12	-0.02
Q29	0.28	**0.64**	0.03	0.18	-0.08
Q21	0.01	**0.64**	0.27	0.25	0.27
Q10	0.41	**0.55**	-0.13	0.09	-0.28
Q4	-0.15	0.11	-0.83	-0.05	0.04
Q30	0.06	0.46	**0.69**	0.12	-0.07
Q31	0.12	0.47	**0.55**	-0.13	-0.01
Q1	0.15	0.25	0.43	0.18	-0.34
Q8	0.07	0.14	0.00	**0.68**	-0.39
Q6	0.25	0.23	0.29	**0.65**	0.06
Q2	0.04	**0.56**	-0.04	-0.01	-0.01
Q5	0.09	0.02	-0.05	-0.03	**0.84**
Q3	-0.09	0.05	-0.14	0.59	**0.46**

indicators are analyzed at the same time, independent and dependent variables will be mixed together which leads to the confusion of cause-and-effect links between the constructs. But on the other hand, the mixed analysis will provide an overview of the correlation between each variable which helps discovering the links between all the constructs. Twenty variables were identified as independent while the rest eleven as dependent. After the factor analysis, nine subsets were categorized in total, and each was given a descriptive name as shown in Table 4.11 and 4.12. Obviously, in the first independent subset, the key word in the six questions was "communication", and it was mostly related to R&D. Thus this subset was named as "R&D communication and internal coordination". In subset two, all the four questions had a common emphasis on "product", like "how innovative is your company on product design", "we monitor if our products meet customers' needs". As a result, this subset could be categorized as "product innovativeness". Two questions in subset three were both related to the innovativeness on post-production process, namely logistics and marketing. Accordingly, this subset was given the name "process innovativeness". Question 8 mentioned importance of innovation to the company and question 6 gave the way company do innovation, to make it clear this subset was concluded as "innovation focus". The last two questions in subset 6 depicted external environment like "new entrant threat" and "bargaining power of suppliers", so this subset was categorized as "business environment". Aside from the questions in subset 6, question 2 "customer trends and desires are easy to forecast" was a very interesting question. Literatures had shown proofs that consumer trends and market orientations are essential in the innovation success of food & beverage processing industry. Thus, it is worthwhile to keep this question in the model as "market orientation".

As shown in Table 4.11, two questions were given grey color, it meant these two questions were left out from the construct structure. The main reason for this was because it was difficult to embed these two questions into the subsets; no common parts could be extracted with the presence of these two questions. Besides, these questions gave low factor loadings to their constructs.

In the results of factor analysis of dependent variables, there were only three subsets categorized by the statistical analysis as shown in Table 4.12. In the first subset, questions like "position of the company compared to main competitors", "our new products enter market faster", and "the return of R&D investment" were grouped together. Obviously it was about performance, and it indicated the overall score of the company not only in single dimension like financial or innovation or competitive, thus the name "business performance" was given. Clearly in subset two, the two questions were both related to finance performance of the company, the conclusion was "financial performance". The three questions in the last subset had the same structure as "our company distinguishes itself compared to our main competitors by". This was about competitiveness of the company, thus the name was "competitiveness performance".

Table 4.12 Factor analysis of dependent variables

	Business perfor-mance	Financial perfor-mance	Competi-tive position
Q24	**0.82**	-0.16	0.04
Q22	**0.72**	0.07	0.15
Q16	**0.67**	0.41	0.18
Q18	**0.65**	0.39	0.15
Q23	**0.60**	0.38	0.26
Q27	**0.57**	0.10	-0.01
Q26	0.10	**0.74**	0.20
Q25	0.24	**0.69**	-0.22
Q20	0.01	**0.67**	0.45
Q17	0.17	-0.01	**0.78**
Q19	0.11	0.19	**0.72**

The factor analysis provided an overview of the division of the constructs from the statistical point of view. In the further model building step, depended on the factor loading of each indicator, as well as based on the literature theories, the structure of the constructs are not strictly referred to the factor analysis. Three main changes are:

a) Both product and process innovativeness was combined as "Innovativeness level";
b) Questions 16 and 24 were excluded from their original subset, together with questions 25 and 26, the group was named "Business performance";
c) Questions 18, 22, 23 and 27 were given the group name of "Innovation performance".

4.4 Model building

The idea of measuring the differences between the two country companies is by checking the two sets of company data through the same model. After the reliability of the model was confirmed, a control variable "country type" was introduced to the model. From the moderating effect results, the differences between Chinese and Dutch agri-food companies would be detected.

4.4.1 Theoretical model test

The theoretical model was imported to SmartPLS, the first run is to check the factor loading of each indicator. The factor loading is used to describe the reliability of the indicator linked with

Table 4.13 Model structure

Construct	Concept	Indicator	Question
Business environment	Business environment	environment	3. New entrants in our sector has a strong influence on the business results of our company
Strategy	Innovation focus	inno-foc1	6. Innovation is important to our company in maintaining competitiveness
		inno-foc2	8. Generally, we use cross-functional innovation teams to organize our work
Input	Market orientation	market	2. Consumer trends and desires are easy to forecast
Throughput	R&D communication and coordination	commu1	7. Senior managers are actively involved in the early stage of the innovation projects
		commu2	9. We consistently codify 'lessons learned' at the end of innovation projects
		commu3	12. There is an excellent communication of R&D and customers
		commu4	13. There is an excellent communication of R&D and distributors
		commu5	14. There is an excellent communication of R&D and production
		commu6	15. There is an excellent communication of R&D and marketing & sales
	Innovativeness level	level1	21. Our company distinguishes itself positively compared to our main competitors by: The education level of our employees
		level3	28. How innovative would you consider your company to be in the following? Product design
		level4	29. How innovative would you consider your company to be in the following? Product production and logistics
		level5	30. How innovative would you consider your company to be in the following? Marketing
		level6	31. How innovative would you consider your company to be in the following? Distribution
Output	Innovation performance	inno-perf2	18. Our company distinguishes itself positively compared to our main competitors by: An effective R&D process
		inno-perf3	22. Our company distinguishes itself positively compared to our main competitors by: The protection that our products and processes receive by patents, licenses, etc.
		inno-perf4	23. Our new products enter the market faster compared to our main competitors' products
		inno-perf6	27. The return from R&D relative to the R&D investments are
	Competitive position	comp-perf1	17. Our company distinguishes itself positively compared to our main competitors by: A strong financial position
		comp-perf2	19. Our company distinguishes itself positively compared to our main competitors by: Our good reputation in the market
		comp-perf3	20.Our company distinguishes itself positively compared to our main competitors by: Our flexibility of market response
	Business performance	fina-perf1	16. The current position of our company compared to our main competitors can be characterized as
		fina-perf2	24. Compared to our main competitors, our sales (in euros)is
		fina-perf4	26. Compared to our main competitors, our yearly growth rate (average percentage over the last 3 years) is

the construct. As explained by Götz et al. (2010), factor loading which is higher than 0.7 reveals a good reliability of the individual items. In an empirical research, weak loadings are frequently observed. It was tested that factor loading less than the cut-off of 0.7 (about 0.6) still indicate an acceptable individual reliability. Accordingly, after the factor loading check, indicators with loadings less than 0.6 were eliminated from the model. In this case, questions 5, 10 and 25 were deleted from the model. Results of the theoretical model can be found in Appendix 3. The structure of the model is shown in Table 4.13 (next page).

Afterwards, the model is ready to be tested on the significance of each line between the constructs. In SmartPLS, this test is achieved by bootstrapping procedure. The program resamples the data from the existing samples size, in this way the problem of small sample size can be solved. Then the t-statistics is applied to judge whether the proposed lines in the model are significant or not. The data used in this test were integrated Chinese and Dutch agri-food companies together, and the resample size was 500. After the test, the non-significant lines were deleted from the model. When the adjustments were done, the reliability of the model was tested again (Table 4.14).

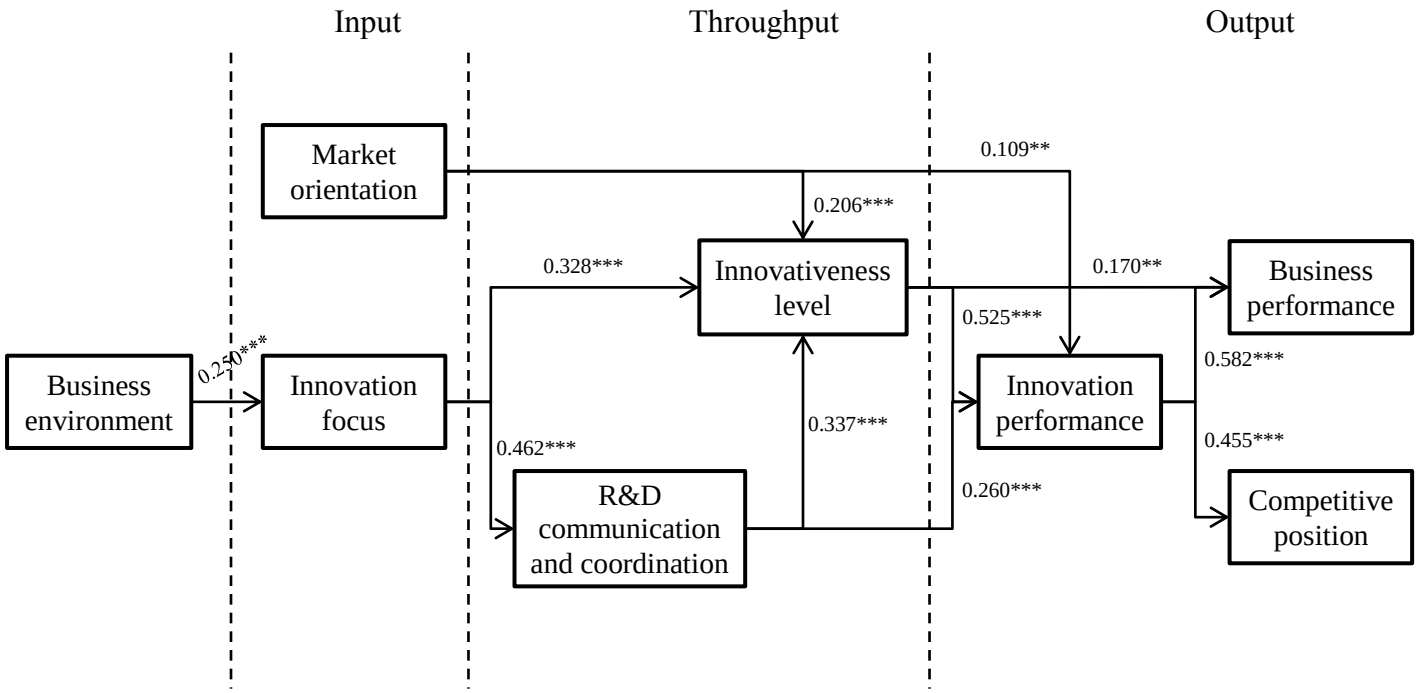
Table 4.14 Inter correlation of overall model constructs

	mean ±S.D.	AVE	CR	R^2	1	2	3	4	5	6	7	8
1 Business environment	3.2 ±1.7	1.00	1.00	0.00	**1.00**							
2 Business performance	4.5 ±1.5	0.56	0.79	0.50	0.09	**0.75**						
3 Competitive position	5.2 ±1.4	0.55	0.78	0.21	0.03	0.38	**0.74**					
4 Market orientation	4.0 ±1.4	1.00	1.00	0.00	-0.01	0.25	0.23	**1.00**				
5 Innovation focus	5.8 ±1.4	0.63	0.77	0.06	0.25***	0.42	0.32	0.03	**0.79**			
6 Innovation performance	5.8 ±1.4	0.53	0.82	0.53	0.03	0.70***	0.45***	0.26**	0.49	**0.73**		
7 Innovativeness level	4.7 ±1.4	0.50	0.83	0.38	0.19	0.57**	0.40	0.25***	0.49***	0.68***	**0.71**	
8 R&D communication	4.8 ±1.6	0.51	0.86	0.21	0.09	0.36	0.26	0.09	0.46***	0.54***	0.51***	**0.71**

** Correlation is significant at the 0.05 level (2-tailed)
*** Correlation is significant at the 0.01 level (2-tailed).
a. The bold numbers on the diagonal are the square roots of the variance shared between the constructs and their measures.

Average variance extracted (AVE) in the table is a parameter in checking the convergent validity of the reflective indicators. AVE includes the variance of its indicators captured by the construct relative to the total amount of variance, including the variance due to measurement error. It was studied that AVE of less than 0.5 is considered insufficient, as more variance is due to error variance than to indicator variance (Götz et al., 2010). CR in the table refers to construct reliability, which aims at measuring if the constructs' indicators jointly measure the construct adequately (Götz et al., 2010). CR varies between 0 and 1, the higher the value is, the more adequate the indicators can explain the construct. As show in Table 4.14, AVE values are all higher than 0.5, and the CR are all high with the lowest of 0.75. The determination coefficient R^2 is aiming to check the goodness of the structural model. R^2 is a normalized term that can assume

values between 0 and 1. The larger R^2 is, the larger the percentage of variance explained (Götz et al., 2010). The insufficient value of R^2 of open innovation in the theoretical model test is the reason why this construct was left out in the structural model. The visualized results of the significance between constructs are shown in Figure 4.15. The raw results from SmartPLS can be found in Appendix 4.



** Path coefficients are significant at 5 % level *** Path coefficients are significant at 1 % level

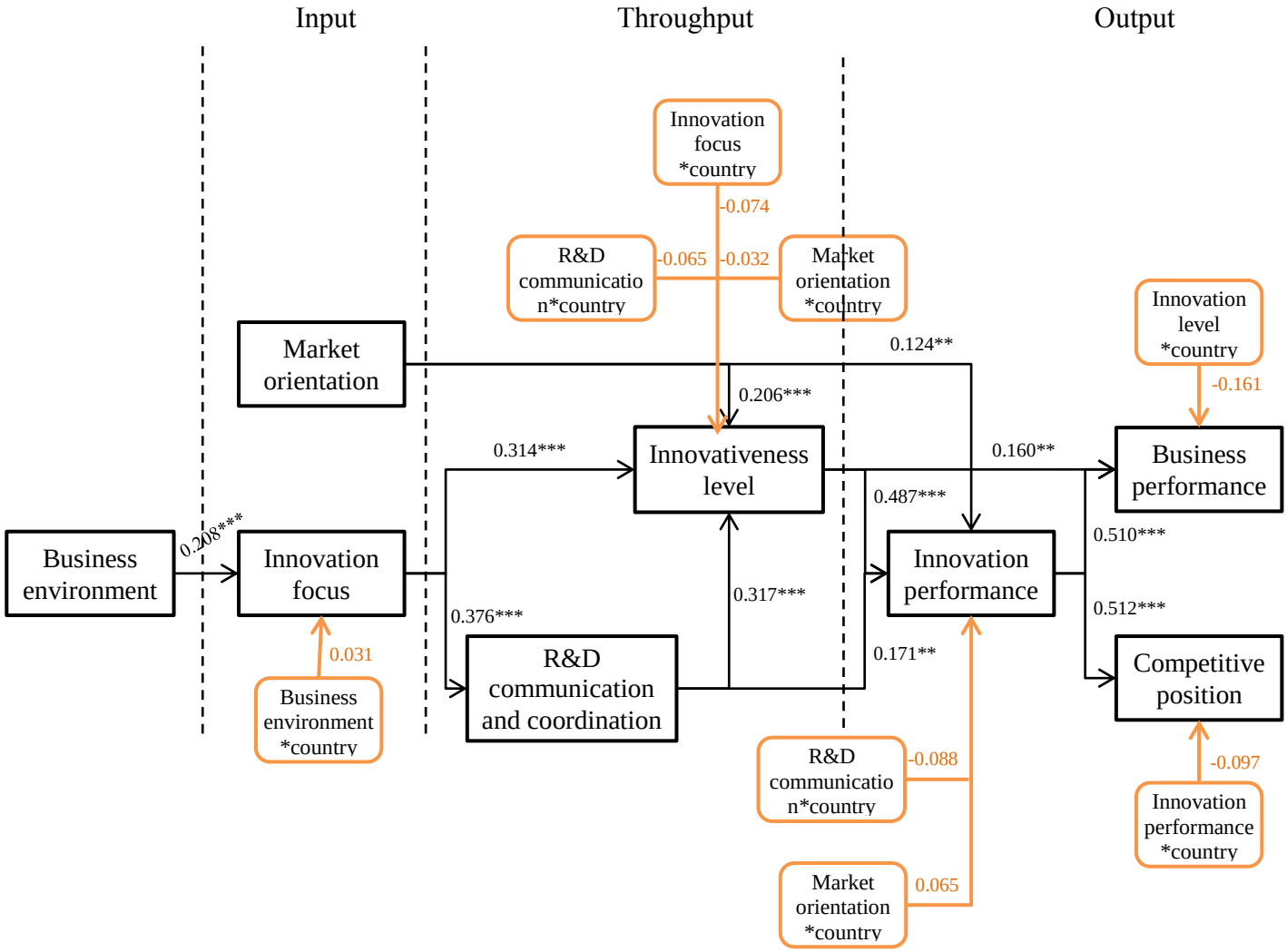
Figure 4.15 Structural model

4.4.2 Moderating effect

In order to study the differences between companies in China and Netherlands, a control variable "country type" was introduced to the model. In order to do it, a new variable named country type was added to the dataset. Chinese companies were given value 1, while Dutch was 0. The control variable was added to the model the same way as the other main construct with only one factor "country type". Then all the dependent constructs were linked with the control variable. The dependent constructs here mean all the constructs which have arrows pointed at.

One step further, by using the moderating effect to the model, whether each path coefficient was affected by country variable can be detected. The moderating effect is aiming to exam the path coefficients on the condition of excluding the effect of different levels of control variable. In this model, by introducing the moderating effect to the model, the different level of country type can be corrected and making it possible to compare the two country type of cases on the same level. Hence by checking the significance of the moderating effects, the question could be answered that if the country type has an influence on the path coefficient in the structural model.

The moderating effects were generated based on the differences in the results when processing single country companies in the structural model (Appendix 5). If the significance level in both single country models were the same as in the structural model, the moderating effect was not applied. On the contrary, where there were differences between the two country type models, as well as the differences between single country models and structural model, the moderating effects were investigated. The results are shown in Figure 4.16.



** Path coefficients are significant at 5 % level *** Path coefficients are significant at 1 % level

Figure 4.16 Moderating effect result

As can be seen from figure 4.16, country type did not have influence on the path coefficients. It means that no path coefficient in this model is different between Chinese and Dutch companies. The differences discovered by the two single country models can be concluded that it is not due to the country effect. On the contrary, it could be that due to the fact when decreasing sample size the statistical error can leads to the differences. However, the minus values of moderating effect do give imagine that Dutch companies have the potential of having strong correlations on the path

coefficients than Chinese companies do. The summarized results of this study are listed in Table 4.15.

It can be seen from the results, two out of thirteen hypothesizes 5 and 10 were not-confirmed. Hypothesizes 7, 12 and 16 are the ones had exactly same path coefficients when processed single country data through the structural model.

Table 4.15 Overview of the confirmation statues of hypothesis

	Hypothesizes	Status	Moderating effect
1	Business environment encourages the innovation focus.	Confirmed	0.031
2	Good market orientation helps improve innovativeness level.	Confirmed	-0.032
3	Good market orientation enhances innovation performance.	Confirmed	0.065
4	Innovation focus has positive effect on innovativeness level.	Confirmed	-0.074
5	Innovation focus help enhance the innovation performance.	Not	×
6	Innovation focus improves R&D communication and coordination.	Confirmed	-
7	R&D communication helps to improve innovativeness level.	Confirmed	-0.065
8	R&D communication helps to improve innovation performance.	Confirmed	-0.088
9	Innovativeness level enhances innovation performance.	Confirmed	-
10	Innovativeness level enhances competitive position.	Not	×
11	Innovativeness level enhances business performance	Confirmed	-0.161
12	Innovation performance enhances competitive position.	Confirmed	-0.097
13	Innovation performance enhances business performance.	Confirmed	-

×: Moderating effect cannot be applied because the path was deleted from structural model.
-: From the single country model test, the path coefficients are proved the same in both country companies.

5 Discussion

5.1 Descriptive results

The country context study from statistical reports and papers (Can, 2004; Wei, 2008), as well as various media sources (Li, 23-09-2010; Tan, 07-10-2010) show that the Netherlands is better in innovation than China, including the agri-food industry. Almost all of the Dutch seed companies and some of the Dutch food & beverage processing invested in this study can be regarded as world-leading. But surprisingly, the descriptive results for most items showed no differences between Chinese and Dutch companies. What's more, even for a few items, Chinese companies statistically proved doing better than Dutch companies do.

The subjective influence of the individual respondent is an element that cannot be ignored when analyzing questionnaire results, especially when the respondents have different country background. Van Muijen and al (1999) found in their study that on the individual level, organization influences both practices and values, whereas country only influences values. Thus, this type of differences cannot be eliminated in a questionnaire method. Despite the un-systematic error in the results, the slightly higher scores advantage in Chinese companies could be an exemplification of the fact that China is becoming an emerging country. With the explosive domestic demand, compared to the current macro-economic crisis situation in Westerner world, there can be some truth in the better performances of Chinese companies. Additionally, the Chinese food & beverage companies investigated in this study are mainly located in Shanghai area. The student who collected the questionnaire data also carried out several interviews with the management level in those Chinese companies. In the interview, most managers mentioned that in Shanghai area, a certain percentage of customers are always willing to try new food & beverage products. With this type of customers, companies are also willing to invest in incremental innovation to pursue the short-term goal.

Another reason for the better performances in Chines companies could be the different innovation contexts in two countries. As mentioned, ten Dutch Seed companies investigated are world-leading players, and the rest of the Dutch food & beverage companies involved in WIAT database are selected ones have innovation orientations. When filling the questionnaire, they take similar type of agri-food companies as their competitors. As a result, they view themselves as middle or upper-middle level in the comparison. While in China, in general the innovation level is low, most Chinese agri-food companies stay at the same level. So when it comes to the comparison, the companies view themselves as upper-middle among the others.

Seen from the radar chart in Figure 4.1, obviously the highest score was reached by question 6 of innovation importance. It depicts the way companies view the importance of innovation. Previous researchers had done empirical studies in exploring the relationship of innovation and survival of companies. The findings show that innovation is vital especially for small and young firms' survival; and in a high competitive industry environment, low innovative firms are easily confronted with survival problems especially new entrants (Audretsch, 1995; Cefis and Marsili, 2006).

Of the 31 items in the questionnaire, all the items with the words "market" and "customer" were given scores above 4 by both Chinese and Dutch companies. Obviously, for companies the market and customers are important to the innovation process. Market orientation is found as the driver of innovation for agri-food companies in both China and the Netherlands. This finding was previous studies in a number of industries and sectors (Atuahene-Gima, 1996; Fortuin and Omta, 2009; Han et al., 1998; Lukas and Ferrell, 2000).

5.2 Model results

5.2.1 Business environment to input

The statistical analysis showed that the business environment has significant influence on innovation focus at 1% level. The only indicator for business environment in the structural model

is question 3 "New entrants in our sector have a strong influence on the business results of our company", which is known as one of Porter's five forces. In his theory, threat of new entry depends on the extent and height of the barriers to entry (Johnson et al., 2008). Typical barriers for new entrants are, for instance, economic scale, experience, legislation or government action, and differentiation if new entrants can provide a higher perceived value for customers. The low scores on business environment given by both Chinese and Dutch companies are an indication for the relative high barriers for new entrants to the agri-food industry. Not surprisingly, one of the stylized facts about entry is the low survival rate of new entrants (Geroski, 1995). However, despite the weak threats of new entrants as perceived by incumbents, the strong path coefficient between the two components showed the threat of new entrants does work as a driver for innovation in the present study. In other studies, it shows that most entry happens at the early stage of the product life cycle, the new input brought by new entrants increasing the competitive level in the market, thus triggers the incumbents focus on innovation to keep their competitive level (Geroski, 1995; Hill and Rothaermel, 2003).

5.2.2 Strategy and input to throughput and output

It is a shared vision of the respondents that an innovation strategy is very important for their business, judged from the score of this component. Based on this strategy, the intensity of R&D activities is enhanced, and the innovativeness level proved significant positively related as well. Guided by the innovation focus, the awareness about innovation importance is increased. Managers make decisions and give priority to innovation; they allocate more i.e. sources to innovation activities, such as recruiting employees or building an excellent R&D communication network in order to serve the research and development functions. Furthermore, via a well implemented R&D communication and internal coordination, the innovativeness level is increased (Hall and Bagchi-Sen, 2002). However, the hypothesis of a direct relationship between innovation focus and innovation performance was not proved. Because innovation is costly and risky, especially for small companies, the challenges are even more obvious. In agri-food business, the failure rate of new products is high. Two out of three new food & beverage products never lived to see the second year on the shelves (Linnemann et al., 2006). As for seed companies, development of new cultivars is a slow process which requires 5.5-10 years (George, 2009). Thus, most small agri-food companies are in favor of incremental innovations, or act as followers in a new market. They are capable to easily adopt existing new products which have high market potential and launch me-too products. From this sense, innovation focus can trigger the innovativeness level, but not the real innovation performance. It cannot be directly derived from the model that the high failure rate of new products in agri-food industry is a barrier to innovation, but it is indeed a hindrance in the innovation process.

Market orientation, as discussed from the descriptive results perspective, is a driver for innovation. Here, in the model path coefficients, it is proved has positive effect on innovativeness level and innovation performance. Good market orientation interprets customer needs, market trends and dynamics of competitors, thus it works as a basis when companies decide how to acts to the market. As expected, via innovativeness level and innovation performance, business

performance and competitive position of companies were stimulated. Market orientation again proved a driver for innovation in the model results.

5.2.3 Throughput to output

Not surprisingly, both innovativeness level and R&D communication and internal coordination, the two central components show a positive effect on innovation performance. It is easy to understand that the precondition of an excellent R&D network provides the foundation for a high innovativeness level. So good quality innovative products can be brought to the market, giving good innovation and business performance (Hall and Bagchi-Sen, 2002; Hult et al., 2004), increasing the payback rate of innovation investments, and wining a good reputation in the market. However, a direct path of innovativeness level to competitive position was not found in the model. The agri-food is categorized as low-tech industry. The low innovative nature results in the fact that the advantages of products lies rather in the attributes like quality and safety, but not on innovativeness level. With this reason, in a company even though with a high innovativeness level, still the advantages introduced by innovativeness are not sufficient to distinguish from the competitors. Thus, the high level of innovativeness can only improve business performance but not competitive position.

Innovation performance known as the first layer of performance has a relative relationship with higher performance levels. It helps companies in achieving the intangible goal of a better competitive position as well as the tangible goal of higher business performance. Hult et al. (2004) studied 181 large (Fortune 500) industrial-based firms and also found that market orientation, innovativeness and entrepreneurial orientation all have a significant positive effect on business performance. As for managers also of SMEs, it is therefore advised to improve the innovativeness level in their effort to attain superior business performance (see also Hall and Bagchi-Sen, 2002).

5.3 Other outcomes

Recently I did an open interview with a staff member of a state owned large enterprise who used to work in a big food & beverage multinational company in Europe. In her opinion, the biggest difference between Chinese and Western companies in the field of R&D is that Chinese companies are more in favor of incremental and applied research, which leading to direct tangible profits within a short span; while the big multinational companies also put effort in fundamental research which typically take more than 5-10 years. This research type difference between Chinese and Dutch companies might be the reason that Chinese companies view themselves as good in innovation because they use a short-term perspective.

Another outcome from this open interview is based on her experiences. She thinks that on the other hand, the complex and miscellaneous administration procedures in Chinese state-owned enterprises are a huge barrier for innovation. Because of the hierarchical structure in the government owned enterprises, it might take years from the proposal stage to the final approval decision by the top management team. On other hand, in most cases, the state-owned enterprises have the most financial resources for innovation. Most western type multinational companies developed faster decision making procedures regarding innovation. Thus the way these

procedures are organized might be a good benchmark for Chinese companies of how to effectively and efficiently manage innovation.

6 Conclusions

In this study, 137 Chinese and Dutch companies in the agri-food supply chain were investigated. The theoretical model was tested using a PLS model, and the country type was tested by moderating effect. The results show that no difference was found regarding the innovation process between Chinese and Dutch companies. The common drivers of innovation can be derived from this study are market orientation and new entrant threat.

It can be concluded from the structural model that the components of R&D communication and internal coordination, innovativeness level and innovation performance are the central elements in the model. The business environment, operationalized as the threat of new entrants proves to trigger the innovation focus in companies. Business performance and competitive position were positively affected by innovation focus via innovativeness level and innovation performance. This indicates that based on the empirical data, innovation orientation and business performance are positively linked (see also Hall and Bagchi-Sen, 2002; Hult et al., 2004). In practice, it shows that nowadays companies are taking innovation as their companies' strategy. Another interesting finding is the role of R&D communication. Previous studies have pointed at the role of R&D communication as one of the central elements in innovation (e.g. Batterink et al., 2006; Hollander, 2002; Tepić, 2012). With an excellent R&D communication, new market information can be swiftly processed into R&D, so quick responses are provided. In this way, business performance and competitive position is strengthened by R&D communication via innovation performance.

This study confirmed the positive correlation of innovation and business performance. In agri-food, where managers of many of the SMEs are reluctant to conduct innovation activities, it is suggested to managers to improve the innovativeness level in their efforts to attain superior business performance both in an emerging country like China and in a developed country such as the Netherlands.

7 Further research

This study was carried out based on an existing dataset, but data were gathered from different questionnaires. Thus, in order to process the comparison, only the same questions from both questionnaires were used, as a result, more than half of the questions from each questionnaire were left out. Therefore, the biggest disadvantage of this study is lack of indicators. Factors like open innovation, organizational environment and absorptive capacity were not feasible to be tested in this study. For further research, more indicators are recommended for performing a reliable and comprehensive PLS model study.

8 Reference

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9 Appendix

9.1 Questionnaire used for Seed Company

Innovation network and performance questionnaire

Especially for vegetable seed companies in the Netherlands and China

The questionnaire includes 62 questions in the following 8 sections:

1. Introduction
2. Business environment
3. Innovation strategy
4. Innovation input
5. Innovation network
6. Absorptive capacity
7. Innovation and business performance
8. Wrap up

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July, 2010

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Huazhong Agricultural University, Wuhan, China

1. Introduction

I. Please provide your respondent details

Name: _____ Name of company: _____

Department: _____ Position:_____

Phone: _____ E-mail: _____

II. Please describe your company's organization

Number of employees:_____ Number of R&D employees: _____

Turnover last year: _____ R&D budget: _____% of turnover

Company founded year: _____ R&D department founded year: _____

Please choose

A. Is your company:

☐ Independent

☐ Part of a larger firm

B. If your company is part of a larger firm, please specify whether your company is:

☐ Subsidiary

☐ Division

☐ Head office

☐ Central R&D unit

☐ Part of joint venture

☐ Other: _____

III. The two most important products of our company are: _____

① Tomato ② Pepper ③ Cucumber ④ Cabbage ⑤ Lettuce ⑥ Cauliflower ⑦ Watermelon ⑧ Melon ⑨ Carrot ⑩ Other_____

2. Business Environment

Each of the following items consists of a statement related to aspects of the industry, your company and its main competitors. Please circle the number that best fits your judgment

1. The sector is rich in investments and marketing opportunities:

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

2. The average profit rate of companies in the vegetable seed industry in this country is:

Very low	1	2	3	4	5	6	7	Very high

3. In the last three years the number of vegetable seed companies has:

Decreased very much	1	2	3	4	5	6	7	Increased very much

4. Consumer trends and desires are easy to forecast:

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

5. Governmental regulation for the vegetable seed industry is:

Very loose	1	2	3	4	5	6	7	Very strict

6. The threshold for entering the vegetable seed industry is:

Very low	1	2	3	4	5	6	7	Very high

7. New entrants in our sector has a strong influence on the business results of our company:

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

8. The bargaining power of our growers has a strong influence on the business results of our company:

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

9. The bargaining power of seed distributors has a strong influence on the business results of our company:

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

3. Innovation strategy

Each of the following items consists of a statement related to aspects of the company strategy and culture. Please circle the number that best fits your judgment

10. Innovation is important to our company in maintaining competitiveness:

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

11. Our firm fights the competition and is directed to market dominance:

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

12. Senior managers actively participate in the selection of R&D projects:

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

13. Senior managers are actively involved in the early stage of the innovation projects:

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

14. The percentage of employees' bonus compared to their total payment:

① <5% ② 5%-10% ③ 10%-20% ④ 20%-30% ⑤ 30%-50% ⑥ >50%

15. The number of Plant Variety Rights granted to our company in the last three years:

① 0 ② 1-2 ③ 3-5 ④ 5-8 ⑤ above 8

16. Number of patents granted to our company in the last three years:

① 0 ② 1 ③ 2-3 ④ 4-5 ⑤ above 5

17. Among all the varieties of seeds that we sell the percentage that stems from:

In-house R&D _____ Bought from others: _____ In-licensed: _____

① <10% ② 10%-20% ③ 20%-30% ④ 30%-50% ⑤ >50%

18. Our company provides time and resources to undertake own projects:

① Employees do not have time to undertake own projects after appoint duty

② Our company neither encourages nor opposes employees to undertake own projects

③ Our company encourages employees to undertake their own projects

④ Our company supports employees to undertake their own projects after they finish their own duty

19. In the last three years fail of innovation projects happened mainly at the stage of:

① Feasibility studies ② Breeding new varieties ③ Field demonstration of new varieties

④ Marketing of new varieties ⑤ Others: _____

20. The tolerance to failure in our company is:

① Failure in innovation is not acceptable, it shows insufficient effort.

② Failure in innovation is unavoidable, but if it happens too often the researchers' career will be negatively effected to some degree.

③ Failure is accepted in innovation, the researchers' career will never been negatively effected.

21. The frequency to report of project progress to senior management is on average:

① (More than) once per month

② Once per season

③ Once per half year

④ Once per year

4. Innovation Input

Each of the following items consists of a statement related to aspects of the company's resources input on innovation activities. Please circle the number that best fits your judgment or fill the options you choose.

22. In the last three years the R&D budget of our company: _____ in the next three years: _____

① Decreased substantially ② Decreased gradually ③ No change

④ Increased gradually ⑤ Increased substantially

23. Our R&D budget:

① Is a long term investment that is not influenced by annual changes in business performance:

② Is influenced by annual changes in business performance to some degree

③ Is influenced by annual changes in business performance to a large degree

24. The percentage of our R&D budget that is roughly spend on:

① In-house R&D projects _____%

② Outsourcing (e.g. to universities, research institutes, specialized technology firms and service providers) _____%

④ Collaborative research with other seed companies_____%

⑤ Other_____%

25. Please choose in which research fields your company conducts R&D (multiple answers possible):

① Breeding and selection of new cultivars ② Collection of new germplasm resources

③③ Basic research (e.g. new breeding methods) ④ Plant tissue culture(e.g. DH production)

⑤ Phytopathology research ⑥ Use of molecular markers

⑦ Use of genetic modification (GMO) ⑧ Genomics and bioinformatics

⑨ Seed technology (e.g. quality control, seed coating etc) ⑩ Other:

26. The priorities of the R&D investment (include internal and out-sourcing) in our company are:

(1) Breeding and selection for new varieties	Low priority	1	2	3	4	5	6	7	High priority
(2) Collection of new germplasm resources	Low priority	1	2	3	4	5	6	7	High priority
(3) Basic research (e.g. new breeding methods)	Low priority	1	2	3	4	5	6	7	High priority
(4) Plant tissue culture (e.g. DH production)	Low priority	1	2	3	4	5	6	7	High priority
(5) Phytopathology research	Low priority	1	2	3	4	5	6	7	High priority
(6) Use of molecular markers	Low priority	1	2	3	4	5	6	7	High priority
(7) Use of genetic modification(GMO)	Low priority	1	2	3	4	5	6	7	High priority
(8) Genomics and bioinformatics	Low priority	1	2	3	4	5	6	7	High priority
(9) Seed technology (e.g. quality control, seed coating etc)	Low priority	1	2	3	4	5	6	7	High priority
(10) Other:	Low priority	1	2	3	4	5	6	7	High priority

27. The education level of employees in our company:

(1) With technical/professional degree _____ (2) With Bachelor degree _____

(3) With Master degree _____ (4) With Doctor degree _____

① <5% ② 5%-10% ③ 10%-20% ④ 20%-30% ⑤ 30%-50% ⑥ >50%

28. Our company provides different kinds of training programs to our employees: (multiple choices possible):

① Internal training ② External training ③ Participatory learning

④ Mentor project ⑤ Online learning courses ⑥ Other:_____

29. The training topics are (multiple choices possible):

① Business/technical skills ② Communication skills ③ Foreign languages

④ Teamwork ⑤ Target management ⑥ Time management

⑦ Leadership and management ⑧ Marketing ⑨ IT

⑩ Other: _____

30. The average training time per year that is offered to our employees is:

① (Less than) 1 day ② 1 to 3 days ③ 3 days to 1 week

④ 1 week to 1 month ⑤ More than 1 month

31. Which kind employees receive the most training?

① New employees ② First line managers ③ Middle managers ④ Senior managers

32. Employees from which department(s) have the best training opportunities (multiple choices possible):

① R&D department ② Marketing department ③ Sales department

④ Production and logistic department ⑤ Other:_____

5. Innovation network

Each of the following items consists of a statement related to internal and external linkage of the firm. Please include the number or letter that best fits your judgment.

33. Our company has a good communication and collaboration with:

(1) Growers	Strongly disagree	1	2	3	4	5	6	7	Strongly agree
(2) Seed distributors	Strongly disagree	1	2	3	4	5	6	7	Strongly agree
(3) Seed retailers	Strongly disagree	1	2	3	4	5	6	7	Strongly agree
(4) Vegetable distributors	Strongly disagree	1	2	3	4	5	6	7	Strongly agree
(5) Vegetable retailers	Strongly disagree	1	2	3	4	5	6	7	Strongly agree
(6) Local government:	Strongly disagree	1	2	3	4	5	6	7	Strongly agree
(7) National government	Strongly disagree	1	2	3	4	5	6	7	Strongly agree

34. Applying for governmental financial support for innovation projects is:

Very difficult	1	2	3	4	5	6	7	Very easy

35. Did our company get governmental financial support for innovation projects in the last 3 years? ☐ Yes ☐ No

If yes, please describe the reason to participate in this kind of projects: (multiple choices)

① Our company got a subsidy to reduce R&D costs ② To lower R&D risks

③ To monitor technological developments ④ Build-up our R&D network

⑤ Improve the time-to-market ⑥ Build brand name

⑦ Other: _____

36. Our company:

① Has no contact and collaboration with universities and research institutes

② Keeps in close contact with universities and research institutes

③ Conducts collaborative projects with universities and research institutes

37. Our company is a member of the following associations(multiple choices possible):

① Plantum NL
② CSA(China Seed Association)
③ Productschap Tuinbouw (Dutch Horticultural Product Organization)
④ CSTA (China Seed Trade Association)
⑤ ESA (European Seed Association)
⑥ CSHS (China Society of Horticulture Science)
⑦ ISF (International Seed Federation)
⑧ Provincial Seed association in China
⑨ ISHS (International Society of Horticulture Science)
⑩ APSA(Asia Pacific Seed Association)

38. Our company uses the following consultancy services(multiple choices):

① Marketing research
② Legal and IP consultant
③ IT
④ Human resource plan consultant
⑤ Logistic
⑥ Public relationship
⑦ Strategy
⑧ Finance
⑨ Other:_____

39. In the last three years, **the number of innovation partners** with whom we collaborate is (put √ in the grids that best fit your judgment):

Innovation partner	None	1-3	4-7	8-10	11-15	16-30	Over 30
(1) Our main suppliers							
(2) Our main customers							
(3) Other seed companies							
(4) Universities and research institutes							
(5) Governmental agencies							
(6) Association/organizations							
(7) Consultancy services							

40. In the last three years, **the frequency we communicate** with our innovation partners is (put √ in the grids that best fit your judgment):

Innovation partner	None	Once to twice per year	Less than once per month	Once to twice per month	Three to four times per month	Once to twice per week	Over twice per week
(1) Our main suppliers							
(2) Our main customers							

(3) Other seed companies							
(4) Universities and research institutes							
(5) Governmental agencies							
(6) Association/organizations							
(7) Consultancy services							

41. **The average duration of the relationship** with our innovation partners is (put √ in the grids that best fit your judgment):

Innovation partner	Less than 1/2 year	1/2-1 year	1-2 years	3-4 years	5-8 years	Over 8 years
(1) Our main suppliers						
(2) Our main customers						
(3) Other seed companies						
(4) Universities and research institutes						
(5) Governmental agencies						
(6) Association/organizations						
(7) Consultancy services						

42. Please, give the names(or abbreviations or even code as "A,B,C,D,E" if confidential) of the 5 most important innovation partners and their relevant information:

No.	Abbreviation or code name of innovation partners	Type (please use the figures) 1=supplier; 2=customer; 3=other seed companies; 4= university or research institute; 5= governmental agency; 6= association; 7= consultancy service; 8=others	Area (please use the figures) 1=same town as our company; 2=same region; 3=same province; 4=same country; 5=foreign country; 6=others
P1.			
P2			
P3.			
P4.			
P5.			

43. Please choose the methods/tools that your company uses in collaboration with the 5 most important innovation partners (multiple answers are possible, give a √ to the ☐ that fit your judgment)

☐ Joint R&D project.	☐ Technology license in/out	☐ Joint venture	☐ Technical exchange	☐ Research consortium

☐ Introduction of advanced equipments	☐ Joint production	☐ Excursion to field trials	☐ IP protection	☐ Venture capital
☐ Joint branding	☐Joint marketing	☐ Employees training	☐Consultancy in technology or law	☐ Consultancy in operation
☐ Discussion on (inter)national policy	☐ To understand trends in technology	☐To understand trends in industry	☐ Sponsoring exhibitions/conferences	☐ Others: _____

44. The R&D department plays a central role in our company:

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

Please specify which department(s) have close linkages to the R&D department:

(1) Sales	Not close	1	2	3	4	5	6	7	Very close
(2) Marketing	Not close	1	2	3	4	5	6	7	Very close
(3) Production	Not close	1	2	3	4	5	6	7	Very close
(4) Logistics	Not close	1	2	3	4	5	6	7	Very close
(5) Finance	Not close	1	2	3	4	5	6	7	Very close
(6) Human resources	Not close	1	2	3	4	5	6	7	Very close
(7) IP	Not close	1	2	3	4	5	6	7	Very close
(8) ICT	Not close	1	2	3	4	5	6	7	Very close
(9) Others, namely……	Not close	1	2	3	4	5	6	7	Very close

6. Absorptive capacity

45. Through the communication and collaboration with our main innovation partners, our company can:

	Strongly disagree ←----------→						Strongly agree
(1) Acquire more technical knowledge	1	2	3	4	5	6	7
(2) Acquire more market information	1	2	3	4	5	6	7
(3) Acquire more professional talents	1	2	3	4	5	6	7
(4) Acquire more pertinence in product development	1	2	3	4	5	6	7
(5) Acquire more ideas for product development	1	2	3	4	5	6	7
(6) Acquire more ideas for process improvement	1	2	3	4	5	6	7
(7) Seize market opportunities more easily	1	2	3	4	5	6	7

46. In order to stimulate communication and collaboration:

	Strongly disagree ←----------→ Strongly agree						
(1) Our company favors an environment for employees that stimulates discussion, such as chat and coffee rooms	1	2	3	4	5	6	7
(2) Our company finds networking competence a basic requirement for the recruitment of new employees	1	2	3	4	5	6	7
(3) Our company finds networking competence a basic element of the employees' performance assessment	1	2	3	4	5	6	7
(4) Our company encourages employees to know other work procedures than those of their own department	1	2	3	4	5	6	7
(5) Our company provides job rotation possibilities to people of different departments when needed	1	2	3	4	5	6	7
(6) Our company arranges informal activities to improve understanding among different departments	1	2	3	4	5	6	7
(7) Outside the work situation, employees communicate frequently	1	2	3	4	5	6	7
(8) There are many innovation teams in which different ranks of employees collaborate	1	2	3	4	5	6	7
(9) Generally, we use cross-functional innovation teams to organize our work	1	2	3	4	5	6	7
(10) We regard training of employees as an investment for our company, not as a cost	1	2	3	4	5	6	7
(11) We share a common vision: once we stop learning our future will be in danger	1	2	3	4	5	6	7
(12) We consistently codify the 'lessons learned' at the end of innovation projects	1	2	3	4	5	6	7
(13) We monitor on a regular basis the extent to which our products and processes align to our customers' needs	1	2	3	4	5	6	7
(14) We attend exhibitions and trade fairs more frequently than our competitors	1	2	3	4	5	6	7
(15) We rarely cancel external collaboration projects for reasons of lack of money	1	2	3	4	5	6	7
(16) Our company uses joint ventures and alliances to make full use of our R&D capabilities	1	2	3	4	5	6	7
(17) There is an excellent communication of R&D and growers	1	2	3	4	5	6	7
(18) There is an excellent communication of R&D and	1	2	3	4	5	6	7

distributors	
(19) There is an excellent communication of R&D and production	1 2 3 4 5 6 7
(20) There is an excellent communication of R&D and marketing & sales	1 2 3 4 5 6 7

7. Innovation and business performance

Each of the following items consists of a statement related to the situation in your company. Please circle the number that best fits your judgment

47. The current position of our company compared to our main competitors can be characterized as:

Follower 1 2 3 4 5 6 7 Ahead of competition

48. Our company distinguish itself positively compared **to the market leader** by:

(1) A strong financial position	Strongly disagree	1 2 3 4 5 6 7	Strongly agree
(2) An effective R&D process	Strongly disagree	1 2 3 4 5 6 7	Strongly agree
(3) Our good reputation in the market	Strongly disagree	1 2 3 4 5 6 7	Strongly agree
(4) Our flexibility of market response	Strongly disagree	1 2 3 4 5 6 7	Strongly agree
(5) The education level of our employees	Strongly disagree	1 2 3 4 5 6 7	Strongly agree
(6) The protection that our products and processes receive by patents, licenses, etc.	Strongly disagree	1 2 3 4 5 6 7	Strongly agree

49. Our company distinguishes itself positively compared **to our main competitors** by:

(1) A strong financial position	Strongly disagree	1 2 3 4 5 6 7	Strongly agree
(2) An effective R&D process	Strongly disagree	1 2 3 4 5 6 7	Strongly agree
(3) Our good reputation in the market	Strongly disagree	1 2 3 4 5 6 7	Strongly agree
(4) Our flexibility of market response	Strongly disagree	1 2 3 4 5 6 7	Strongly agree
(5) The education level of our employees	Strongly disagree	1 2 3 4 5 6 7	Strongly agree
(6) The protection that our products and processes receive by patents, licenses, etc.	Strongly disagree	1 2 3 4 5 6 7	Strongly agree

50. The main competitive strength(s) of our company are:

(1) Price	Not competitive	1 2 3 4 5 6 7	Very competitive
(2) Quality	Not competitive	1 2 3 4 5 6 7	Very competitive

(3) Delivery	Not competitive	1	2	3	4	5	6	7	Very competitive
(4) Customer relationships	Not competitive	1	2	3	4	5	6	7	Very competitive
(5) Uniqueness of products	Not competitive	1	2	3	4	5	6	7	Very competitive
(6) Technical excellence	Not competitive	1	2	3	4	5	6	7	Very competitive

51. Our new products enter the market faster compared to our main competitors' products:

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

52. Compared to our main competitors, our sales (in euros)is:

Much lower 1 2 3 4 5 6 7 Much higher

53. We expect the sales volume of our current products in the coming three years to:

Strongly decrease 1 2 3 4 5 6 7 Strongly increase

54. The market share of our first main product is growing quickly:

Strongly decrease 1 2 3 4 5 6 7 Strongly increase

55. The market share of our second main product is growing quickly:

Strongly decrease 1 2 3 4 5 6 7 Strongly increase

56. Our sales is highly dependent on new products which are launched to the market in the last three years:

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

Please specify the percentage of sales generated by new products: _____

① <5% ② 5%-10% ③ 10%-20% ④ 20%-30% ⑤ 30%-50% ⑥ >50%

57. Compared to our main competitors, our yearly growth rate (average percentage over the last 3 years) is:

Much lower 1 2 3 4 5 6 7 Much higher

Please specify the percentage of yearly growth rate: _____

① <5% ② 5%-10% ③ 10%-20% ④ 20%-30% ⑤ 30%-50% ⑥ >50%

58. Compared to our main competitors, our operating profit margin (operation results/revenue) is

Much lower 1 2 3 4 5 6 7 Much higher

Please specify: _____

① <5% ② 5%-10% ③ 10%-20% ④ 20%-30% ⑤ 30%-50% ⑥ >50%

59. The returns from R&D relative to the R&D investments are:

Very unsatisfactory	1	2	3	4	5	6	7	Very satisfactory

60. How innovative would you consider your company to be in the following?

(1) R&D	Not innovative	1	2	3	4	5	6	7	Very innovative
(2) Breeding processes	Not innovative	1	2	3	4	5	6	7	Very innovative
(3) Product production and logistics	Not innovative	1	2	3	4	5	6	7	Very innovative
(4) Marketing	Not innovative	1	2	3	4	5	6	7	Very innovative
(5) Distribution	Not innovative	1	2	3	4	5	6	7	Very innovative

8. Wrap up

61. Are you willing to participate in follow-up on this survey and future research of this type? ☐ yes ☐ no

62. Please add any remarks or recommendations for improving this survey

……

……

……

……

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9.2 Questionnaire used for Food Company

Please provide the following information

Your name: _____ Your email: _____

Position: _____ Company's name: _____

Please briefly describe your main function:

_____

A. Please indicate the following figures about your company (one respondent per company)

	2 years prior to Last book year	last book year	in two years time (expected)
A.1 Total revenues (million €)	……..……	……..……	……..……
A.2 Operating profit margin* (%)	……..……	……..……	……..……
A.3 R&D spending (% of total revenues)	……..……	……..……	……..……
A.4 Number of employees	……..……	……..……	……..……
A.5 Number of R&D employees	……..……	……..……	……..……

B. Please name the three most important product divisions and indicate roughly the average Product Life Cycle (PLC)** of their typical products

B.1 Product group 1 (*name*)……. Product Life Cycle…….years

B.2 Product group 2 (*name*)……. Product Life Cycle…….years

B.3 Product group 3 (*name*)……. Product Life Cycle…….years

C. Percentage of total sales per type of market:

C.1 Regional ……..%

C.2 National ……..%

C.3Continent ……..%

C.4 Global: ……..%

_____

Total 00%

***Operating Profit Margin**: Operating Results/Revenues

****Product Life Cycle (PLC)**: The time-span from the moment that the first product is delivered to the external customer to the time at which the sales are about 10% of its maximum and at the end of the PLC.

Each of the following items consists of a statement related to aspects of the industry sector, your company and its main competitors. Please circle the number that best fits your judgment

1. The business environment is safe and provides little threat for the survival and well being of our company

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

2. The sector is rich in investments and marketing opportunities

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

3. Actions of competitors are easy to predict

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

4. Consumer trends and desires are easy to forecast

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

5. We expect the sales volume of our current products in the coming three years to

Strongly decrease 1 2 3 4 5 6 7 Strongly increase

6. The current position of our company compared to our main competitors can be characterized as

Follower 1 2 3 4 5 6 7 Ahead of competition

7. Our firm fights the competition and is directed to market dominance

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

8. The bargaining power of our suppliers has a strong influence on the business results of our company

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

9. The bargaining power of our business buyers has a strong influence on the business results of our company

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

10. New entrants in our sector have a strong influence on the business results of our company

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

11. The number of substitutes for our products is

Small	1	2	3	4	5	6	7	Large

12. Compared to our main competitors our profitability is

Much lower	1	2	3	4	5	6	7	Much higher

13. Compared to our main competitors our sales volume is

Much lower	1	2	3	4	5	6	7	Much higher

14. Compared to our main competitors our growth rate is

Much lower	1	2	3	4	5	6	7	Much higher

15. How many important competitors are active on your main market?

1 to 5 [ ]

6 to 25 [ ]

Over 25 [ ]

Unknown [ ]

Our company distinguishes itself positively compared to our main competitors by:

16. A strong financial position

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

17. An effective R&D process

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

18. Our good reputation in the market

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

19. Our flexibility of market response

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

20. The protection that our products and processes receive by patents, licenses etc

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

21. The educational level of our employees

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

22. How innovative would you consider your company to be in the following?

Marketing

Not innovative	1	2	3	4	5	6	7	Very innovative

Product design

Not innovative	1	2	3	4	5	6	7	Very innovative

Product quality

Not innovative	1	2	3	4	5	6	7	Very innovative

Distribution

Not innovative	1	2	3	4	5	6	7	Very innovative

Manufacturing processes

Not innovative	1	2	3	4	5	6	7	Very innovative

23. The main competitive strength(s) of our company are (you may tick more than one of the boxes)

Price [ ]

Quality [ ]

Delivery time [ ]

Uniqueness of products [ ]

Product assortment [ ]

Technical excellence [ ]

Customer relationships [ ]

Other, namely _____

Each of the following items consists of a statement related to the situation in your company. Please circle the number that best fits your judgment

24. Innovation is important to our company in maintaining competitiveness

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

25. There are efficient reward procedures and motivation drivers to stimulate innovation

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

26. Our new products enter the market faster compared to our main competitors' products

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

27. The returns from R&D relative to the R&D investments are

Very unsatisfactory 1 2 3 4 5 6 7 Very satisfactory

28. There are regular cross-functional screening processes (including for instance, marketing, purchasing, and manufacturing) to identify and select new product/technology opportunities

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

29. Current market information (such as segmentation, trends and feedback on competitors' products and processes) is passed on by marketing to R&D on a regular basis

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

30. The progress of all R&D projects is communicated regularly to the Business Units clients

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

31. Few restrictions are imposed on R&D by administrative regulations (e.g. regarding travel, budget, etc)

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

32. KPIs (Key Performance Indicators) are used to monitor the innovation process

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

33. Our company uses joint ventures and alliances to make full use of our R&D capabilities

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

34. We consistently codify the 'lessons learned' at the end of innovation projects

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

35. We monitor on a regular basis the extent to which our products and processes align to our customers' needs

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

36. Corporate managers and BU managers actively participate in the selection of R&D projects

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

37. There is an excellent communication between R&D and marketing

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

38. There is an excellent communication between R&D and manufacturing.

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

39. There is an excellent communication between R&D and purchasing

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

40. There is an excellent communication between R&D and our main suppliers

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

41. There in an excellent communication between R&D and our main buyers

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

42. Percentage of R&D budget for external R&D

Universities and Research institutes ..…..%

Companies ..…..%

43. What are the main priorities for your company's R&D investment?

Designing and launching new products [ ]

Increasing efficiency of existing processes [ ]

Designing and implementing new processes [ ]

Basic research [ ]

This is the end of the survey. Thank you very much for your cooperation.

9.3 Result of theoretical model test

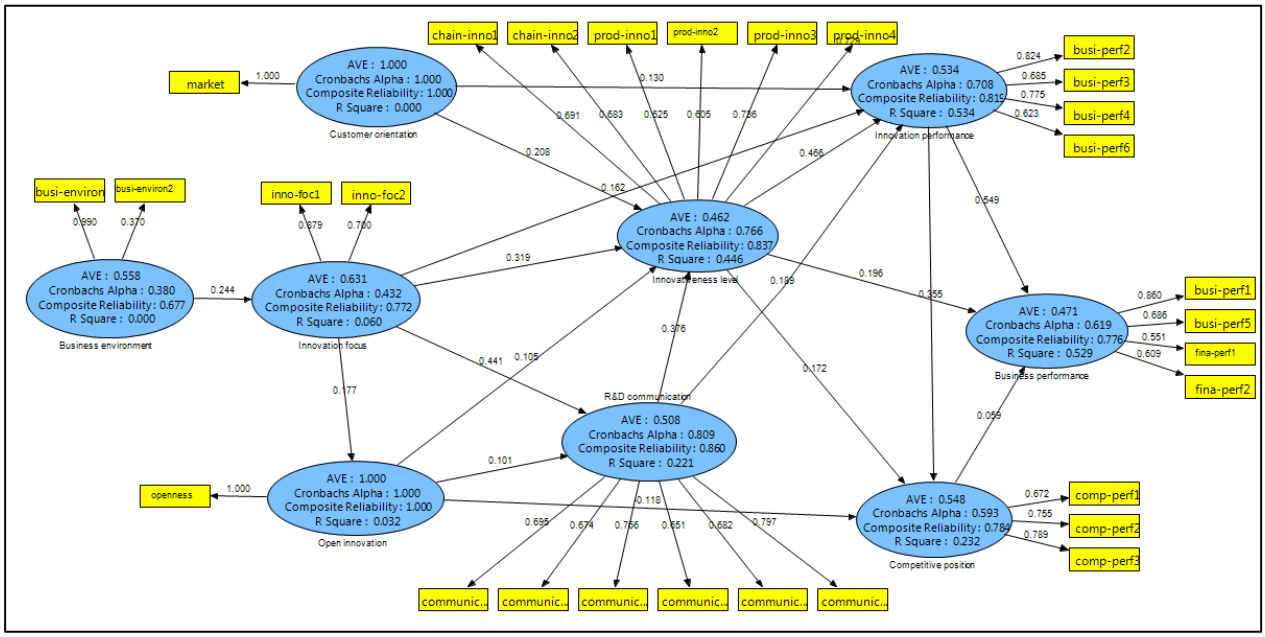


Figure 9.1a Result of theoretical model

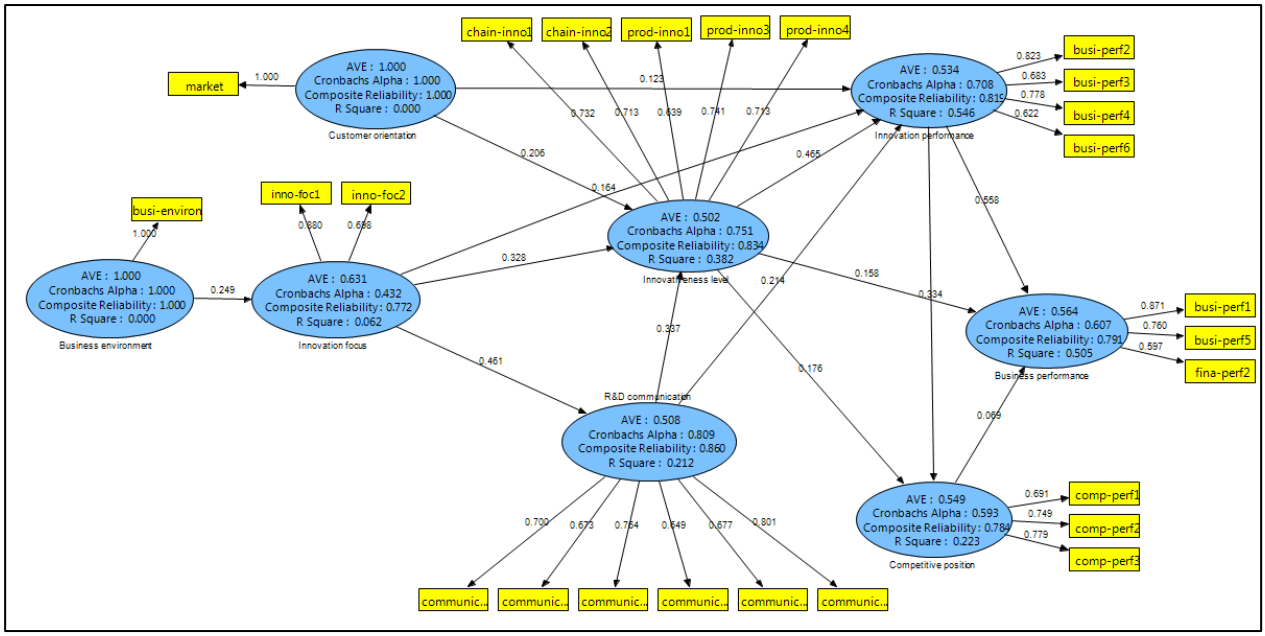


Figure 9.1b Result of theoretical model deleted low loading factors

9.4 Results of structural model test

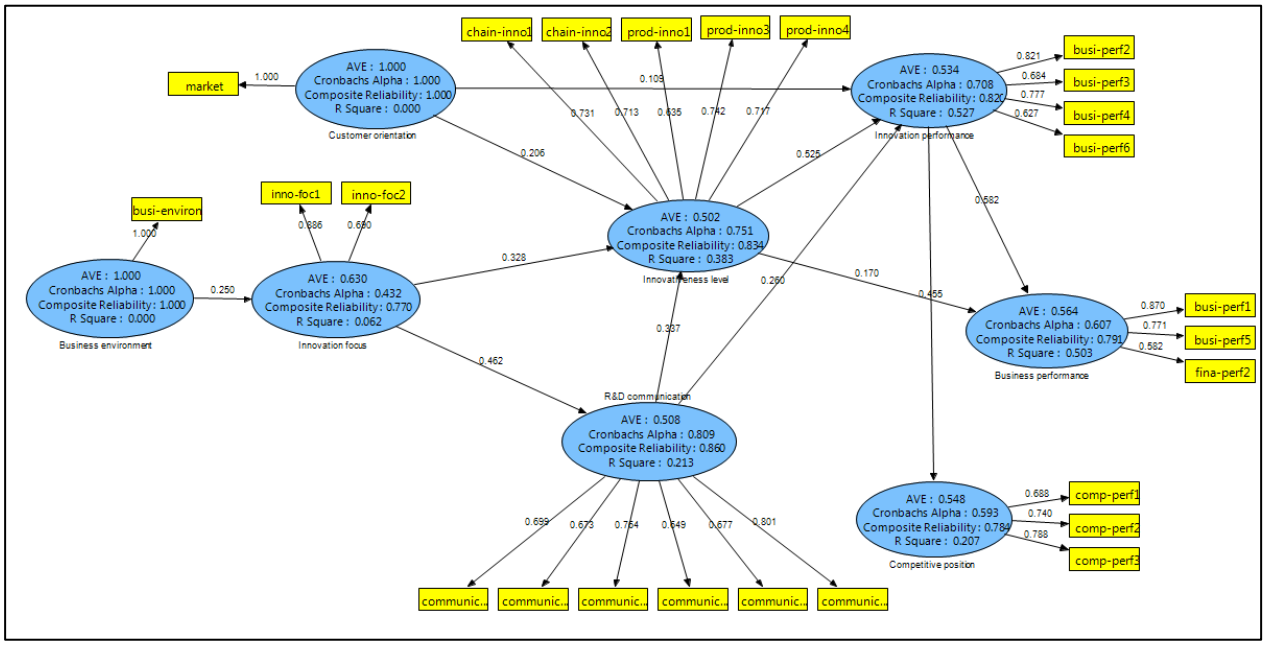


Figure 9.2a Algorithrn test result of structural model

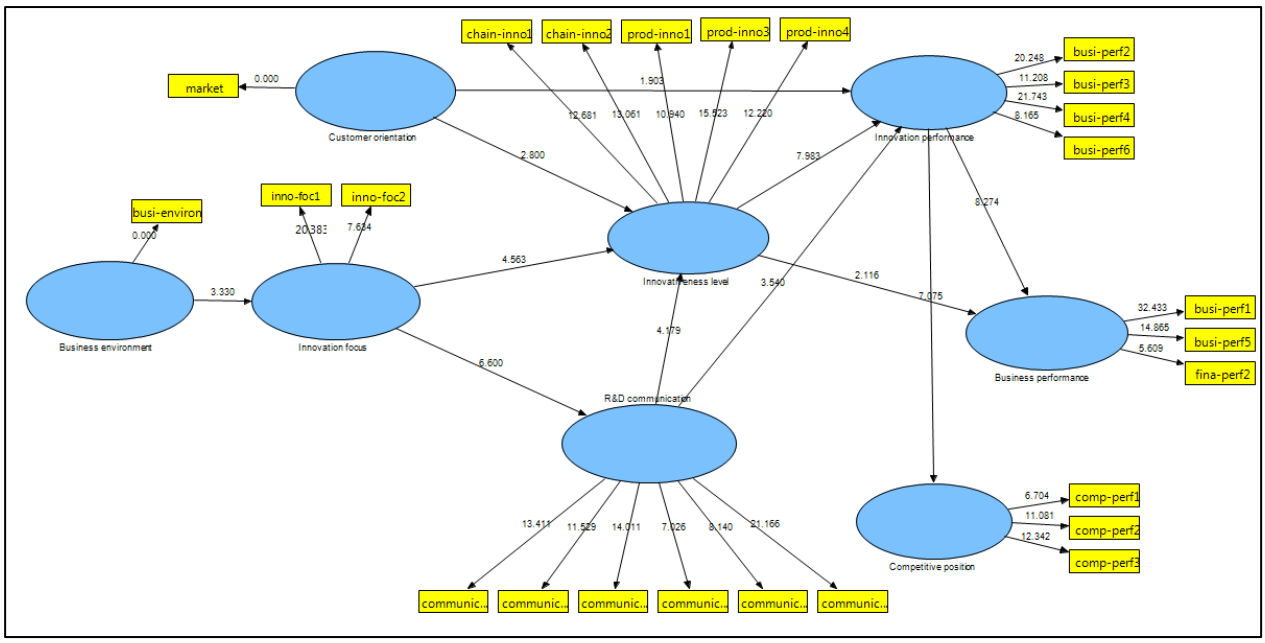


Figure 9.2b Bootstrapping test result of structural model

9.5 Results of single country companies processed with structural model

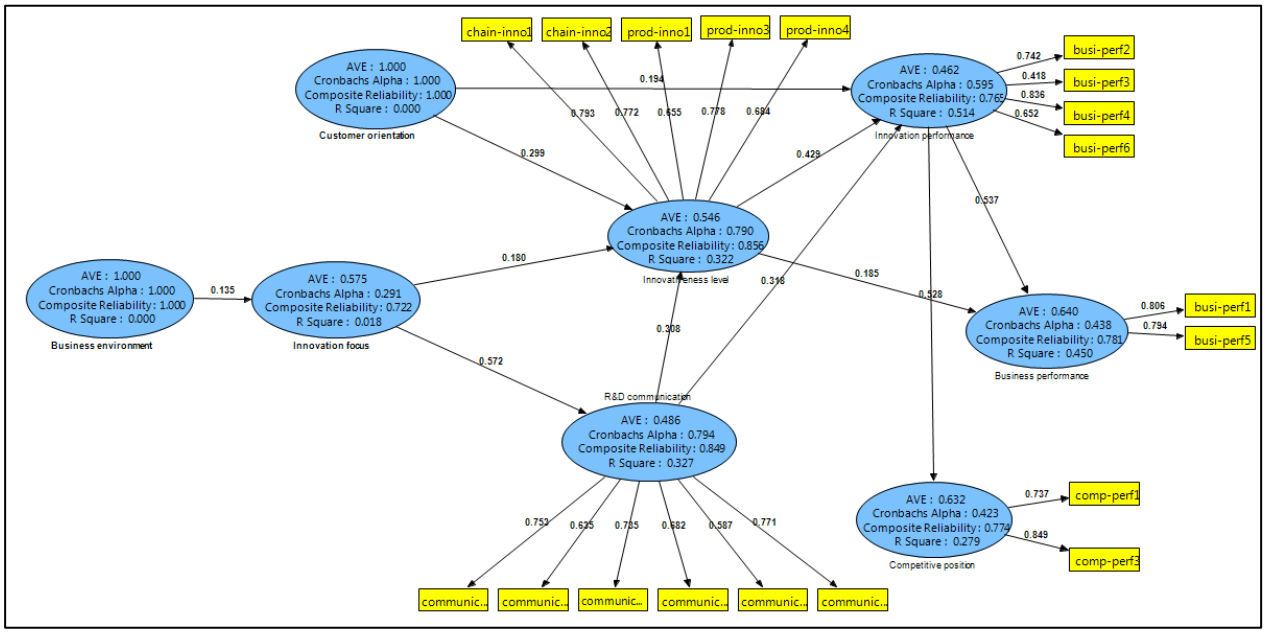


Figure 9.3a Algorithrn test result of structural model processed with Chinese companies data

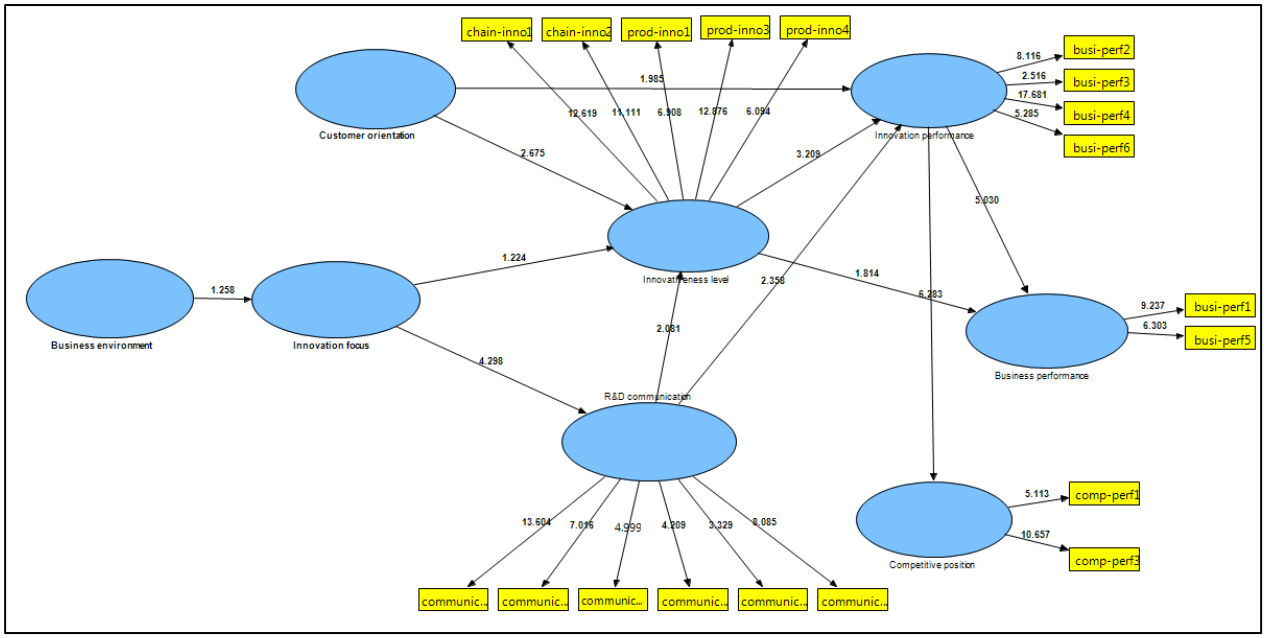


Figure 9.3b Bootstrapping test result of structural model processed with Chinese companies data

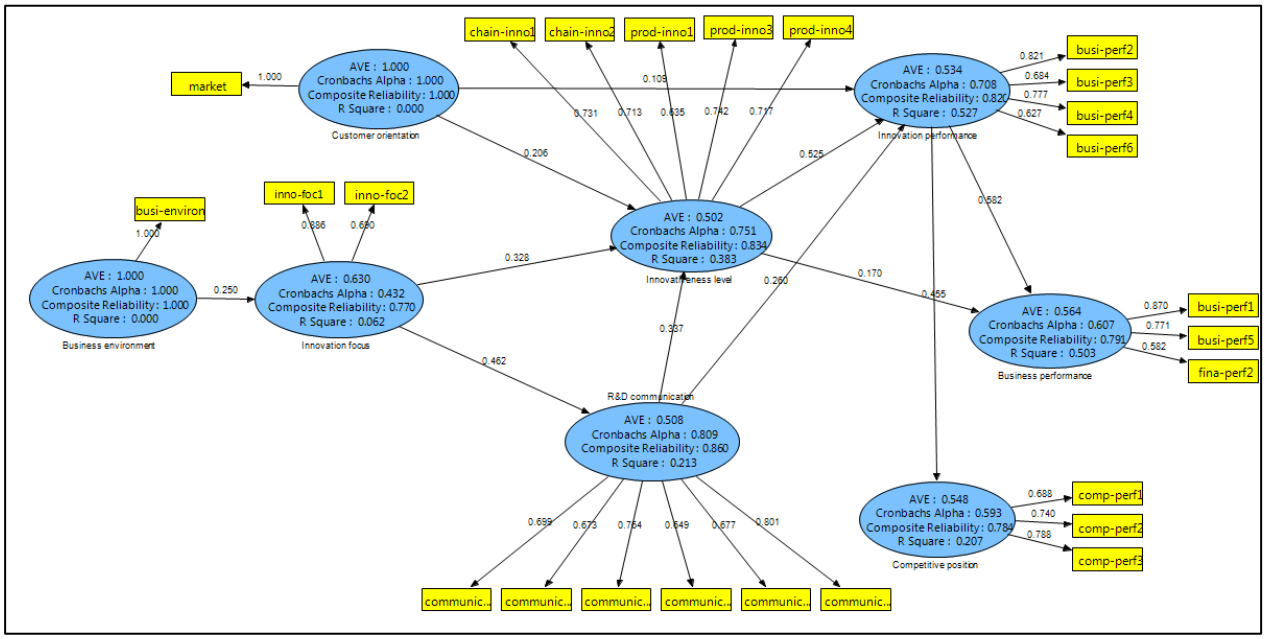


Figure 9.4a Algorithrn test result of structural model processed with Dutch companies data

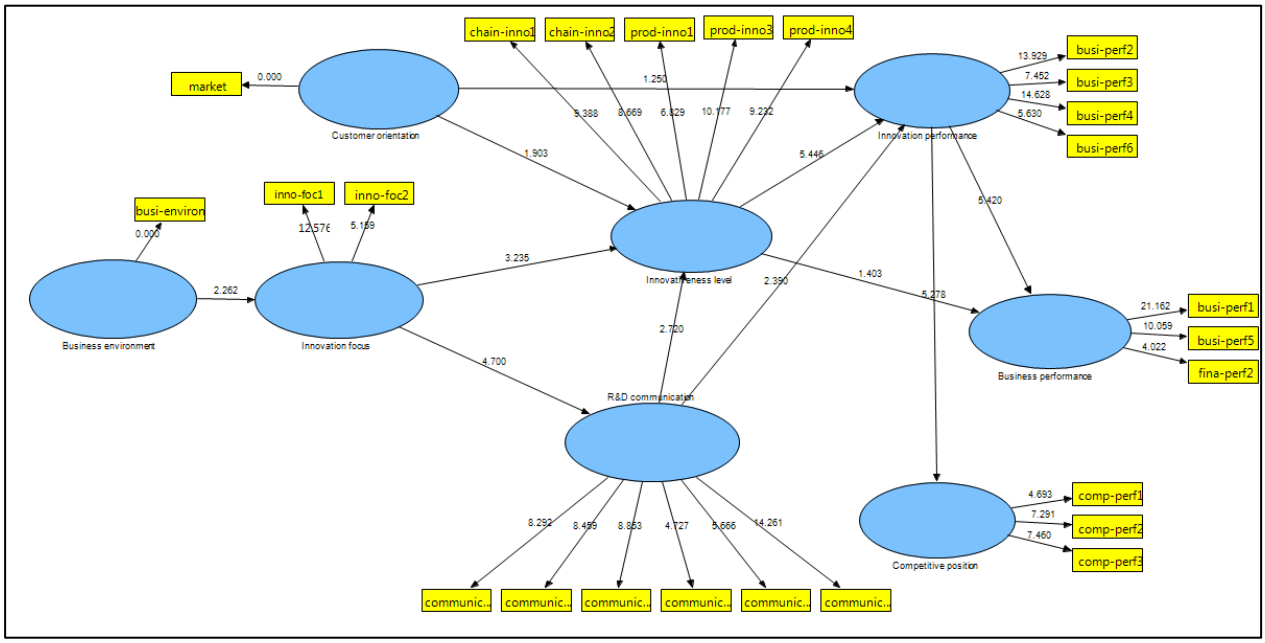
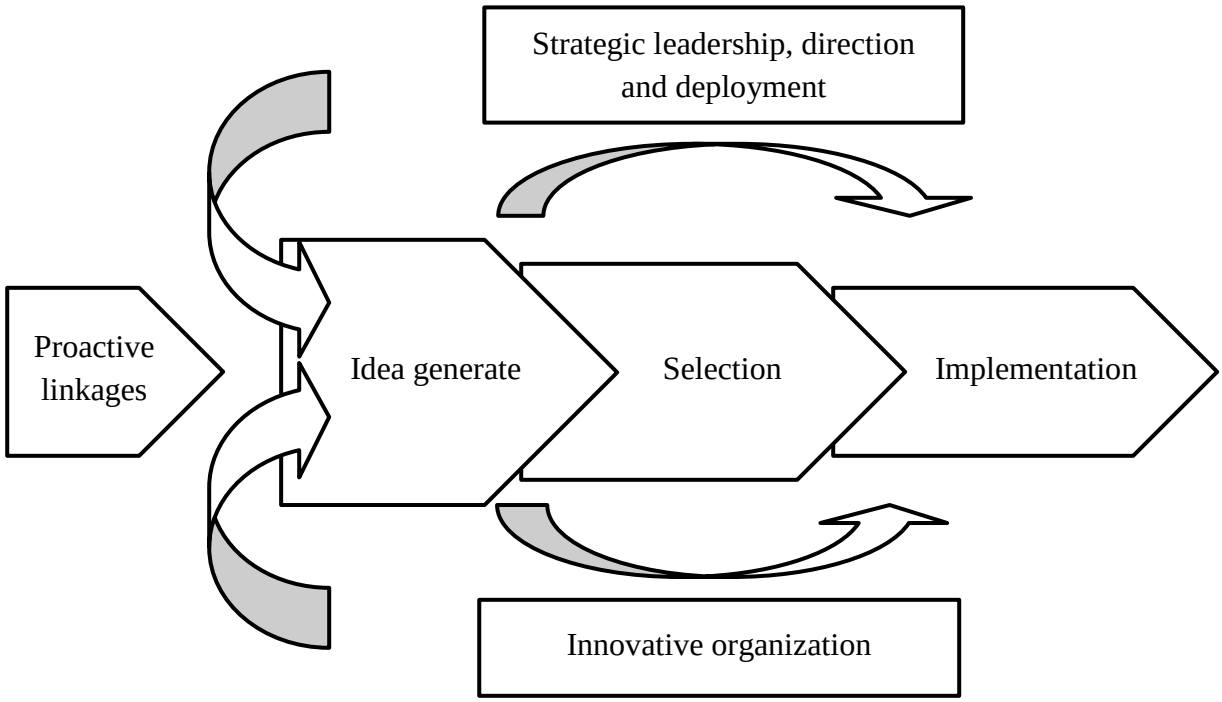


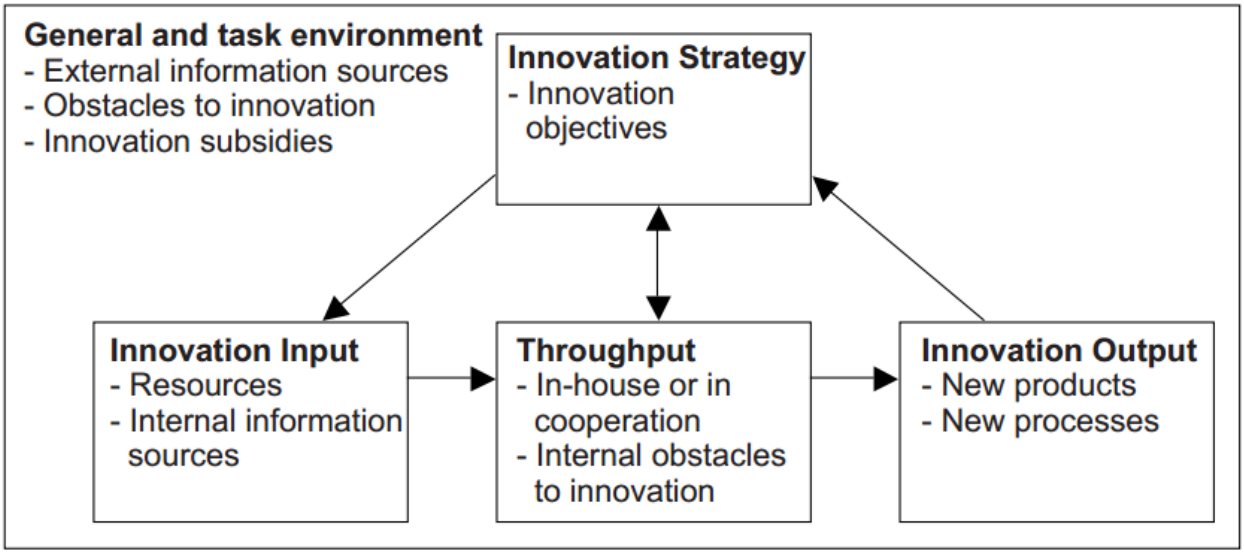
Figure 9.4b Bootstrapping test result of structural model processed with Dutch companies data

9.6 Original model of internal influencing factors on innovation



Source: Bessant and Tidd (2007)

9.7 Original model of innovation input-throughput-output model



Source: (Batterink et al., 2006)

[i] Company: IBM Corporation

Website: http://www-01.ibm.com/software/analytics/spss/

Release: 16.0.0

Year: 2007

[ii] Authors: Ringle, Christian Marc; Wende, Sven; Will, Alexander

Title: SmartPLS

Release: 2.0 (beta)

Internet: http://www.smartpls.de

Organization: SmartPLS

City: Hamburg, Germany

Year: 2005