

COMPANY INNOVATIVENESS MEASUREMENT

Development of an assessment tool to measure the innovation performance of companies

Thesis for the Master of Science Program in Management of Technology

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EXECUTIVE SUMMARY

This research deals with the measurement of company innovativeness based on innovation output indicators. In the beginning of the research, a necessity of such a measurement was identified: The previous research of Reijzen (2006) on Innovation Capacity Test has already covered the earlier steps in the process dealing with how to achieve better business performance through innovation activities. With the elaboration of innovation inputs through Innovation Capacity Test, a check of innovation outputs is required. Therefore, the scope of this research is the logical next step in the process of studying the connections between innovation inputs, innovation strategy, innovation performance, and the ultimate (financial) performance of a firm. The focus of this research has been deliberately confined on the measurement of actual outputs of innovation (e.g. patent applications, new process introductions, sales from new products/services). This kind of metrics has already been found to have a mediator function between the firm and its ultimate (financial) performance (Reijzen, 2006).

In a review on the available literature which is relevant to company innovativeness and its measurement, three dimensions of company innovativeness have been selected to form a multi-dimensional conceptual and measurement framework, which are product innovativeness, process innovativeness, and business model innovativeness. Every dimension consists of 3 or 4 sub-dimensions, every of which is measured by 2 to at most 8 metrics. All the 25 metrics have been proposed and applied in previous researches which were relevant with company innovativeness. Based on this framework, a measurement questionnaire has been developed.

The Company Innovativeness Measurement questionnaire consists of 49 questions. A 5-point Likert scale has been applied to show the performance of a company in this aspect compared to the ideal situation. Based on the responses, the measurement tool calculates the scores on all the dimensions and their sub-dimensions. Multiple

respondents from every application unit have been invited to answer the questionnaire to make sure the scores can reflect the reality as much as possible.

The measurement results provide a picture of the overall innovation performance of a firm. When more respondents with various background and job responsibilities are available, the measurement tool can give a good overview of a variety of innovation outputs. Results comparisons across different business units in the same company can also give insights on the internal cooperation and mutual understanding between different departments. Besides, the measurement results can be applied in the empirical examination of the relation between innovation capacity and innovation performance (innovativeness). When the results are analyzed together with Innovation Capacity Test results and Strategy Fit Analysis results, further indications on how to improve innovation activities and to achieve better innovation performance can be obtained. In expert reviews, pilot testing, and results discussions, it has been displayed that the measurement results indeed provide new insights which are interesting for further discussion and investigation.

In the reflection on the measurement model and its practical tool, it has been showed that the measurement tool still needs some improvements on its objectivity and user friendliness because of the limitations in this research. Some further study or application is required, but after all the research has already deliver important insights on the innovation activities of IBM Netherlands. Moreover, the conceptual framework underlying in the measurement tool is almost ready to be used by IBM Netherlands on other kinds of companies.

1 INTRODUCTION

In this chapter, an overall introduction of the research is provided, including the major research problem and the design of the entire research. In 1.1, the central research question and the sub-questions will be given. In 1.2, the scientific and practical goals of the research, the research scope, and the major methodology applied in this research will be introduced.

Why do companies innovate? Many empirical studies suggested that innovation enhances company performance and functions as a necessary cause of survival and business performance improvements of a company. For example, the econometric study by Geroski et al (1993) showed that innovative firms grow faster in terms of profitability and employment. It has been widely recognized that innovation is key to the survival and success of a company in fierce competition and fast-changing market nowadays. A large number of studies on company innovation activities have emerged in the past few decades. However, the relationships between innovation capacity, innovativeness, and business performance suggested by these studies remained implicit, which is yet to be explored by more researches (Neely and Hii, 1998).

In 2006, Sander van Reijzen developed the Innovation Capacity Test to provide a managerial insight into the internal innovation processes of a firm (Reijzen, 2006). The tool measures the innovation capacity of a firm from a resource-based perspective, focusing on the inputs of innovations. To move a logical next step further, it requires measurement of actual innovation performance to examine the influence of changing innovation capacity. Therefore, this research aims at measuring the innovativeness degree of a company based on its innovation outputs.

1.1 Problem statement

Precise conceptualization and measurement of company innovativeness is crucial for the exploration of the relationship between innovation capacity and innovativeness.

Moreover, the measurement of company innovativeness will also facilitate the study of the impact of innovation capacity, the influence of company strategies.

The measurement of company innovativeness and innovation performance has been a hot research topic in the field of innovation management for a long time. Many former studies on this topic were met with criticism on two aspects: First, the variables measured by most studies failed to reflect the complex nature of the source of innovativeness; second, the studies gathered data from top executives, which cannot provide a true measure of the entire organizations (Neely & Hii, 1998). These two problems should be taken into consideration in the development of an appropriate measurement tool.

The central problem of this research is “*What is an appropriate method to measure the innovativeness degree of a company*”.

This research problem can be split into the following sub research questions:

- 1 What is an appropriate definition of company innovativeness in the research?
- 2 What are the dimensions of company innovativeness?
- 3 How can these dimensions be measured?
- 4 What indications about the relationship between innovation capacity and innovativeness can be perceived when comparing the measurement results?

1.2 Research design

1.2.1 Research goal

The scientific goal of this research is to conceptualize and measure company innovativeness as a multi-dimensional concept. The measurement will be useful in the studies of the relationship of innovation capacity and innovativeness, as well as in the investigations of the influences from company strategies.

The practical goal, on the other hand, is to build an assessment tool to be combined with the Innovation Capacity Test and Strategy Fit Analysis. The tool aims at providing insights of the innovation performance of the company, which is IBM Netherlands particularly in this research, to support appropriate decision-making for innovation activities. The further improvement and extension of this tool in the future, which is out of the scope of this research, may enable it to be used by IBM on their clients as a consultancy service product.

1.2.2 Research scope

The scope of this research is indicated in the following figure.

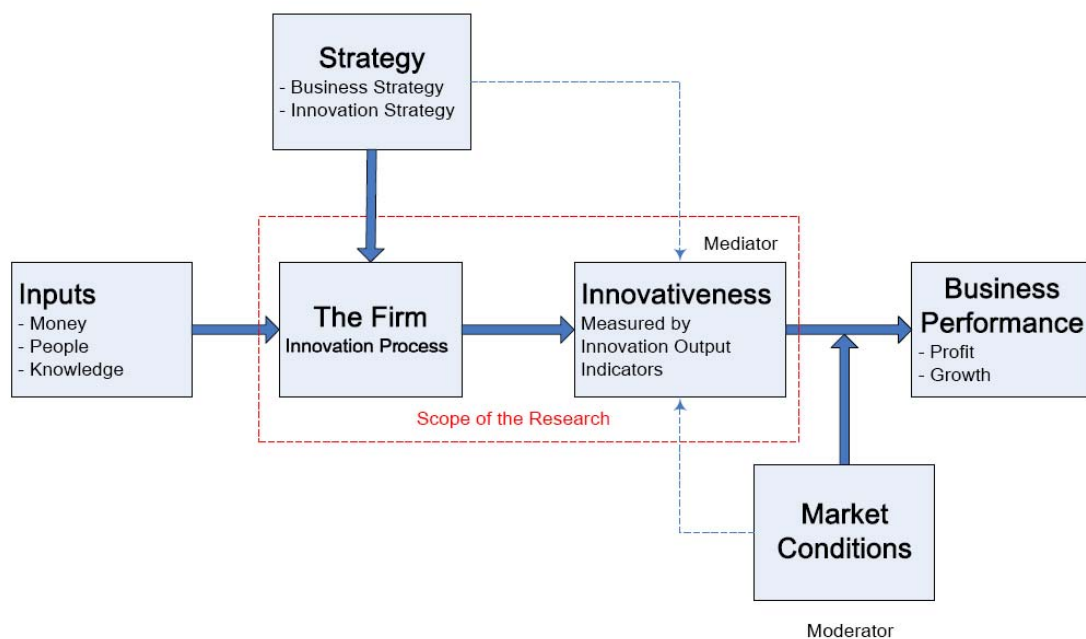


Figure 1: Research scope

This research is conducted at a company level, since it aims at applying the tool and the analysis methods to different kinds of companies in the future. The literatures used as basis of this research are mainly investigations of innovative companies. The practical part of this research was conducted in IBM Netherlands. Therefore the study unit here is IBM Netherlands, a company which aims to operate innovatively in service

sector. The further application of the tool may require changes of some of its metrics, but the analysis methods of the results will remain the same.

1.2.3 Research Methodology

Based on the sub research questions, the methodology of the research is described by phases dedicated to answer those questions.

Research Questions	Variable(s)	Research Methods	Phase
What is an appropriate definition of company innovativeness in the research? What are the dimensions of company innovativeness?	company innovativeness	<ul style="list-style-type: none"> ✓ literature review ✓ interview ✓ data archiving 	1, 2
How can these dimensions be measured?	company innovativeness	<ul style="list-style-type: none"> ✓ questionnaire ✓ data archiving ✓ interview 	2, 3
What indications about the relationship between innovation capacity and innovativeness can be perceived when comparing the measurement results?	company innovation capacity, company innovativeness	<ul style="list-style-type: none"> ✓ case study 	4

Table 1: Research Methodology

1. Model formulation

This phase dealt with the theoretical part of the research. Literatures on innovativeness measurement and innovation performance evaluation were reviewed to choose the appropriate indicators. Six experts in this domain, whose detailed information is enclosed in Appendix 3, were consulted for advice and suggestion. At the end of this phase, a measurement model for company innovativeness was formed to be applied and refined in the subsequent phases.

2. General information collection

The aim of this phase was to gather practical information from IBM to serve as a reference for model formulation and data collection. Therefore it had time overlaps with both the previous theoretical stage and the next testing stage. The collection of information involved interviews with IBM employees and data archiving.

3. Data collection and validation

In this phase the model developed and refined in previous phases was tested and applied to the business units in IBM. A pilot test of the measurement tool was conducted before the actual data collection. The data of the model was collected through a questionnaire. In addition to the general requirement, the questionnaire was also designed to meet following specific requirements:

- The tool should be applicable for IBM Netherlands;
- The tool should be able to be adjusted to be used on clients of IBM;
- The results should lead to a relevant overview for discussion with high-level managers;
- The tool should be user-friendly to respondents.

The details of these requirements will be elaborated in Chapter 3.

Four business units, two of which had taken part in the tests last year in Reijzen's research, participated. Therefore part of the results could be analyzed together with those of Reijzen's research. Feedback from the respondents helped to evaluate and to refine the model.

4. Results and feedback analysis

This phase was dedicated to answer the last sub-question. The data gained in tests was used to investigate the relationship between innovation capacity and company

innovativeness. Due to the limited number of respondents, the analysis in this phase was mainly qualitative. Three discussions on test results were conducted respectively with the respondents from three out of the four involved business units. The analysis also went a bit deeper to the level of sub-dimensions of the two concepts. The results of strategy fit analysis from Begum Aydinoglu were also taken into consideration in the analysis in order to see whether the strategy fit degree of a company has latent influence on its innovativeness.

1.2.4 Relations with other research

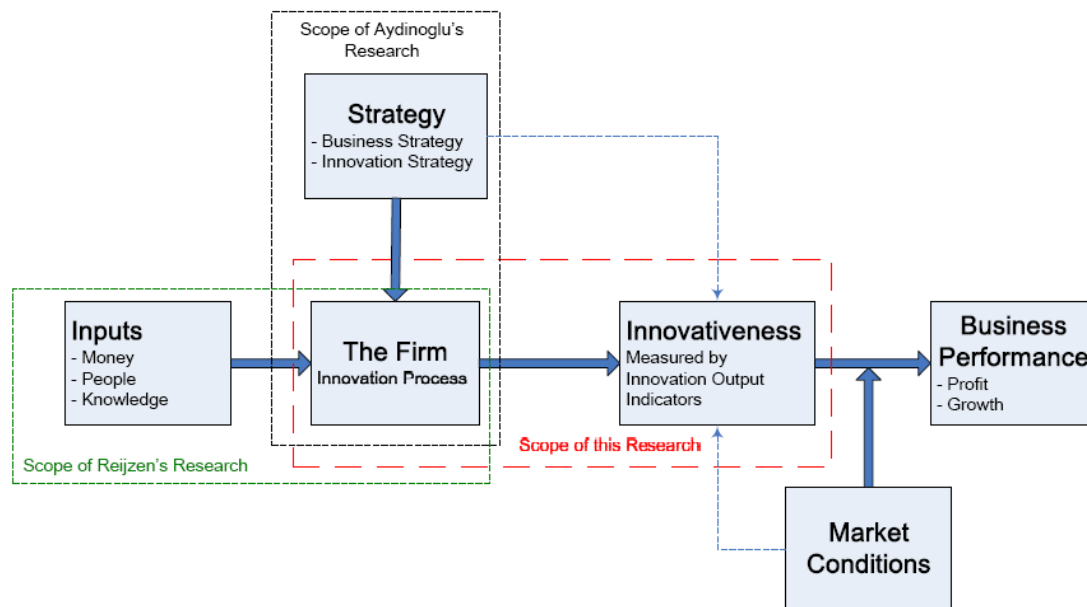


Figure 2: Scopes of the three researches

Figure 2 displayed the scopes of the three researches: Sander van Reijzen's research on innovation capacity, Begum Aydinoglu's research on strategy fit, and this research on company innovativeness. Reijzen's research studied the financial, personnel, and knowledge inputs of the innovation process of a firm. Focusing on innovativeness measured by innovation output indicators, the assessment tool developed in this Company Innovativeness Measurement research can facilitate the study on the relationship between the inputs and the outputs of a firm's innovation process.

Aydinoglu's Strategy Fit Analysis (SFA) studied strategy as another input of a company's innovation process. Different with other innovation inputs, the strategy fit degree can only be presented qualitatively instead of in a quantitative form. On the one hand, the results of Aydinoglu's analysis were used to investigate whether an obvious link between strategy fit and innovation performance exists. On the other hand, the Strategy Fit Analysis results can be used in the analysis of the sub-dimensional scores of company innovativeness to see whether the strategic focus was directly reflected in the company innovativeness scores.

1.3 Structure of the thesis

In this chapter a brief introduction of the Company Innovativeness Measurement research was provided, including the research aims, the research question, the research design, and its relations with other relevant researches. In the following chapters, the process and the achievements of this research will be provided in a more detailed way.

Chapter 2 is dedicated to an overview of the theoretical background of this research. It provides a brief introduction of the previous relevant literature based on the literature review of this research. Literature on definition of company innovativeness was reviewed to support defining the concept here in this research. Former researches and studies on innovativeness measurement were referred here as the basis of the conceptual model of the measurement tool. Literature on relationship between innovation capacity and innovation performance was also included to provide indication for the analysis in following chapters.

Chapter 3 describes the measurement tool developed in this research. The description includes the conceptual structure, the selection of its dimensions and metrics, the requirements for the design of the practical tool, the questionnaire as the practical

form of the tool, and the obtainment and application of the measurement results. The aspects related with the conceptual model of the tool are based on the reviewed literature introduced in Chapter 2.

Chapter 4 provides details about the validation and testing of the measurement tool, including expert reviews, pilot testing of the questionnaire, and results discussions with respondents on the application results.

In Chapter 5, the results and feedback from the application of the tool are to be analyzed. The feedback from the respondents will be investigated in order to facilitate the further application and improvements of the measurement tool. The Company Innovativeness Measurement results will be combined with results of researches of Reijzen (2006) and Begum Aydinoglu to investigate the linkage between the three concepts – innovation capacity, innovation strategy, and innovativeness. In addition, the application results of IBM Netherlands will be analyzed in order to reflect the reality in the company and to give suggestions to the managers.

In Chapter 6 the research achievements and the limitations in this research will be concluded. Conclusions generated from the reflection of application results of IBM Netherlands will be provided afterwards together with suggestions to the company management staff based on these results. In addition, suggestions to the successive researchers who want to apply or improve the tool will also be enclosed in this chapter.

In the appendixes, information on the application results, the questions and statements used in the questionnaire, the experts in the expert review of the measurement tool, and the details of the refinement of the questionnaire is provided.

2 THEORETICAL BACKGROUND

This chapter is dedicated to the concise description of the results of the literature review as the theoretical basis of this research. The relevant previous theoretical works are briefly introduced. In 2.1 and 2.2, studies on definition and framework of company innovativeness are reviewed to form a multi-dimensional definition of the concept. From 2.3 to 2.6, the definition, measurement, and selection of candidate dimensions are provided. In 2.7, previous literature on relationship between innovation capacity and innovativeness is introduced.

2.1 Definition of Company Innovativeness

First of all, a clear definition of company innovativeness should be made to clarify it from concepts such as product innovativeness or user innovativeness. Innovativeness is a broad concept which can be divided and studied at different levels, for example individual-level innovativeness, firm-level innovativeness, and regional-level innovativeness, etc. The concept “company innovativeness” here in this research is at an organizational level, at which a firm is viewed as a study unit.

To make the definition of company innovativeness clear, it is better to compare it with that of innovation capacity to clarify their difference and relevance. It seems that the definitions of these two concepts had some overlaps in many previous literatures. In a literature review in 1998, the concept of innovativeness was concluded “relates to the propensity of an individual or a firm to innovate”, while “innovation capacity”, on the other hand, was defined as “the potential of a firm, region or nation to generate innovative output”, which was influenced by firm culture, internal processes, and external environment (Neely & Hii, 1998, p. 34). In this review, the term “innovation capacity” was used to describe the actual latent ability of an organization to innovate. “Innovativeness”, on the other hand, was used to describe whether the individual or the firm is willing and eager to innovate, which was more subjective compared with “innovation capacity”. In the research of Avlonitis et al on the assessment of

organizational innovativeness, “company innovativeness” was viewed to “represent a latent capability of firms” to innovate (Avlonitis et al, 1994, p. 9). Similar definition of innovativeness was given by Tidd et al (2005) in their book: “An innovative organization implies more than a structure, it is an integrated set of components which work together to create and reinforce the kind of environment which enables innovation to flourish.” The above two definitions have more in common with the definition of “innovation capacity” in Neely and Hii’s literature review. To clarify the scope of the two concepts and to avoid confusion of them, these definitions cannot be applied here in this research.

In the researches of economists on innovation measurement, various indicators can be divided into two groups: the ones which measure the innovation inputs, for example R&D expenditure, and those which measure the innovation outputs, like patent applications and new product announcements (Kleinknecht et al, 2002). This division can also be applied to non-economical indicators. For example, the utilization of human resource on generating new ideas is an indicator which measures the inputs of innovation, while the product innovativeness is the one assessing the output. These two groups of indicators were often applied together in the some former researches on innovativeness. For example, in the research of Avlonitis et al (1994), the proposed multi-dimensional conceptual model of organizational innovativeness has not only dimension on innovation inputs, named “manifested strategic innovation intentions”, but dimensions on innovation outputs, like “product innovativeness”, as well.

Reijzen’s Innovation Capacity Test developed in 2006 was formed from a resource-based academic perspective, mainly focusing on the inputs of the firm. When adopting this model in the study of linkages between innovation capacity, innovativeness, company strategy, and business performance, the concept “company innovativeness” had better be formed as a measure of the innovation performance of a firm. The scopes of the two concepts will then have no overlaps which can cause confusions. Therefore, here in this research the notion “company innovativeness” is

defined as *the actual performance of a firm's innovation activities, which is measured by the innovation output indicators*. The innovations here involved in the output measurement include not only product and process innovations, but also innovations on the organization structure and the business model of a company. This definition of company innovativeness will serve as a crucial criterion in the selection of indicators. On the other hand, financial performance of the company, which is considered as being influenced by innovativeness, is out of the scope of this research. Therefore, the indicators measuring profits and market growth will also be excluded in the selection.



Figure 3: Definition of company innovativeness

2.2 Framework of company innovativeness

In previous researches on the conceptualization and assessment of innovativeness, researchers have developed different multi-dimensional conceptual frameworks.

Community Innovation Survey (CIS) is a microeconomic survey of innovation activities and policies. It is carried out in different countries and regions every year. In the 4th CIS questionnaire for data collection from companies, there are 4 categories: product innovation, process innovation, market innovation, and organizational innovation (see Table 2). In every category, the introduction and impact of one particular kind of innovations are investigated. This division can be viewed as a framework for the economic study of innovation activities, including both inputs and outputs of innovations.

product innovation	new-to-the-market goods/services
	new-to-the-firm goods/services
process innovation	new manufacturing/producing methods of goods/services
	new delivery/distribution methods
	new supporting methods
market innovation	design innovations
	promotion innovations
	market placement innovations
	pricing innovations
organizational innovation	new or significantly improved knowledge management systems
	new management systems
	changes of employee decision making and responsibility
	changes of management structure
	changes of the relations with other firms or public institutions

Table 2: Categories of innovations in CIS-4

One of the frameworks which consist of both quantitative and qualitative indicators was developed by Avlonitis, Kouremenos, and Tzokas in 1993. A three-layer conceptual framework of organization innovativeness was generalized in the research. It has 5 fundamental dimensions – technological innovation challenges, manifested strategic innovation intentions, product innovativeness, innovativeness of core machinery, and innovative leadership (see Figure 4). These 5 dimensions are influenced by 11 economic factors, 17 managerial/organizational factors, 4 industry specific factors, and 3 governmental legislation and infrastructure factors (Avlonitis et al, 1994). This framework appeared to be more applicable for manufactory industries. For service companies, in many circumstances it is meaningless to talk about innovativeness of machinery. On the other hand, innovative leadership has overlap with product innovativeness, since the innovative leadership of a company may partly or even entirely result from high innovativeness degree of its product.

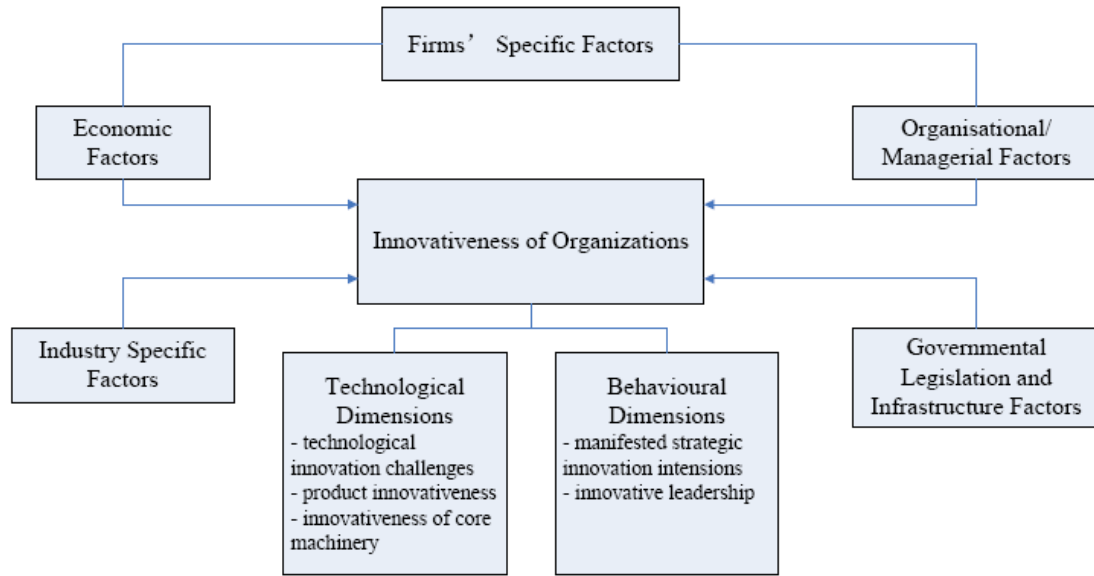


Figure 4: Conceptual framework of Avlonitis et al (1994)

A more comprehensive model was developed by Wang and Ahmed, based on an overview of previous researches on the theoretical development of organizational innovativeness construct (see Table 3). Five main dimensions which determine the overall innovativeness of an organization were defined, which were product innovativeness, market innovativeness, process innovativeness, behavioral innovativeness, and strategic innovativeness (Wang & Ahmed, 2004). As Wang and Ahmed stated in their paper, their research aimed at dealing with the 3 problems of similar former researches: First, the primary focus was not scale development and the measures were often ad hoc; Second, scales often adopted only one perspective instead of overall capabilities; Third, the multiple facets pertinent to the domain were often neglected (Wang & Ahmed, 2004). These three aspects will also be the points which need to be concerned carefully in our research.

Author	Product	Market	Process	Behaviour	Strategic
Schumpeter (1934)	×	×	×		
Miller and Friesen (1983)	×		×	×	×
Capon <i>et al.</i> (1992)		×			×
Avlonitis <i>et al.</i> (1994)	×		×	×	×
Subramanian and Nilakanta (1996)			×		
Hurley and Hult (1998)				×	
Rainey (1999)				×	×
Lyon <i>et al.</i> (2000)	×		×		
North and Smallbone (2000)	×	×	×	×	

Table 3: Dimensions of organizational innovativeness (Wang & Ahmed, 2004)

Both the two models of Avlonitis et al (1994) and Wang and Ahmed (2004) took company strategy as a component of company innovativeness in their conceptual framework. However, company strategy is not a notion which can be defined as an output of innovation activities. Instead, in many cases it actually was viewed as an input of innovation. For example, in the Innovation Capacity Test, strategy was included as a component of the capability dimension. It was believed that company strategy may influence innovation outputs directly or indirectly through its impact on innovation processes (Reijzen, 2006). Since we define company innovativeness here as the outputs of innovation processes in the firm, it is wiser not to include strategy as an element of this concept here. The same criterion is also applied to the exclusion of behavioral innovativeness, which was defined as the reflection of the “sustained behavioral change” of the organization towards innovations (Wang & Ahmed, 2004). From the definition it is clear that this notion reflects more the innovation inputs and the formation of the culture dimension of innovation capacity of a firm than its innovation outputs. Therefore, in the end the dimensions which can be applied in the framework of company innovativeness defined in our research are product innovativeness, market innovativeness, and process innovativeness.

2.3 Product innovativeness measures

2.3.1 Microeconomic measures of product innovations

In the book “*Determinants of Innovation*” written in 1996, Brouwer and Kleinknecht analyzed three quantitative innovation output indicators, other than the prevailing R&D intensity and patent applications. The three innovation output indicators consist of:

1. a collection of new product announcements in one year from a large number of trade journals in The Netherlands;
2. the share of innovative products in a firm’s total sales, the latter being

subdivided into:

- a) products “new to the sector”, which were not introduced earlier by a competitor;
 - b) products “new to the firm”, which were already known in the sector.
- (Brouwer & Kleinknecht, 1996)

As being stated in the book, the first indicator may have undergone some ‘filtering’, as new product announcements have passed through some editorial process in a journal (Brouwer & Kleinknecht, 1996). Besides, considering the perspective of Brouwer and Kleinknecht’s research, this indicator is not quite appropriate or applicable in my research. Instead, the data of new product or service introduction should be directly gathered from the company.

As Brouwer and Kleinknecht discussed in the book, it would be better to tune the three indicators according to the size of the firm. By comparing the data of different size classes, they found that firm size had significant impact on innovativeness. As they concluded, smaller firms announce new products less frequently, but they have more new product announcements relative to their size if they do so (Brouwer & Kleinknecht, 1996). The finding provides useful instruction for benchmarking the results.

Furthermore, the data of Brouwer and Kleinknecht’s research referred in the book was confined in one year, since it was the first time they applied the survey. The two researchers noticed that it limited the insights into the accumulative influences of former innovation activities as well as the difference between impacts of temporally innovating and permanent innovating. Therefore, while applying the indicators, it will be better to prolong the time of data from one year to longer period.

In 2002, these two researchers conducted an overview on the alternative econometric indicators together with Montfort. In this overview they found that the two most

commonly used indicators, R&D efforts and patents & patent applications, had more weaknesses than people generally assumed (Kleinknecht et al, 2002). Again they drew the conclusion that indicators should be normalized to reduce the correlation between them resulting from firm size. The choice of indicators, according to the researchers, does matter and therefore should depend on what to investigate and what level of aggregation is applied.

According to Kleinknecht et al's conclusion, R&D expenditure cannot be taken as an indicator in the conceptual framework of company innovativeness here, since it measures the input of innovation, and only one of the several inputs. Patents & patent application as an intermediate output measure is still meaningful, but the use of this indicator should be very careful about the four types of mistakes mentioned in Kleinknecht et al's paper: the underestimation of innovation of companies in low technological opportunity sectors, the overestimation of innovation in firms which collaborate a lot on R&D, the underestimation of the innovation of small firms, and the overestimation of the innovation intensity of small-sized patent holders (Kleinknecht et al, 2002).

In addition to the above two, five new indicators were also studied in the research: total innovation expenditure, sales of imitative and innovative products, new product announcements, and significant/basic innovations (Kleinknecht et al, 2002). Total innovation expenditure will not be involved here since it is also a measure of innovation inputs. Sales of imitative and innovative products and new product announcements have already been discussed before. Besides the disadvantages mentioned in Kleinknecht's book in 1996, some more weaknesses of the sales indicators were pointed out, such as sensitivity to business cycles, hardness of assessing inter-sector technology flows, problematic inter-sector comparisons, etc (Kleinknecht et al, 2002). The indicator significant/basic innovation is a direct measure of successful market introduction. However, it requires expert interviews on the judgment of significant/basic innovations, which will involve high research costs

as well as the problems of dubious statistical properties and missing incremental innovations. Therefore, it is better not to include this indicator here.

2.3.2 NPD program performance measures

Cooper and Kleinschmidt are two famous researchers in the domain of product innovation performance measurement. In their study on success factors of product innovations, they used factor analysis to identify 3 independent and strong dimensions which characterize new product performance: financial performance, opportunity window, and market impact (Cooper & Kleinschmidt, 1987). In these dimensions, financial performance and market impact are the measure of business performance, which is out of the scope of my research but will be important for successive studies. The remaining dimension, opportunity window, measures the degree to which the new product opened up new opportunities to the company in terms of a new category of products and/or a new market area for the company (Cooper & Kleinschmidt, 1987). This dimension included 3 measures: window on new markets, window on new product categories, and sales versus objectives. In Cooper and Kleinschmidt's research, opportunity window was related with success factors focusing on product uniqueness in dynamic market or industry. Therefore it can be included as a parameter in the measure of market innovativeness.

In a later article of these two researchers, they identified two dimensions of new product development (NPD) program performance to benchmark critical success factor of firms in NPD. The two dimensions were NPD program profitability and NPD program impact (Cooper & Kleinschmidt, 1995). The former dimension is again the measure of financial performance and therefore out of the scope here. The latter dimension was measured by 5 parameters: commercial success rate, percentage sales of new product, technical success rating (rated success to the spending of NPD), impact on annual total sales, and impact on annual total profit (Cooper & Kleinschmidt, 1995). These parameters, as the measure of the impact of new product,

are relevant to the measurement of product innovativeness.

Some other scholars also did researches on NPD success factors, in which the measure of NPD performance was involved. Their works gave ideas on analyzing NPD performance and influential factors depending on different types of innovations. In Brentani's article on success factors for service innovations, the author found that several factors play a distinctive role depending on how innovative the new service was. Therefore he concluded that "it is important that managers understand the very different keys for achieving success in each type of venture" (Brentani, 2001). Similar idea had already been proposed in Griffin and Page's paper on measures for product development success and failure. They hypothesized that the most appropriate set of measures for accessing project-level success depends on the project strategy (Griffin & Page, 1996). For example, the objectives and the success criteria for a new product which creates an entirely new market will differ from those of a project which extends an existing product line. The two authors divided product development projects into 6 different types: new-to-the-company, new-to-the-world, product improvements, additions to existing lines, product repositions, cost reduction (Griffin & Page, 1996). This typology can be applied in the analysis and interpretation of the measurement results.

2.4 Process innovativeness measures

2.4.1 Microeconomic measures of process innovations

In the 4th Community Innovation Survey (CIS), process innovation was defined as the use of new or significantly improved methods for the production or supply of goods and services, which must be new to the enterprise but not necessarily new to the industry (CIS IV, 2004). Whether the innovation was originally developed by the enterprise own or by other enterprises or institutes did not matter in the survey. However, purely organizational or managerial changes were not included, since they

were categorized as organizational innovations.

In the CIS 4 Harmonised Survey Questionnaire, questions on process innovations were focused on two aspects, the introduction of innovative business processes and the impact of the new or significantly improved processes. Three kinds of innovative processes were identified:

1. New manufactory or provision methods of goods or services;
2. New delivery or distribution methods for goods or services;
3. Other new supporting methods for the business of the enterprise.

The major effects of process innovations listed in the questionnaire were:

1. Increased range of goods or services;
2. Reduced costs per unit produced or provided;
3. Increased capacity for production or service provision;
4. Improved flexibility of production or service provision.

The first two kinds of effects can also be assessed through differentiation and productivity measures.

2.4.2 Knowledge productivity measures

Two traditional parameters in productivity measures are the percentage of R&D employees and labor productivity. For example, in Fritsch's economic research on interregional differences in R&D activities, these two parameters were involved in the empirical investigation (Fritsch, 2000). However, researchers have found that these two measures could not reflect the influence of knowledge on improving business performance. They started to seek appropriate methods to assess the impact of knowledge, which is generally "soft" and implicit and therefore difficult to measure.

In the article of Zegveld and den Hartigh in 2002, knowledge was analyzed from an economic perspective. Knowledge creation within a firm was considered as a

consequence of knowledge at the level of different core stakeholders (partner, customer, provider of capital, and employee) and knowledge at the level of the firm as an entity. Therefore, it was concluded that the total productivity development of a firm is a result of the relative sum of the productivity developments of the different core stakeholders and the productivity developments at the firm level (Zegveld & den Hartigh, 2002). The former can be analyzed by calculating the labor productivity and capital productivity of employees and capital providers. The latter, knowledge at the firm level, can be measured by analyzing productivity development of the firm insofar not assignable to labor or capital.

In the article of Zegveld in 2004, a more detailed model to analyze company-specific knowledge at the firm level was proposed. Based on the calculation of total factor productivity (TFP) and total resource productivity (TRP), the residual value which represents the change of knowledge productivity can be obtained. The residual change is therefore calculated through change of output per employee minus the product of capital per output and change of capital per employee (Zegveld, 2004).

2.5 Market innovativeness measures

Market innovativeness is closely connected with product innovativeness. Andrews and Smith in their article referred market innovativeness to innovations related to market research, advertising, and promotion (Andrews & Smith, 1996). Ali et al (1995), on the other hand, defined the concept as identification of new market opportunities and entry into new markets. To separate market innovativeness from product innovativeness as a component in their framework, Wang and Ahmed referred to this concept as “the newness of approaches that companies adopt to enter and exploit the target market” (Wang & Ahmed, 2004).

In the CIS 4 Harmonised Survey Questionnaire, questions on market innovations were focused on two aspects, the introduction of innovative market-oriented approaches

and the impact of these new or significantly improved approaches. Four kinds of market innovations were identified:

1. New designs of product or service and new packaging designs;
2. New market strategies, promotion techniques, and promotion media;
3. New sales channels and new concepts in product or service presentation;
4. New pricing methods.

The major effects of market innovations listed in the questionnaire were:

1. Sales growth;
2. Introduction of new markets or new customer groups;
3. Increased visibility of products or business;
4. Strengthened relationship with customers;
5. Improvements on customer satisfaction.

Besides, just as mentioned above in the review of studies on NPD program performance measure, opportunity window can also be viewed as a measure of market innovativeness. According to the definition given by Cooper and Kleinschmidt, opportunity window measures the degree to which the new product opened up new opportunities to the company in terms of a new category of products and/or a new market area for the company (Cooper & Kleinschmidt, 1987). This definition fits in with that of market innovativeness by Wang and Ahmed (2004).

2.6 Business model innovativeness measurement

Researchers have noticed that innovation does not only mean the changes in what a company offers the world and the way it creates and delivers the offerings. Therefore, innovations in areas other than product, service, and process have also been defined and studied. For example, in the paper of Francis and Bessant, the two authors defined 4 'P's of innovation targeting – product, process, position, and paradigm – to include innovation activities on market positions and business models (Francis & Bessant,

2005). In CIS questionnaires, market innovation and organizational innovation were the other two categories in addition to product innovation and process innovation. In the 4th CIS in 2004, 4 kinds of market innovations (together with 4 effects of them) and 4 kinds of organizational structure improvements were investigated.

In this research, the performance measures of these innovations are categorized in the dimension business model innovativeness. Former studies and literatures on business model were reviewed as theoretical support for the categorizing.

2.6.1 Business model definition

In the conference paper of Pateli and Giaglis in 2003, they reviewed 22 previous articles on business model and formed a framework for understanding and analyzing. The framework decomposed the research area of business unit into 7 sub-domains: definitions, components, taxonomies, representations, change methodologies, and evaluation models. In the domain of business model definitions, they concluded that there were mainly two kinds of interpretations. “Some researchers perceive the Business Model as a purely business concept that explains the logic of making business for a firm, while some others consider it as a link between strategy, business processes, and information systems.” (Pateli & Giaglis, 2003)

The difference between these two interpretations is the relationship of business model with strategy, business processes, and technology. The first kind of interpretations concerned these concepts as parts of business model, while the second considered them “as inter-linked components set in different levels of a pyramid construct” (Pateli & Giaglis, 2003). Considering that strategy is treated as a separate block out of the scope of my research, the second interpretation is applied here. Its definition framework is shown in Figure 5. A typical example of the this kind of interpretations is the definition provided by Osterwalder and Pigneur: “A business model is nothing else than a description of the value a company offers to one or several segments of

customers and the architecture of the firm and its network of partners for creating, marketing and delivering this value and relationship capital, in order to generate profitable and sustainable revenues streams.” (Osterwalder & Pigneur, 2002)

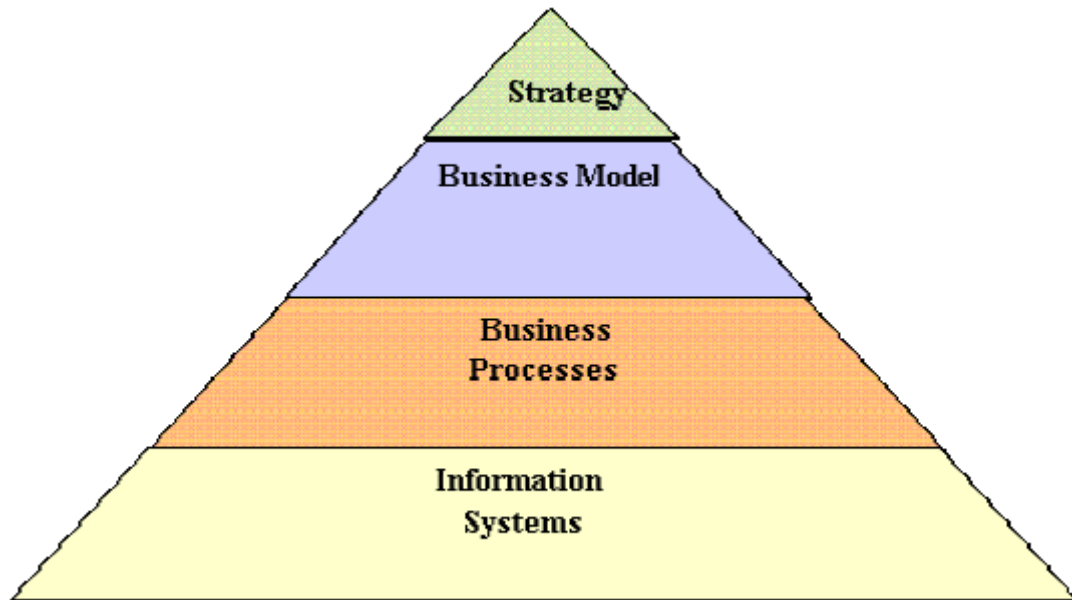


Figure 5: Business model definition framework (Pateli & Giaglis, 2003)

2.6.2 Business model components

Based on the literature review of 12 previous articles, Pateli and Giaglis (2003) designed a generic framework (see Figure 6) which synthesized a number of standard business model components identified by the majority of researchers in this field. The framework consists of two main frames:

1. The horizontal frame, including all the primary components of a business model: mission (strategic objectives), target market (scope and market segment), value proposition (product/service offering), resource (capabilities and assets), key activities (intra- and inter-organizational processes), cost and revenue model (cost and revenue streams, pricing policy), value chain/net (alliances and partnerships);
2. The vertical frame, including the underlying components of business models and the issues that outline the wider business and social environment of a business model's implementation: market trends, regulation, and technology

(Pateli & Giaglis, 2003).

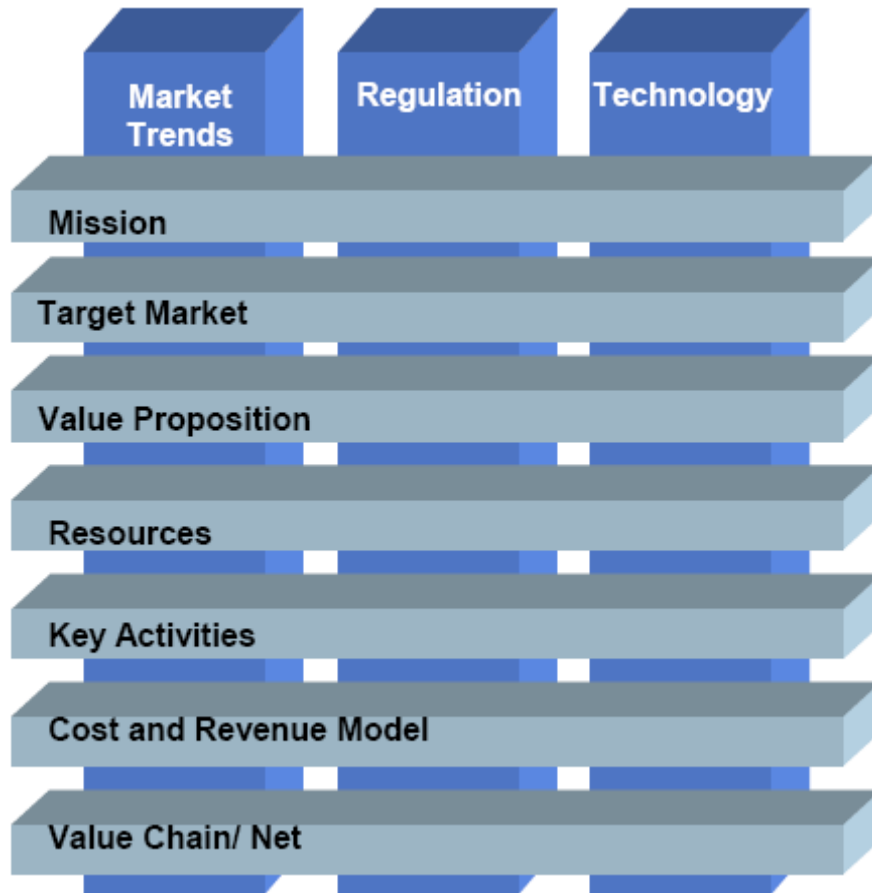


Figure 6: Business model components framework (Pateli & Giaglis, 2003)

According to this component framework, market innovativeness measures can be included as part of business model innovativeness metrics. Referred to the definition of market innovativeness applied in this research – “the newness of approaches that companies adopt to enter and exploit the target market” (Wang & Ahmed, 2004) – these approaches, whose effects are measured by market innovativeness, are contained in the business model of a company. Therefore, the parameters measuring market innovativeness can be included in business model innovativeness parameters.

2.6.3 Evaluation of business model innovativeness

The domain of business model evaluation appears to be a less mature research area. As Pateli and Giaglis perceived, the majority of the evaluation criteria proposed in the

literature were derived from generic theory and mostly driven by financial indicators such as profitability and margins, which are very difficult to measure ex ante (Pateli & Giaglis, 2003). Besides, profit measures are also out of the scope of my research. Instead, the factors which were proposed to have impact on the profitability and feasibility of business models are relevant here.

There are two books which discussed the influential factors on the profitability and viability of a business model. In Hamel's book *Leading the Revolution*, he identified four factors that determine the wealth potential of a business model:

1. Efficiency, which is the efficient extent to which the business concept delivers customer benefits;
 2. Uniqueness, which is the extent to which the business concept is unique;
 3. Fit, which is the degree of fit among the elements of the business concept;
 4. Profit boosters, which mean the degree the business concept exploits profit boosters (increasing returns, competitor lock-out, strategic economies, and strategic flexibility) that have the potential to generate above-average returns.
- (Hamel, 2000)

All the four factors were related with the notion 'business concept'. Hamel defined this notion as following: "The business concept defines a business market opportunity, products and services offered to the customers/clients, competitive dynamics of the industry/business sector, strategy to obtain a dominant position, and strategic options for evolving the business." (Hamel, 2000)

In the other book written by Weill and Vitale, another three key factors were referred to. These influential factors are:

1. Level of ownership for the customer relationship, data, and transaction
- "Owning the customer relationship brings the leverage of influence. The customer looks to the relationship holder for trust, recommendations, and tailored advice.

Owning the customer data brings the leverage of insight, as the firm has the detailed information about the history and the needs or likes of the customer. Owning the customer transaction generates the leverage of revenue from fees for services. Revenue will come from assets under management or the services implicit in owning the relationship.” (Weill & Vitale, 2001)

2. Access to key information about customers, products, markets, and costs

This factor is related with knowledge management of a firm, especially the learning and accumulation of information and knowledge of the market the firm is competing in.

3. Conflicts raising from combination of atomic models

Weill and Vitale mainly identified four kinds of conflicts, including channel conflict, competency conflict, infrastructure conflict, and information conflict. For every kind of conflict, they also gave an example to elaborate it. For example, an airline company may be confronted with channel conflict when it applies both online ticket booking and traditional ticket agencies. The attractive convenience and discounts of online ticket booking can result in the sales declination of traditional ticket booking agencies.

In general, all these factors are measures for static performance of a business model. One of the four factors proposed by Hamel (2000), the uniqueness of the business concept of the business model, appears to directly evaluate the innovativeness degree of that model. The others, on the other hand, are not specific evaluation parameters of business model innovativeness. However, introductions of business model innovation will influence the performance of a business model. Therefore, the changes on these proposed aspects can reflect the impact of business model innovations.

Based on the above thoughts, following measures of business model innovativeness can be concluded:

1. Increase of efficiency extent to which the business concept delivers customer benefits;
2. Uniqueness of the business concept;
3. Improvement of fitness among business model elements;
4. Enhancement of exploitation of profit boosters;
5. Increase of level of ownership for the customer relationship, data, and transaction;
6. Improvement of key information access;
7. Release of conflicts rising from combination of atomic models.

2.7 Relationship between innovation capacity and innovation performance

In the literature review of Neely and Hii (1998), they looked at the issue of the impact that innovation has on business performance. Based on the review of previous articles and empirical researches, they drew following conclusions on the link between innovation and business performance:

1. Innovation enhances business performance because the product of innovation increases a firm's competitiveness and the process of innovation transforms a firm's internal capabilities making it more adaptive to the change;
2. Innovation is necessary, but not sufficient, cause of business performance and survival;
3. Numerous empirical studies suggested that innovation does enhance firm performance;
4. The literature they reviewed suggested an implicit relationship between innovation capacity, innovativeness, and competitiveness of a firm.

A recent empirical research conducted by Prajogo and Ahmed (2006) further investigated the relationship between innovation stimulus, innovation capacity, and innovation performance. Based on the literature review, they formed a conceptual

model (see Figure 7) including 3 hypotheses:

H1: There is a significant relationship between stimulus factors and capacity factors of innovation management.

H2: There is a significant relationship between capacity factors of innovation management and innovation performance.

H3: There is a significant relationship between stimulus factors of innovation management and innovation performance.

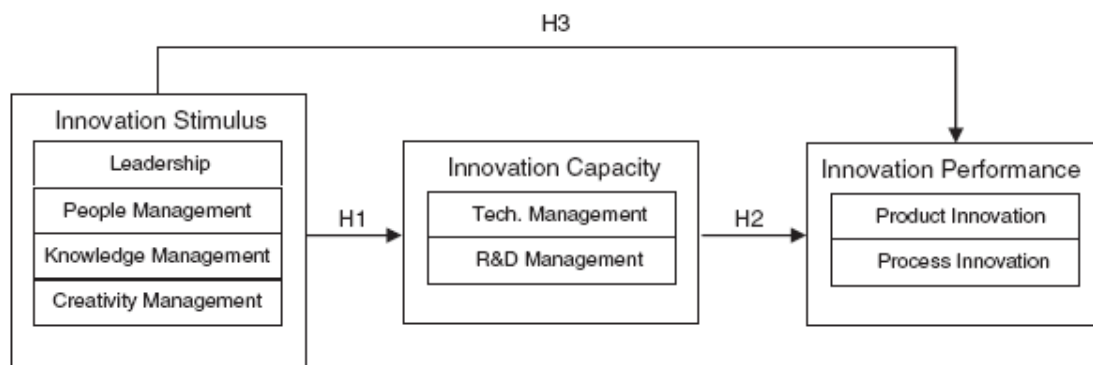


Figure 7: An integrated model of innovation management (Prajogo & Ahmed, 2006)

After testing amongst 194 managers of Australian firms, the first and the second hypotheses were supported by the empirical data. But the results did not support the direct relationship between stimulus and performance, which, according to the two researchers' conclusion, suggested that "innovation capacity fully mediate the relationship between innovation stimulus and innovation performance" (Prajogo & Ahmed, 2006, p. 510).

This study, however, has two major limitations which have to be considered when referencing its conclusions. First, the data gathered in the study relied entirely on the perspective of managers, which confined the study by its self-report nature and by opinions only from management level. Second, the variables in the study were deliberately kept narrow to facilitate testing. For example, the definition of innovation capacity did not involve cultural and network factors, and the measurement of innovation performance was only focused on product and process innovations. Further studies which include the complexity of 'hard' and 'soft' aspects of innovation

management in investigation should incorporate more factors and even more variables.

Two of the four business units involved in Company Innovativeness Measurement in this research, Sales and Distribution (S&D) and Business Continuity and Recovery Services (BCRS), also participated in the research of Reijzen (2006) on Innovation Capacity Test. The results of these two business units in the Innovation Capacity Test and here in this research can therefore be used to check whether they are consistent with the hypothesis of Prajogo and Ahmed (2006). The analysis of the results is enclosed in 5.4 in Chapter 5.

3 THE MEASUREMENT TOOL

This chapter describes the measurement tool formed on the basis of the previous literature for company innovativeness measurement. In 3.1 the theoretical framework structure and the selection of metrics of every dimension will be explained. The design criteria of the practical tool based on the theoretical framework will be listed in 3.2. In 3.3, the practical form of the tool, the questionnaire will be introduced in details. At last, the information about the results, including its calculation, presentation, and application, will be provided.

3.1 The framework

Based on the review of literature on company innovativeness, several dimensions can be concluded as possible constructs for the conceptual framework in this research. These dimensions together with the selection of them are shown in Table 4.

Based on the dimension selection, a three-dimensional framework of the concept was finally built for its measurement. The three dimensions of company innovativeness here are product innovativeness, process innovativeness, and business model innovativeness. Market innovativeness and organizational innovation impact are both included as parts of business innovativeness. However, the measures of business model innovativeness are more than the combination of their measures. The assessment of business model innovation impact is also included in this dimension. The overall framework is displayed in Figure 8.

Dimensions	Authors	Selection
product innovativeness	Avlonitis et al (1994) Lyon et al (2000) North & Smallbone (2000) Wang & Ahmed (2004) The 4th CIS (2004)	applicable
process innovativeness	Avlonitis et al (1994) Subramanian & Nilakanta (1996) Lyon et al (2000) North & Smallbone (2000) Wang & Ahmed (2004) The 4th CIS (2004)	applicable
behaviour innovativeness	Avlonitis et al (1994) Hurley & Hult (1998) Rainey (1999) North & Smallbone (2000) Wang & Ahmed (2004)	not applicable (innovation input measure)
strategic innovativeness	Avlonitis et al (1994) Rainey (1999) Wang & Ahmed (2004)	not applicable (innovation input measure)
market innovativeness	North & Smallbone (2000) Wang & Ahmed (2004) The 4th CIS (2004)	both applicable, and can be viewed as sub-dimensions of business model innovativeness according to the definition and components of business model
organizational innovation impact	The 4th CIS (2004)	

Table 4: Company innovativeness dimension selection

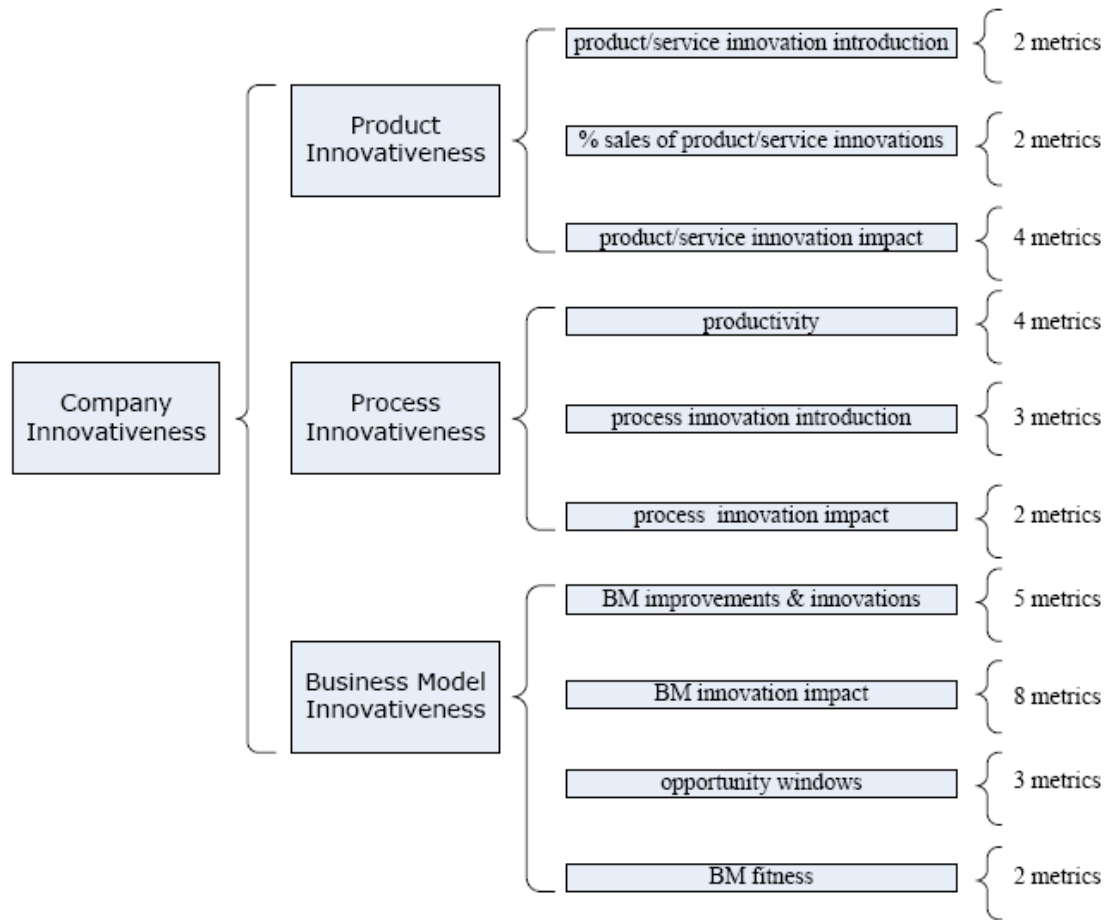


Figure 8: Framework of the dimensions of company innovativeness

3.1.1 Product innovativeness

The definition of ‘product’ here includes not only the manufactured goods, but the services to the customers as well. The deliverables of a firm to its clients can be tangible or intangible. Therefore services can also be viewed as ‘products’ a firm delivers to its clients.

This dimension mainly measures the introduction and impacts of product innovations and service innovations. All the metrics used here have been applied or studied in previous researches, therefore are proven measures. The sources and selection of product innovativeness metrics are shown in Table 5.

Metrics		Sources	Selection
microeconomic measures	R&D intensity	Brouwer & Kleinknecht (1996) Kleinknecht et al (2002)	not applicable (input measure)
	patent applications	Brouwer & Kleinknecht (1996) Kleinknecht et al (2002)	applicable, better tuned by company size
	new product announcements in trade journals	Brouwer & Kleinknecht (1996) Kleinknecht et al (2002)	not applicable for IBM NL which is in IT service sector
	% sales of new-to-the-sector products	Brouwer & Kleinknecht (1996)	applicable
	% sales of new-to-the-firm products	Brouwer & Kleinknecht (1996)	applicable
	total innovation expenditure	Kleinknecht et al (2002)	not applicable (input measure)
	sales of imitative & innovative products	Kleinknecht et al (2002)	applicable (redundant)
	significant/basic innovations	Kleinknecht et al (2002)	not applicable (high costs of time and effort, judgment problem)
NPD program impact measures	commercial success rate	Cooper & Kleinschmidt (1995)	applicable
	% sales of new products	Cooper & Kleinschmidt (1995)	applicable (redundant)
	technical success rating	Cooper & Kleinschmidt (1995)	applicable
	impact on annual total sales	Cooper & Kleinschmidt (1995)	applicable
	impact on annual total profit	Cooper & Kleinschmidt (1995)	applicable

Table 5: Product innovativeness metrics selection

As shown in Table 5, there are two big groups of product innovativeness metrics, microeconomic measures and NPD program impact measures. Microeconomic measures consist of two kinds of questions, one of which is related with the

introduction of innovations (e.g. the application of patents) and the other is about the sales generated from innovations. Then the 8 selected metrics can be categorized into 3 groups: product or service innovation introduction, the percentage of sales of the introduced innovations, and the impact of the introduction of those innovations. Similar categorizing of questions was found in the section on product innovation of the CIS 4 Harmonised Survey Questionnaire in 2004 (the number of innovations, the percentage of turnover from the innovations, and the product-oriented effects of innovations). Therefore, the 3 groups are viewed as the 3 sub-dimensions of product innovativeness in this research (see Table 6).

Sub-dimensions	Metrics
product/service innovation introduction	# of patent applications per employee
	% of purchased innovations
% sales of product/service innovations	% sales of innovations new to the market
	% sales of innovations new to the firm
product/service innovation impact	commercial success rate
	technical success rate
	impact on annual total sales
	impact on annual total profits

Table 6: Sub-dimensions of product innovativeness

3.1.2 Process innovativeness

Process innovativeness here means the innovativeness degree of a firm's various operation processes, including goods manufacturing process, service providing process, delivering or distribution process, and supporting process. Same as the 4th CIS, purely organizational or managerial changes were not included. These changes and their effects are categorized in the dimension business model innovativeness. Therefore, the type of innovations assessed by this dimension is only business process innovation.

All the metrics used here have been applied or studied in previous researches, therefore are proven measures. The sources and selection of process innovativeness

metrics are shown in Table 7.

Metrics		Sources	Selection
productivity measures	% of R&D employees	Frisch (2000)	applicable
	labor productivity	Brynjolfsson & Yang (1996) Frisch (2000)	applicable
	knowledge productivity	Zegveld & den Hartigh (2002) Zegveld (2004)	applicable
	differentiation	Zegveld (2004)	applicable
microeconomic measures	introduction of new operating process	CIS 4 Harmonised Survey (2004)	applicable
	increased range of goods/services	CIS 4 Harmonised Survey (2004)	applicable (redundant with differentiation measure)
	reduced costs per unit produced/provided	CIS 4 Harmonised Survey (2004)	applicable (redundant with productivity measure)
	increased capacity for production/provision	CIS 4 Harmonised Survey (2004)	applicable
	improved flexibility of production/provision	CIS 4 Harmonised Survey (2004)	applicable

Table 7: Process innovativeness metrics selection

In the CIS 4 Harmonised Survey Questionnaire (2004), the microeconomic measurement questions on process innovations were categorized into two groups: the number of 3 kinds of new processes and the process-oriented effects of innovations. Therefore, the 9 selected metrics here in this research can be categorized into 3 groups. They are viewed as the 3 sub-dimensions of process innovativeness in this research in order to facilitate summarizing results of the metrics (see Table 8).

Sub-dimensions	Metrics
productivity	% of R&D employees
	labor productivity
	knowledge productivity (reduced costs per unit produced/provided)
	differentiation (increased range of goods/services)
process innovation introduction	introduction of new manufactory or provision methods
	introduction of new delivery/distribution methods
	introduction of other new supporting methods
process innovation impact	increased producing/providing capacity
	improved producing/providing flexibility

Table 8: Sub-dimensions of process innovativeness

Because of the limitation of data using, the productivity metrics could not be measured through calculation of financial figures. Instead, they were measured through multiple choice questions to respondents on an ordinal scale. This weakened the measurement accuracy compared with calculating on financial data. The two metrics from CIS 4 Harmonised Survey, increased range of goods/services and reduced costs per unit produced/provided were also used, though they are redundant with productivity measures, as compensation.

3.1.3 Business model innovativeness

As stated before, this research applied the definition of business model which considers business model, strategy, business processes, and information systems as inter-linked components set in different levels of a pyramid construct. This definition means business model innovativeness here also includes the innovativeness of the management system and organizational structure of a firm. In addition, market innovativeness is also viewed as a part of this dimension, since market targeting, cost and revenue model, and value chain/net are parts of a business model according to the

component framework of Pateli and Giaglis (2003). The types of innovations related to this dimension are business model innovation, management & culture innovation, and policy & society innovation.

All the metrics used here have been applied or studied in previous researches, therefore are proven measures. The sources and selection of process innovativeness metrics are shown in Table 9.

Metrics		Sources	Selection
microeconomic market innovation measures	introduction of market innovations	The CIS 4 Harmonised Survey Questionnaire (2004)	applicable
	sales growth	The CIS 4 Harmonised Survey Questionnaire (2004)	not applicable (financial performance measure)
	new markets or customer groups introduction	The CIS 4 Harmonised Survey Questionnaire (2004)	applicable
	increased visibility of products/business	The CIS 4 Harmonised Survey Questionnaire (2004)	applicable
	improved customer satisfaction	The CIS 4 Harmonised Survey Questionnaire (2004)	applicable
organizational innovation measures	improvements of knowledge management system	The CIS 4 Harmonised Survey Questionnaire (2004)	applicable
	improvements of management systems for production or supply operations	The CIS 4 Harmonised Survey Questionnaire (2004)	applicable
	increase of employee decision making and responsibility	The CIS 4 Harmonised Survey Questionnaire (2004)	applicable
	changes of the management structure of the firm	The CIS 4 Harmonised Survey Questionnaire (2004)	not quite applicable (more like input measure)

Metrics		Sources	Selection
organizational innovation measures	improvements of relations with other firms or public institutions	The CIS 4 Harmonised Survey Questionnaire (2004)	applicable
opportunity window measure	new opportunity window on new markets	Cooper & Kleinschmidt (1987)	applicable
	new opportunity window on new product/service categories	Cooper & Kleinschmidt (1987)	applicable
	sales versus objectives	Cooper & Kleinschmidt (1987)	applicable
business model evaluation	efficiency	Hamel (2000)	applicable
	uniqueness	Hamel (2000)	applicable
	fit	Hamel (2000)	applicable
	profit boosters	Hamel (2000)	applicable
	profitability	Afuah & Tucci (2001)	not applicable (financial performance measure)
	profitability prediction	Afuah & Tucci (2001)	not applicable (financial performance measure)
	business model component attributes	Afuah & Tucci (2001)	not applicable (detailed appraisal of components regarding to financial performance)
	level of ownership for customer relationship, data, and transaction	Weill & Vitale (2001)	applicable
	access to key information	Weill & Vitale (2001)	applicable
	conflicts from combination of atomic models	Weill & Vitale (2001)	applicable

Table 9: Business model innovativeness metrics selection

The microeconomic questions on market innovation in the CIS 4 Harmonised Survey Questionnaire were categorized into 3 groups: the introduction of 4 kinds of market innovations, the effects of these innovations, and the importance of related activities. The first two groups of questions were selected to be used in this research as measurement metrics. Similar categorizing was applied on the questions on organizational innovations. Following this scheme, in this research the selected metrics from the CIS 4 Harmonised Survey can be categorized into 2 groups, the introduction of business model innovations and improvements, and the impact of these innovations.

According to the discussion in 2.6.3, metrics based on the evaluation factors of business model can also be viewed as measures of business model innovation impact. In particular, two metrics related with the alignment in a business model were categorized together as business model fitness measures here in this research. Different with other metrics on the effects of business model innovation, management & culture innovation, and policy & society innovation, these two metrics assess a business model from an overview perspective. Therefore, they were distinguished here as measures of business model fitness to stress the difference.

In summary, the 18 selected metrics can be categorized into 4 groups, which are viewed as the 4 sub-dimensions of business model innovativeness in this research (see Table 10).

Sub-dimensions	Metrics
business model improvements and innovations	introduction of market innovations
	improvements of knowledge management system
	improvements of operation management system (redundant with process innovation impact metrics)
	increase of employee decision making & responsibility
	improvements of relations with clients, other firms, or public institutions
business model innovation impact	new markets or customer groups introduction
	increased visibility of products/business
	improved customer satisfaction
	increased efficiency (redundant with productivity metrics)
	business concept uniqueness
	degree of exploitation of profit boosters
	improved access to key information about customers, products, markets, and costs
	level of ownership for customer relationship, data, and transaction
opportunity windows	new opportunity window on new markets
	new opportunity window on new product/service categories
	sales versus objectives
business model fitness	degree of fitness among elements of the business concept
	conflicts raising from combination of atomic models

Table 10: Sub-dimensions of business model innovativeness

3.1.4 Interrelation between dimensions

The three dimensions of company innovativeness framework are not mutually exclusive or irrelevant. On the contrary, they are interrelated and partly overlapped.

1. product innovativeness and business model innovativeness

As a sub-set of business model innovativeness, market innovativeness, as stated before, is highly connected with product innovativeness. On the one hand, the introduction of innovative end-products or services can help to create or enter a market. In addition, the innovativeness degree of goods or services provided by a company also influences some metrics measuring market innovativeness. For example, the introduction of a highly innovative product may require the company to introduce corresponding new sales channels and new promotion media or techniques for this product as well. On the other hand, identification of new market niche will influence a firm's strategy and inputs on product and service innovation, and therefore will also affect its product innovativeness indirectly. For example, the identification of a big new opportunity window on a new product or service category may stimulate the firm to invest on the R&D of such new products or services, which will possibly lead to the increase of the product innovativeness degree of this firm.

Besides market innovativeness, other business model innovativeness metrics may also influence product innovativeness, considering that value proposition (product/service offering) is one the major components of a business model.

2. process innovativeness and business model innovativeness

Efficiency, one of the four evaluation dimensions of business model proposed by Hamel (2000), is also a measure of process innovativeness. Besides, the metric key information access, which was referred by Weill and Vitale (2001), is also a key aspect in knowledge management, and therefore relevant with knowledge productivity as well. Considering that key activities (including intra- and inter-organizational processes) are defined as a primary component of business model, it is understandable that similar metrics are used to measure both these two company innovativeness dimensions. High innovativeness degree of a firm's business model may have positive influences on its process innovativeness degree. For example, a company which has a

unique business concept in its industry sector probably has unique operating processes different with its competitors in the sector as well.

3.2 Design requirements

Since this measurement tool is also an assignment for a company (IBM), some more requirements apart from the academic ones have to be drawn up.

1. The tool should be applicable for IBM Netherlands.

IBM Netherlands mainly focus their businesses in IT service domain. The company is aiming at operating innovatively and being ‘the innovator’s innovator’. This means the measures of the tool should consider the specific situations of service sectors which are different for those manufacturing companies. Besides, the results had better be able to reflect the differences of a company’s innovation strategies.

2. The tool should be able to be adjusted to be used on clients of IBM.

The measurement tool also aims at being applied on IBM’s clients in future. Therefore, its framework should allow appropriate adjustments to be used on companies operating in different business sectors.

3. The results should lead to a relevant overview for discussion with high-level managers.

The data inputs of the tool can and will be obtained from people from every layer in the company. However, the results are going to be discussed with higher level management. Therefore, the tool should be able to give a clear and easy understanding overview of the real outputs of the company’s innovation activities. The strengths and weaknesses of innovation performance should be displayed in a simple overview.

4. The tool should be user-friendly to respondents.

In order to get as much and precise information as possible, the tool has to be friendly to its user. Since most of the respondents are not familiar with the specific knowledge and terms in the domain of innovation management, the introductions and statements should be clear and simple to understand. The questions should be easy to answer and to relate with the real situations. And the time duration of answering all the questions should not be too long.

3.3 The questionnaire

The data inputs of the measurement tool are collected through questionnaire. The questionnaire is a combined one for both the Strategy Fit Analysis (SFA) and Company Innovativeness Measurement (CIM). It is in the form of Word file, and therefore can be answered either digitally or be printed out to fill in. The majority of the questions are multiple choice questions. Respondents are also asked to directly estimate or give numbers in a few questions. There are 50 questions in all, in which the last one is an open question and will not be involved in results calculation.

Most questions applied ordinal level scales. At this level there is a distinction between less or more, but the intervals between categories cannot be expressed in numbers. A 5-point Likert scale is applied to these questions. For example, in the part of business model innovativeness, 17 statements describing situations in a business unit are given. Respondents can give their opinions towards these statements by choosing their answers from ‘strongly disagree’, ‘disagree’, ‘neutral’, ‘agree’, and ‘strongly agree’. For every statement, the respondent can only choose one answer out of the five options. Similar methods were applied on multiple choice questions like Question 64 (see Appendix 2). When being asked about the service providing costs of the business unit, the respondent is required to choose one out of the five options – “notably

decreased”, “slightly decreased”, “remained at the same level”, “slightly increased”, and “notably increased”.

On the other hand, respondents are requested to directly estimate numbers to answer a few questions in the questionnaire, for example, Question 52 which is on new patent applications (see Appendix 2). The purpose is that the answers will be more precise than using ordinal scale. However, in pilot testing it turned out to be very difficult for people to directly give answers to these questions, especially those about the percentage of sales. Therefore, many of them were changed to the form of multiple choice questions in the formal data collection stage in order to get higher respondent rates. Only the question on patent application remained as its original form. The details of the changes can be found in Chapter 4 and Appendix 4.

In the general information part of the questionnaire, respondents are asked to give the information of their business unit, job responsibilities, age, etc. These questions will be used to categorize the results from different respondents in the analysis.

3.4 Results

3.4.1 Results calculation

A few of the results are the estimated numbers, such as the number of new patents and the percentage of sales generated from product/service innovations. These results will be benchmarked through comparison with average figures on the same item in other researches. For example, in the results of the 3rd CIS, the average percentage of profits generated from new-to-market innovations in the total annual turnover of companies in 15 European countries is 7.4%¹. Then the obtained results from the respondents here will be compared with this value. The results will be benchmarked as ‘very low’ if they are 60% below the EU-15 mean, ‘low’ if they are 20% below it, ‘medium’ if

¹ Source: EUROSTAT, 3rd Community Innovation Survey (CIS-3). National sources

they are between 80% to 120% of EU-15 mean, 'high' if they are 20% higher than it, or 'very high' if they are 60% higher than it. Then the score of this item will be given from 1 ('very low') to 5 ('very high').

Similar method is applied to the benchmarking of the number of patents. In the results of the empirical economic research by Fritsch (2000), the item "number of patents per employee" of 11 regions in Europe was recorded. The average annual value of them was 0.024. Then the number of patents in 2004 – 2006 gathered from the questionnaires will be divided by the number of employees in the business unit and then be divided by 3. After that the calculated value will be compared to the mean value of 11 European regions. The benchmarking criteria used to judge whether it is 'very low', 'low', 'medium', 'high', or 'very high' is the same as that of the percentage of profits generated from innovations.

For the questions applying Likert scale, the scoring methods will be simpler. A value from 1 ('strongly disagree') to 5 ('strongly agree') will be given to the items using statements, since these statements describe the best possible situations of the reality. To the questions whose choices are anchored by different descriptions, the scoring methods are similar, from 1 (the worst situations like 'very little' or 'notably worsened') to 5 (the best situations like 'very large' or 'notably improved').

The overall results matrix and the calculations of them are presented in Table 11 and Table 12.

	Question	Respondent 1	...	Respondent n	Answer
Dimension 1					
Parameter 1.1	Q_1	$A1_1$	...	An_1	$A_1 = \text{Average}(A1_1; An_1)$
	\vdots	\vdots		\vdots	\vdots
	Q_m	$A1_m$	...	An_m	$A_m = \text{Average}(A1_m; An_m)$
Parameter 1.m	Q_{m+1}	$A1_{m+1}$	...	An_{m+1}	$A_{m+1} = \text{Average}(A1_{m+1}; An_{m+1})$
\vdots	\vdots	\vdots		\vdots	\vdots
Dimension 3					
Parameter 3.k	Q_{49}	$A1_{49}$	...	An_{49}	$A_{49} = \text{Average}(A1_{49}; An_{49})$

Table 11: The results matrix

	Score	Dimension Score
Dimension 1		$DS_1 = \text{Average}(S_{1.1}; S_{1.m})$
Parameter 1.1	$S_{1.1} = \text{Average}(S1_1; Sn_1)$	
\vdots	\vdots	
Parameter 1.m	$S_{1.m} = \text{Average}(S1_m; Sn_m)$	
\vdots	\vdots	\vdots
Dimension 3		$DS_3 = \text{Average}(S_{3.1}; S_{3.k})$
Parameter 3.k	$S_{3.k} = \text{Average}(S1_{49}; Sn_{49})$	

Table 12: The overall results calculation

The weights of the sub-dimensions and the metrics are the same in calculations. However, the importance of different sub-dimensions and metrics will not be all the same for business units or companies who have their respective strategies, goals, and market environments. In Begum Aydinoglu's research on strategy fit analysis (SFA), information about particular strategy and mostly focused type of innovation projects of every business unit was obtained. The strategy typology of Treacy and Wiersema (1995) and the innovation project typology of Griffin and Page (1996) are applied in

her research. The results of SFA are going to be combined in the analysis of the innovativeness scores of different business units in IBM. On the one hand, the particular strategy of a business unit and the type of its major innovation projects can provide directions to judge which dimensions and sub-dimensions of innovativeness are important and therefore should be paid attention to. On the other hand, the scores of different dimensions and sub-dimensions of innovativeness may support the fit analysis of innovation strategies.

3.4.2 Results presentation

In order to facilitate results interpretation and further studies combined with Innovation Capacity Test, the radar graph is also used in results presentation in addition to mathematical results. In such a graphic presentation, the scores of all the dimensions and sub-dimensions, as well as their relative value to the best practice can be incorporated. An example of graphic presentation is shown in Figure 9.

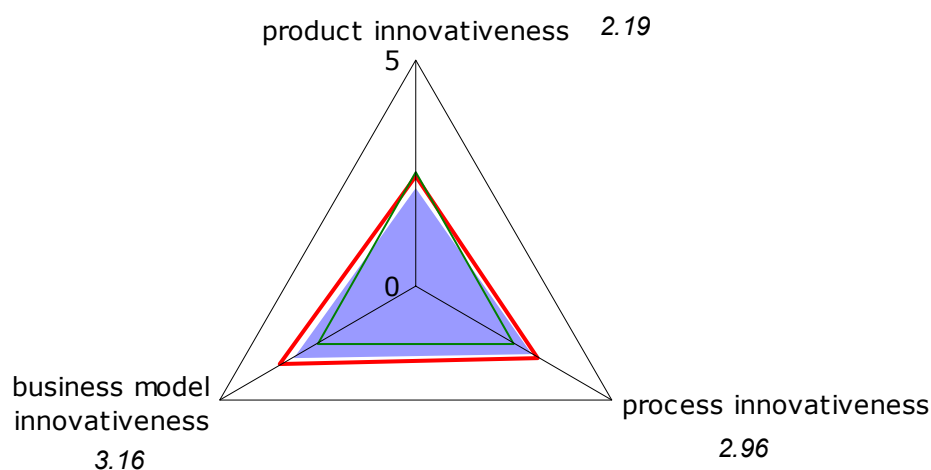


Figure 9: Radar graph for results presentation

All the scores are unified on a 0 – 5 scale, in which scoring higher means having higher innovativeness degree. The shading area represents the measured results of the particular business unit. The score of every dimension is recorded beside or under the name of that dimension. The red line in the graph is the average results of all

respondents regardless of their business unit. It serves for a relative comparison between the particular business unit and the average situation of the whole sample. The green line in the graph marks out an absolute threshold, 2.5 for every dimension. It mainly helps to position the level of dimensional scores to see whether it is in the lower half or the higher half.

3.4.3 Results application

The final scores of company innovativeness measurement can provide managers an overall picture of the innovation performance of the business unit or company. Besides, when being combined with Strategy Fit Analysis and/or Innovation Capacity Test, the results will be able to give more insights.

As it was stated in 3.4.1, the information of innovation strategy and mainly focused innovation project of a certain business unit or company is helpful for interpreting the Company Innovativeness Measurement results. The same dimension may have different degrees of importance to different business units or companies. For example, the score on process innovativeness is fairly important to a company which aims at achieving operational excellence and mostly engaged in innovation projects on cost reduction. The results of productivity measures and process innovation impact measures will help the company to examine whether its effort on improving its operational processes and efficiency is really effective. Nevertheless, the check of inconsistency between the claimed or perceived innovation strategy of a company and its CIM results will be more meaningful and useful for managers. For example, if a company with a strategy on achieving product leadership scores low in product innovativeness but high in process innovativeness, then the inconsistency suggests problems in implementation of the strategy. Probably the company is still operating as an efficiency pursuer instead of a product innovating leader. The managers of the company then really need to pay attention to it.

When the results of company innovativeness and innovation capacity are analyzed together, it will enable people to check whether there is a relation or inconsistency between the inputs and the outputs of innovation. If the results show comparatively high innovation capacity accompanied by relatively low innovativeness degree, it may suggest that the business unit or the company has problem of insufficient deployment of its innovation capacity. Such an inconsistency may also result from the impact of other factors, for example, the low strategy fit.

4 VALIDATION AND TESTING

This chapter describes the validation and testing process of the measurement tool. In 4.1, the results of expert reviews for the theoretical framework of the tool and its practical form, the questionnaire, are shown. Section 4.2 will describe the process and results of the pilot testing of the questionnaire. In 4.3, the feedback from successive discussions with respondents after the formal questionnaire application will be summarized.

Due to the limited time and resource constraints, it is impossible to apply large-scale quantitative tests for the validation of the measurement tool. Instead, qualitative validation methods are used to assess the correctness of the tool.

4.1 Expert review

During the formulation stage of the measurement tool, 4 experts, two from the university and two from IBM Netherlands, were consulted on the appropriateness of the framework and the translation of framework into the tool. Detailed information including the expertise of them is enclosed in Appendix 3.

The original structure of the framework (see Figure 10) was based on the categories of the 4th Community Innovation Survey (CIS) and the innovativeness framework proposed by Wang and Ahmed (2004). As it is stated in Chapter 2.2, behavioral innovativeness and strategic innovativeness in Wang and Ahmed's framework are out of the scope of this research. Therefore, the remaining 3 dimensions of company innovativeness are product innovativeness, process innovativeness, and market innovativeness, which are same as the categories used in the 4th CIS. In the 4th CIS, organizational changes were also taken into consideration, but were treated mostly like moderating factors on the innovation performance of enterprises.

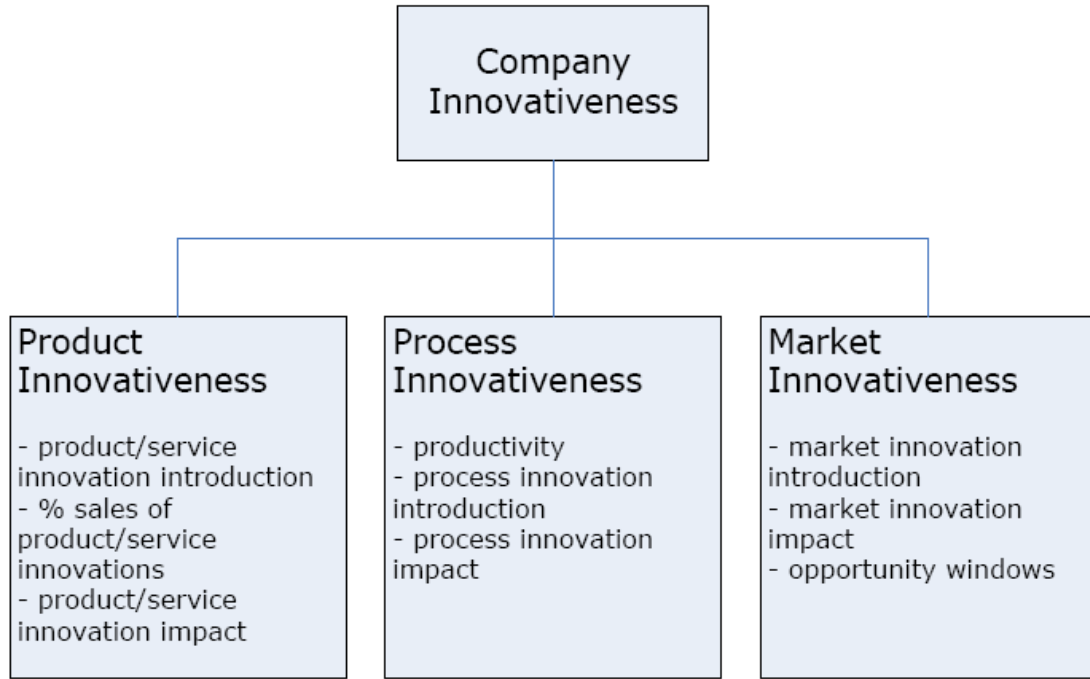


Figure 10: Framework of company innovativeness before expert review

In the expert review, following comments were given on this framework:

1. They agreed that product innovativeness, process innovativeness, and market innovativeness are crucial dimensions of company innovativeness. Since a number of studies in these domains have already been conducted, it is better to use validated metrics for the measure of these dimensions.
2. Innovations on management systems and organization structures are of same importance as innovations on product, service, and process. Therefore, there should be a separate dimension which measures the outputs of this kind of innovations.
3. Business model innovation is a topic becoming more and more popular nowadays. It is better to incorporate this concept into the measurement as well, since it is also an attractive domain to IBM.

Based on the comments from the experts, a refined framework (see Figure 11) was proposed, which has 3 dimensions: product innovativeness, process innovativeness, and business model innovativeness. According to the discussion in 2.6.2, market innovativeness is incorporated in business model innovativeness. The metrics

measuring market innovativeness are therefore included as metrics of business model innovativeness dimension. The details of dimension selection have been discussed in 3.1. Compared to the original framework, the introduction of business model innovativeness also includes measures of organizational innovations. Moreover, the concept of business model innovativeness is broader than market innovativeness plus organizational innovation impact. Therefore, the refined framework takes more aspects into consideration and therefore is more comprehensive.

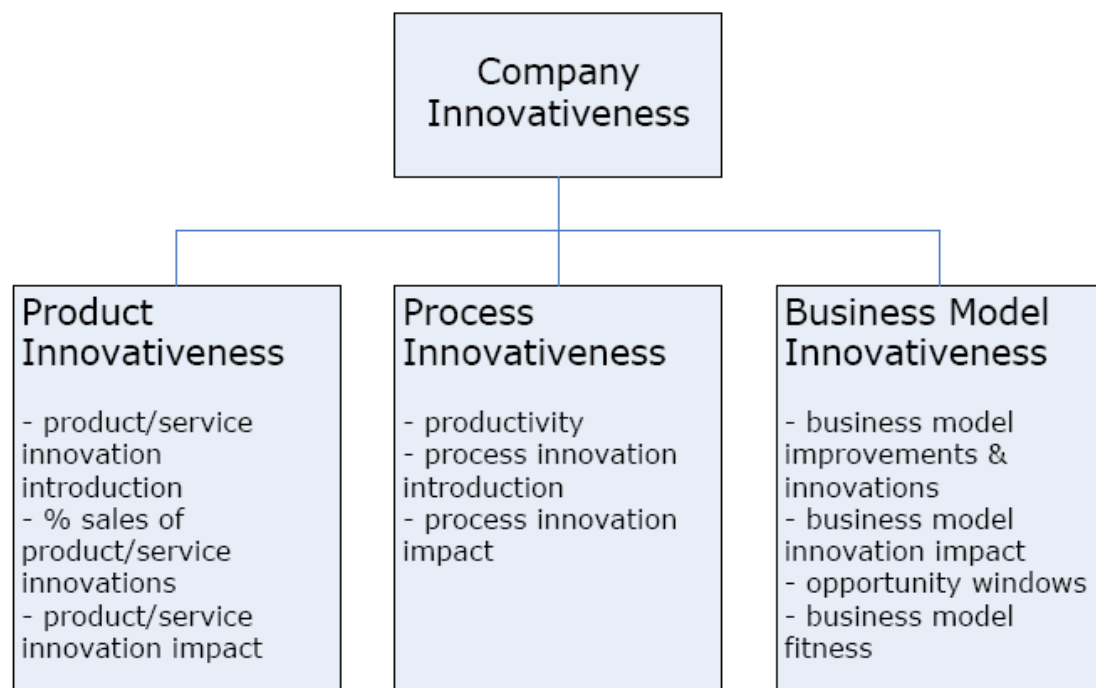


Figure 11: Refined framework of company innovativeness after expert review

During the pilot testing stage of the tool, 4 experts from the university (detailed information in Appendix 3) were asked to review the questionnaire and to give their comments and suggestions. In general, they thought the questions are really measuring the innovation outputs of a company, and are relevant for IBM Netherlands as a company in service sector. Besides, they gave some suggestions on statements/questions, measuring scales, and the questionnaire layout. For the questions directly asking for percentage number, some experts suggested to change them from open questions to multiple-choice questions, using benchmarking to categorize choices. Then it will be easier for people to make estimations and thus increase the possibility that people are willing to answer. They also suggested

changing the scaling of some questions, so that the scaling of most questions can be unified in the form of 5-point scale.

4.2 Pilot testing

For the validation of the working of the tool, pilot tests have been conducted on both people within and outside IBM. The non-IBM respondents involved were given questionnaires in the form of paper version. Reactions of the respondents in the pilot test were observed. Feedback from them was collected by face-to-face discussion right after they finished answering the questions. The 2 respondents from IBM were not in any business units which were involved in the formal data collection stage. They chose to answer the questions digitally and sent back the answers and opinions by email. After their answers were received, they were also invited to a face-to-face meeting to discuss about the questionnaire.

The following aspects were investigated during the pilot testing:

1. Is the introduction provided enough to understand what was expected from the respondents?
2. Are all questions clear and unambiguous?
3. Are the respondents able to answer every question with their business unit or company in mind?
4. Do the respondents perceive the questions as relevant for their business unit or company?
5. Do the respondents think the questionnaire can yield meaningful/interesting results?
6. Is the format and setup of the questionnaire good?

The average feedback ratings on these items by the respondents together with the standard deviation of the ratings are shown in Table 13.







Evaluation Question	Rating						Standard Deviation
	0	2	4	6	8	10	
Was the introduction provided enough to understand what was expected from you?							0.67
Were all questions clear and unambiguous?							0.52
Were you able to answer every question with your company in mind?							0.82
Do you think the questions were relevant for your company?							1.17
Do you think that this questionnaire can yield meaningful/interesting results?							0.57
Was the format and setup of the test good?							0.74

Table 13: Feedback to the questionnaire in pilot testing

The feedback showed that the weakest point of the questionnaire is the third aspect. By refining the introduction and instruction contents and rephrasing the statements and the questions, this aspect was slightly improved. In the formal data collection stage, the evaluation question “Were you able to answer every question with your business unit in Netherlands in mind” was kept as feedback question. The average rating of this evaluation question was 7, just slightly better than the results of pilot testing. It is understandable, though, since IBM has a very complex organization structure and a wide range of businesses. The major responsibilities and businesses of different business unit vary a lot. Therefore, it is normal that some questions are not quite applicable to all the business units involved in the research.

Refinements of the questionnaire were made based on both the comments from expert reviews and feedback from pilot tests. The changes are mainly focused on the following aspects:

1. Stressing the scope, which is the business unit of IBM Netherlands in which

the respondent has been working for a period of time, in the introduction and instruction contents;

2. Unifying the scale of as many questions as possible to a 5-point ordinal scale;
3. Rephrasing statements and questions in simpler sentences in order to facilitate easy understanding;
4. Using multiple choice questions instead of open questions to increase respondent rate;
5. Arranging questions in a clearer layout for easy reading and avoidance of misunderstanding.

The refined questions and detailed changes are recorded in Appendix 4.

4.3 Results discussion

Interviews with people from the business units involved were conducted after the results were gathered through the questionnaire. The tables of the scores together with the radar graphs were shown and explained to these people during the interviews for their opinions on them.

In general, the feedback from the interviewed respondents showed that they felt the 3-dimensional model covers all the aspects of innovation outputs in their business units. However, some respondents thought that questions on some parts of the measurement model, although relevant for the company as a whole, were out of the scope of the responsibility and business of their particular business unit. According to this opinion, to those respondents the measurement model turned out to be valid at the overall company level, but not appropriate for a business unit which has specific business function on just a part of the value chain. Such a validity problem points to issues on two aspects: the perception of innovations and the assessment of business model innovativeness.

The problem of people's perception of innovations was reflected in the results of product innovativeness measurement, especially the low score on product/service innovation introduction and the big discrepancy between perceptions of different business units on percentage of sales of the innovations. About the notably low score on product/service innovation introduction, the respondents invited in the discussions all thought it reflected the reality in their business units. On the one hand, they agreed that not all people in the company were aware of innovations and the opportunities to innovate. On the other hand, they also raised questions on definition of innovation: What kinds of new product/service can be viewed as an innovation? Whether recombination of existing elements of service packages is also an innovation? When discussing about the discrepancy on the perception of percentage of sales generated from the innovations, the respondent from GBS Distribution sector, which had a high score on this sub-dimension, said that the percentage in reality should be lower. But still he agreed that there was big difference between their answers on this sub-dimension and those of the other business units. This difference, according to his view, reflected the discrepancy of people from different units on the perception of innovations and the necessity of improvements on communication and mutual understanding in cooperation.

The problem of business model innovativeness measure is not obviously reflected in measurement results. Instead, it was raised out only in the discussions with respondents. In general, all the 4 business units involved in this research scored relatively high on business model innovativeness compared with their scores on the other dimensions. However, in the results discussion, some respondents expressed their doubts on the scores. According to their opinions, business model was a concept considered at a high level in the company, which was hard for ordinary employees to give precise estimations for innovativeness measurement. Some of them also thought that the business model of their business unit was given by the upper level of the company rather than being developed or improved by the unit itself. Indeed, the evaluation of business models is a domain just being investigated and requiring

further investigations and researches. Therefore it is understandable that the assessment of business model innovation is a field yet to be explored and studied more. Besides, it was pointed out that the perception of opportunity windows in this dimension was closely related with people's perception of innovations. The appearance of gaps between the results of different business units on the two sub-dimensions in the same time also suggested this linkage.

In particular, in the feedback from the Sales and Distribution (S&D), more questions were claimed not applicable to the unit than in the feedback from other business units, especially the questions on the introduction of innovations. This is partly due to the problem of people's perception of innovations, which is mentioned above. In addition, it also suggested that the questionnaire is not as appropriate for a business unit which just focuses on one particular business function, like S&D in this research, as for an entire company.

Another particular problem reflected in the discussion with respondents from S&D is the understanding of business model innovation. Since the employees in S&D often work together with their clients to innovate the business model of the clients, the respondents from this business unit often confused business model innovation of their own unit with that of their clients when they answered the questionnaire. All the respondents from S&D answered the questionnaire on printed-out paper form without any oral explanation or direction from the researcher. Therefore, it pointed out the importance and necessity to arrange face-to-face meeting or instant phone call with respondents to have the questionnaire filled in.

5 APPLICATION AND RESULTS ANALYSIS

This chapter is mainly dedicated to the application results of the measurement tool and a preliminary analysis of the results. Section 5.1 will concentrate on the feedback and the respondent situations of the tool. From 5.2 to 5.5, the measurement results of IBM Netherlands will be analyzed to investigate the overall innovation performance of the company, the differences between business units within the company, and the relations with innovation capacity and innovation strategies of the company.

The tool was applied on four business units in IBM Netherlands: Strategy and Change (S&C), Sales and Distribution (S&D), Global Business Service – Distribution Sector (GBS D), and Business Continuity & Recovery Services (BCRS). In total, 19 people participated in the questionnaire survey, the distribution of which is shown in Table 14. All respondents were given a questionnaire in Word form. 14 of them completed the questionnaire without oral explanation or instruction at the same time. 5 of them filled in the questionnaire during face-to-face meetings or conference calls, which allowed them to ask for instant explanation when they had confusions about understanding the questions and the contexts. The overall sample composition were shown in Table 15.

Business Unit	# of Respondents	Managers	Non-Managers
Strategy & Change	6	0	6
Sales & Distribution	5	2	3
Global Business Service – Distribution Sector	4	2	2
Business Continuity & Recovery Services	4	2	2

Table 14: Distribution of respondents in the 4 business units

Sample Composition	Management Layer		Age		Job Experience	
	manager	6	below 30	3	0 ~ 6	9
			31 ~ 40	6	6 ~ 12	5
	not manager	13	41 ~ 50	9	12 ~ 18	0
			51 ~ 60	1	18 ~ 24	4
			above 61	0	24 +	1
Total	19					

Table 15: Sample composition

5.1 Feedback on the tool

Two evaluation questions were kept in the formal questionnaire for tool application.

11 out of the 19 respondents gave rates on these two questions (see Figure 12).

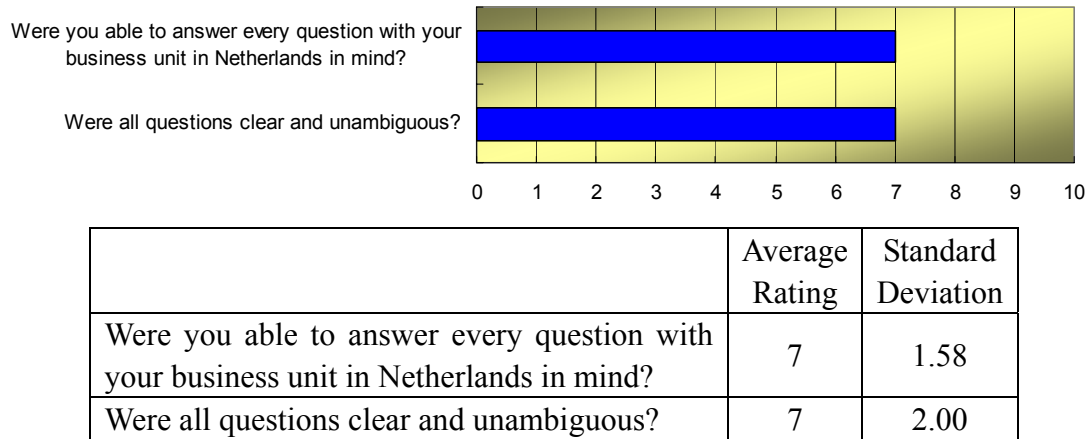


Figure 12: Feedback on the evaluation questions

According to the feedback, the clarity degree of the questions is slightly above medium level. The highest rating on this question was 10, while the lowest was just 4. For the evaluation on relevance to the business unit, the ratings also differed a lot, ranging from 4 to 9. Notably, respondents who could ask for oral explanation when filling in the questionnaires gave higher ratings. Besides, the standard deviation of these ratings reflected that people with different background and experience have different degrees of difficulty in understanding the same contents. These all suggested that instant clarification through face-to-face meeting or telephone call helps the understanding of respondents a lot. Due to the limitation of time, in this research it was not possible to arrange such meetings for every respondent.

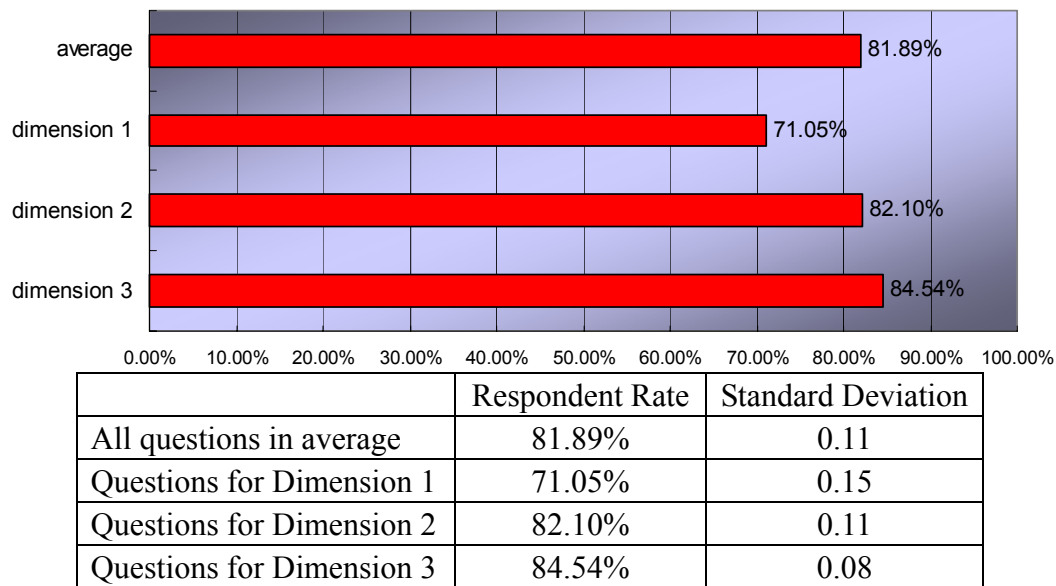


Figure 13: Respondent rate of the questions

The respondent rates of all questions are shown in Figure 13. In average, more than 80% of all the questions were answered. The respondent rate of the first dimension, product innovativeness, is the lowest among those of all three dimensions. In the mean time, the respondent rates of questions in this dimension also varied most. Two major reasons could provide explanations for that: First, it is difficult for people who do not work with the financial figures of their business unit to estimate the numbers related with innovations, for example, the percentage of sales of innovations. Second, since IBM Netherlands mainly operates in service sectors, people in this company probably relate product innovativeness to purely R&D of tangible products and therefore viewed those questions not applicable for their business units. This innovation perception problem was also reflected in the results discussion with the respondents. This situation may be improved by oral clarification of researchers during the process of filling questionnaires.

When investigating the respondent rates of different sub-groups in the overall sample, more indications can be found. Comparisons on respondent rates were made between different management layer groups as well as between groups with different length of job experience (see Figure 14 and Figure 15).

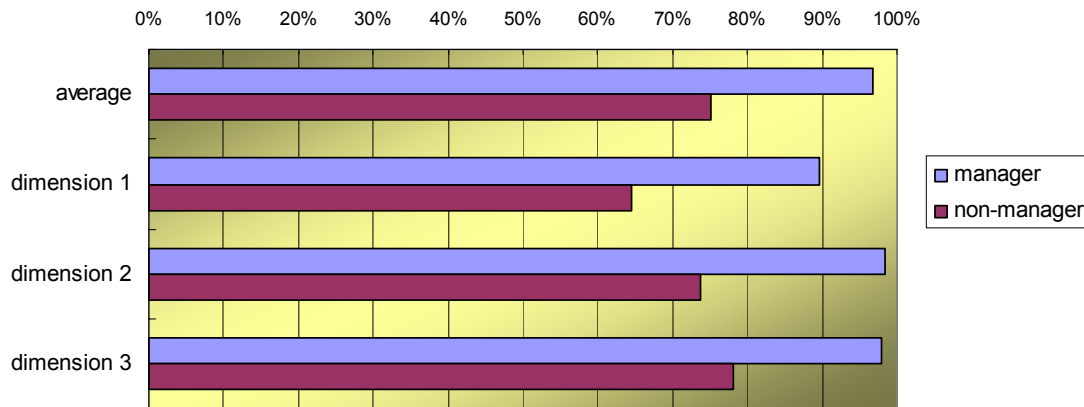


Figure 14: Respondent rate difference between management layers

Figure 14 showed that managers generally answered more questions than ordinary employees. It suggests that the questionnaire appears to be more appropriate for the management staffs that usually have better overview of business situations in the firm. Analyzing from another perspective, it also suggests that non-manager employees in IBM Netherlands were much less familiar to the exact situations of the innovation activities in their business units than their managers.

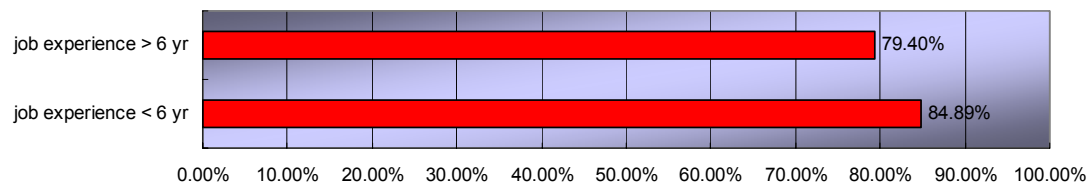


Figure 15: Respondent rate difference based on job experience

Figure 15 showed that employees whose job experience were less than 6 years gave their responses to more questions than their colleagues who had worked in the company more than 6 years. This phenomenon is opposite to the general expectation that more experienced employees know more about the company. Probably the respondents with longer job experience were more conservative on giving answers to questions measuring performance than their less experienced colleagues.

5.2 Overall results analysis

The overall results based on the answers from 19 respondents are displayed in Table

16 and Figure 16.

	Average Score	Standard Deviation
Product Innovativeness	2.37	0.80
Product/Service Innovation Introduction	1.55	0.98
Sales of Product/Service Innovation	2.31	1.54
Product/Service Innovation Impact	3.24	0.50
Process Innovativeness	3.14	0.17
Productivity	3.58	0.25
Process Innovation Introduction	2.58	0.31
Process Innovation Impact	3.25	0.43
Business Model Innovativeness	3.43	0.33
Business Model Improvements and Innovations	3.36	0.40
Business Model Innovation Impact	3.33	0.32
Opportunity Windows	3.72	0.79
Business Model Fitness	3.32	0.34

Table 16: CIM results (overall)

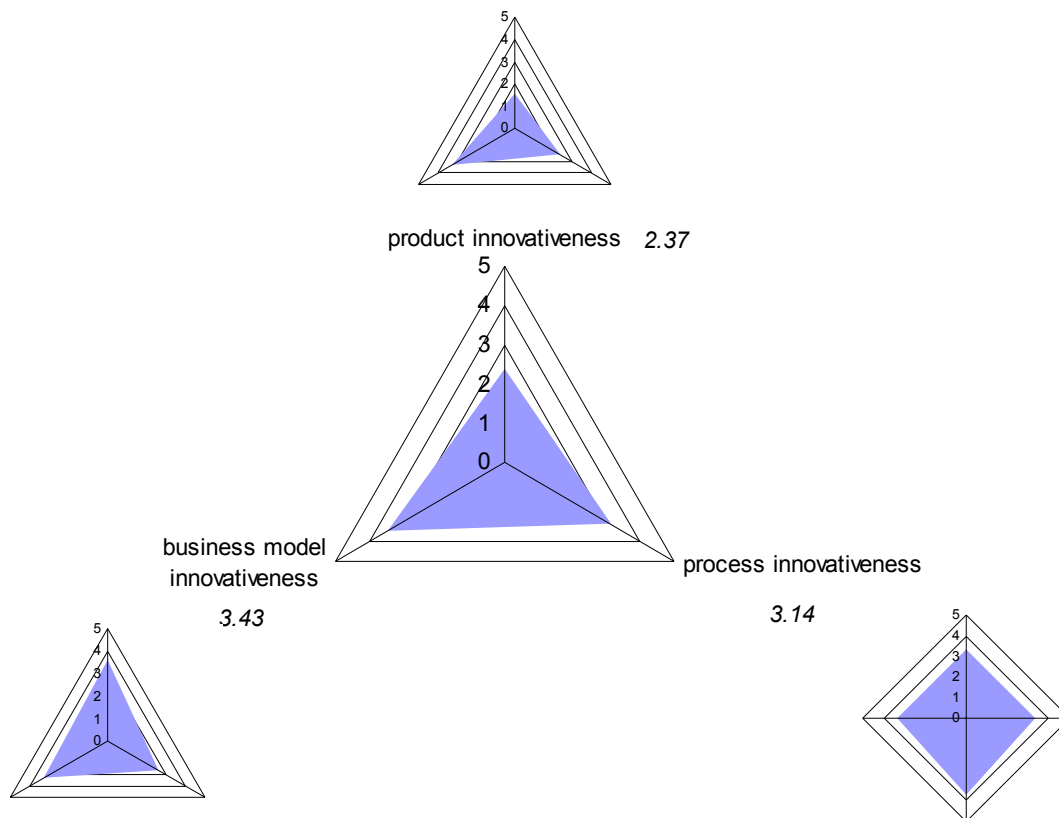
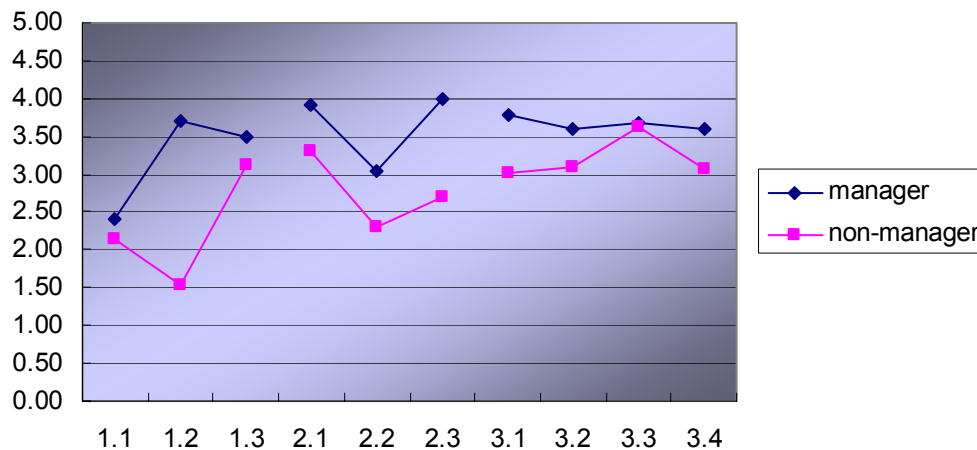


Figure 16: CIM graphic results (overall)

The dimension which got the lowest score is product innovativeness. In particular, the average score on the sub-dimension “product/service innovation introduction” is the

lowest. In the mean time, the opinions of the respondents on this dimension also differed most, especially on the sales generated from product/service innovations. On the contrary, business model innovativeness was given relatively high scores, particularly its sub-dimension “opportunity windows”. According to the standard deviations of the scores, the perceptions on process innovativeness were least differed, especially on the productivity of their business units.

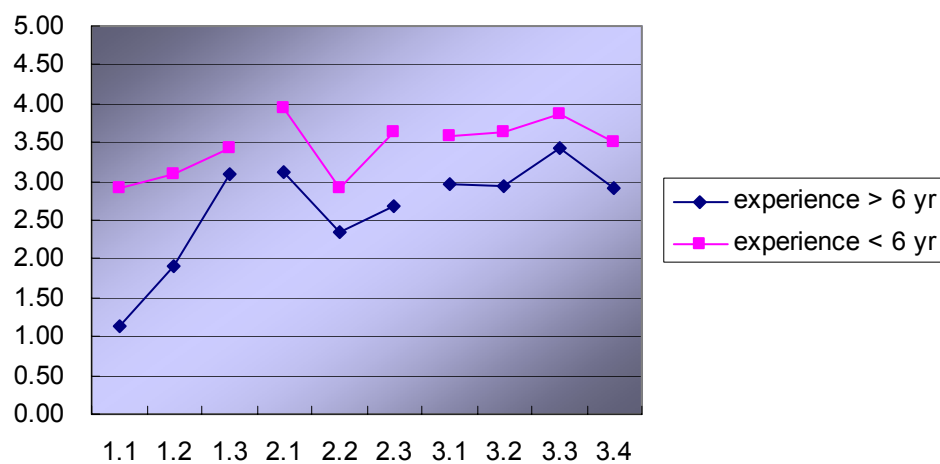


product innovativeness	
1.1	product/service innovation introduction
1.2	% sales of innovations
1.3	product/service innovation impact
process innovativeness	
2.1	productivity
2.2	process innovations introduction
2.3	process innovation impact
business model innovativeness	
3.1	business model innovations
3.2	business model innovation impact
3.3	opportunity windows
3.4	business model fitness

Figure 17: Difference between responses from managers and non-managers

When being compared on a position sub-group level, the perceptions of managers and non-manager employees on the innovation outputs turned out to be different in many aspects (see Figure 17). Managers perceived higher innovativeness degree than ordinary employees did. In general, though, the trends of answers from managers and non-manager employees were almost the same, except for the evident difference

between their estimations on sales of product/service innovations. Managers felt that new-to-the-market and new-to-the-company innovations had generated a considerable percentage of sales. However, ordinary employees turned out that they did not perceive much weight of these two types of innovations in the annual sales. Concerning the respondent rates of managers and ordinary employees (discussed in 5.1), the low perception of non-managers on this sub-dimension is probably also due to their lower respondent rate on relevant questions. On the contrary to the big difference on sales of product/service innovations, the opinions of managers and non-managers on opportunity windows were almost the same. Generally they all felt that there are relatively big opportunity windows on new markets and new product/service categories for their business units.



product innovativeness	
1.1	product/service innovation introduction
1.2	% sales of innovations
1.3	product/service innovation impact
process innovativeness	
2.1	productivity
2.2	process innovations introduction
2.3	process innovation impact
business model innovativeness	
3.1	business model innovations
3.2	business model innovation impact
3.3	opportunity windows
3.4	business model fitness

Figure 18: Difference between responses from people with different job experience

In the comparison of sub-groups with different length of job experience, gaps also exist between the results of the two groups when the general trends of their answers seemed to be similar. Respondents with shorter job experience gave more positive perceptions than their more experienced colleagues on all the sub-dimensions. Again, the higher respondent rate of this sub-group could be one cause. It could also be true that respondents with longer job experience in the company were more conservative on perceiving the innovation outputs of their business units.

In conclusion, the overall analysis of the answers from all the 19 respondents together mainly showed two trends:

1. In all the three dimensions of company innovativeness, product innovativeness in IBM Netherlands was perceived as the weakest while business model innovativeness was given the most positive perception;
2. There are differences between the perceptions on innovation outputs of managers and non-managers as well as between people with different length of job experience.

The first trend provides indications for giving suggestions to IBM Netherlands, although the responses of 19 employees from 4 business units are not fully sufficient to conclude the situations of the entire company yet. The second trend suggests that attentions should be paid to sample composition in further application of the CIM tool. To get more indications on both the tool and the innovation performance of IBM Netherlands, the analysis should go deeper into details through comparisons on business unit level, which is going to be discussed in the next section.

5.3 Difference between business units

When looking at the respective results of different business units, their scores appear to differ obviously, especially the scores of product innovativeness dimension (see

Figure 19 and Figure 20).

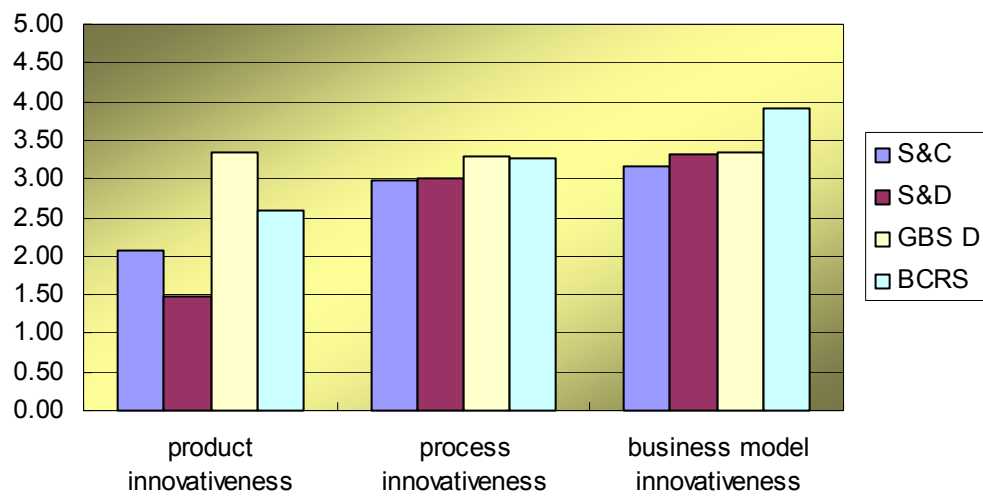
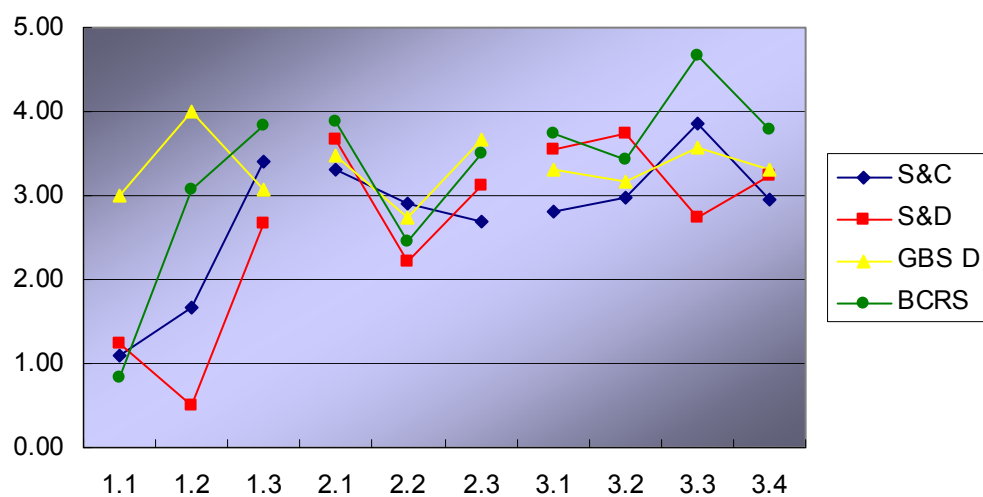


Figure 19: CIM results of different business units



product innovativeness	
1.1	product/service innovation introduction
1.2	% sales of innovations
1.3	product/service innovation impact
process innovativeness	
2.1	productivity
2.2	process innovations introduction
2.3	process innovation impact
business model innovativeness	
3.1	business model innovations
3.2	business model innovation impact
3.3	opportunity windows
3.4	business model fitness

Figure 20: Differences of sub-dimensional scores

The biggest difference exists in the scores on product innovativeness. In particular, as two business units whose major business tasks are similar, Sales and Distribution (S&D) and Global Business Service Distribution sector (GBS D) have opposite scores on product innovativeness. This big difference mainly results from their extremely different scores on the two sub-dimensions, ‘product/service innovation introduction’ and ‘percentage sales of product/service innovations’ (see Figure 20). This phenomenon was discussed with respondents from the two business units in the successive interviews. They agreed that such a gap on CIM results did reflect some problems in reality. Characteristic difference of the two units could be one of the explanations – S&D is client-based while GBS Distribution sector is solution-based. Moreover, it seems that these result differences mainly resulted from the discrepancy of people’s awareness and understanding of innovations. When taking the difference on their scores on ‘opportunity windows’ into consideration, the inconsistency of people’s perceptions of innovations are more evident. People from GBS D had fairly positive attitude on the introduction and the opportunities of innovative solutions. On the contrary, people from S&D did not perceive many innovations having been introduced to fulfill the market needs they found on their clients. Nor did they have positive view on the exploration of new service categories or new markets. They thought other relevant business units always failed to transform the opportunities they perceived on the market into innovative products or solutions they could offer their clients. It can be concluded that the differences of CIM scores reflected the problems on communication, collaboration, and knowledge and information transfer between these two business units.

On the other hand, the measurement results of process innovativeness do not differ much among the four business units. While analyzing the sub-dimensions of process innovativeness, the trends of answers from different business units were also similar. In general, all the respondents thought the productivity of their business units were high, though they did not perceived many process innovations having been introduced.

Their perceptions on the impact of process innovations differed a little. Respondents from Strategy and Change (S&C) gave comparatively low estimation on this metric, while people from the other 3 business units had relatively positive perceptions.

Compared to the other three business units, Business Continuity & Recovery Services (BCRS) has higher score on business model innovativeness. This high score was probably due to the extremely positive perception on opportunity windows. In the mean time, a more influential factor could be BCRS' high scores on process innovativeness, especially on productivity. As it is discussed in 3.1.4, the three dimensions in the CIM model are not all mutually independent. The measures of business model innovativeness are interrelated with those of product innovativeness and process innovativeness. Therefore, it is possible that BCRS outperformed on business model innovativeness also because of its highest efficiency. The domain of business model evaluation is immature and largely dependent on traditional measures, many of which are related with business process evaluation. This results in the interrelation between business model innovativeness measure and process innovativeness measure. This interrelation probably has some impact on the validity of the measurement model due to the lack of mutual-independency. The significantly high score of BCRS on business model innovativeness seems to suggest such an impact.

5.4 Innovation capacity and innovativeness

As it is introduced in 2.7 in Chapter 2, Prajogo and Ahmed (2006) formed and tested their hypothesis that a significant positive relationship exists between innovation capacity and innovation performance. It was also concluded in the earlier literature review of Neely and Hii (1998) that the literature they reviewed suggested an implicit relationship between innovation capacity, innovativeness, and competitiveness of a firm.

However, an inconsistency between the innovation capacity and innovativeness degree of Sales and Distribution (S&D) and Business Continuity and Recovery Services (BCRS) was observed while combining their results in this research and the Innovation Capacity Test (See Figure 21). According to the results of Reijzen's research in 2006, S&D had larger innovation capacity than BCRS with higher values in all the 4 dimensions. However, the results of CIM showed that the innovativeness degree of S&D was lower than BCRS.

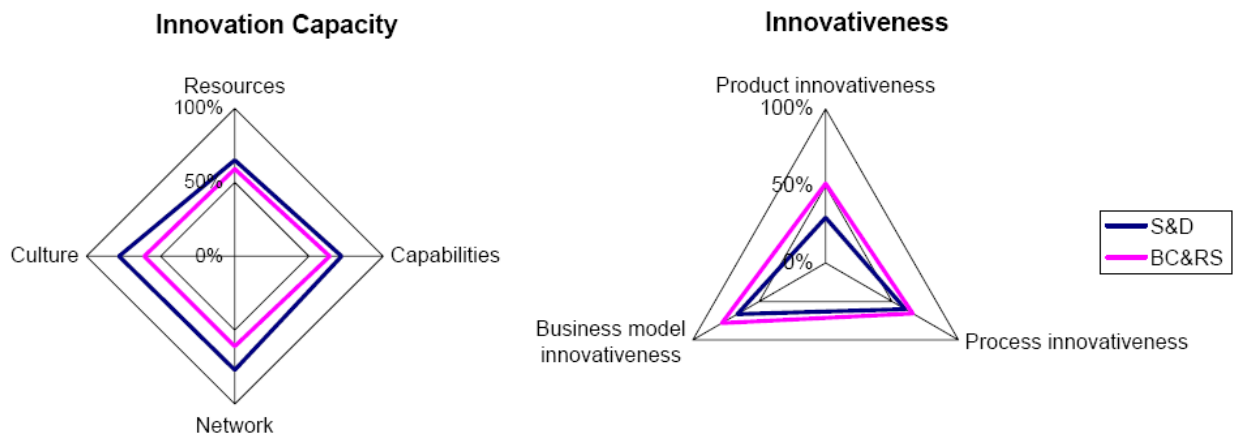


Figure 21: Innovation capacity and innovativeness of two business units

First of all, it should be noticed that the hypothesis formed by Prajogo and Ahmed (2006) on the relationship between innovation capacity and innovation performance was verified based on narrowed variables. The definition of innovation capacity in that research did not have culture and network dimensions. And the measurement of innovation performance only consisted of product and process innovation measures. The concepts of 'innovation capacity' and 'innovativeness' applied in this research are more complex, therefore the verified hypothesis cannot necessarily be applied here. Besides, the respondents in the research of Prajogo and Ahmed (2006) were all managers, while in Reijzen's research on Innovation Capacity Test and the application of CIM questionnaire in this research both managers and non-manager employees were involved. Moreover, in Prajogo and Ahmed's research the measurements of innovation capacity and innovation performance were conducted at the same time on the same respondents, which involved risk of self-report nature of the data.

To further investigate the causes of the abnormal inconsistency observed in the results comparison, more aspects need to be scrutinized. The first aspect is the sample demography in the two researches. In the Innovation Capacity Test of Reijzen (2006), the detailed demographic characteristics of the respondents from BCRS were unknown. In this CIM research, the demographic compositions of the samples from S&D and BCRS are shown in Table 17. In 5.2, it has been observed that managers and respondents with shorter job experience intended to give more positive perceptions than non-managers and respondents with longer job experiences. The higher percentage of managers in the respondents from BCRS may be an explanation of its higher scores in CIM results. However, the percentage of people with less than 6 years' job experience is lower than that of S&D, which did not confirm the overall trend observed in 5.2. Therefore, in general demography is hard to be considered as a major cause of the inconsistency between the results of the two tests.

	S&D		BCRS	
Total respondents	5		4	
Managers	2	40%	2	50%
Non-managers	3	60%	2	50%
Age above 40	3	60%	2	50%
Age below 40	2	40%	2	50%
Job experience > 6 yr	3	60%	3	75%
Job experience < 6 yr	2	40%	1	25%

Table 17: Demographic characteristics of the respondents from S&D and BCRS

The second aspect which needs to be investigated is the appropriateness and quality of the measurement questions. It has been mentioned in 4.3 “Results discussion” that the respondents felt problems in questions on product innovativeness and business model innovativeness. As for product innovativeness, they thought that this dimension is relevant for the company as a whole but mostly out of their capability and responsibility. Therefore, the respondent rate of S&D on this dimension is low and the perception on the performance of product/service innovations was low as well. As for business model innovativeness, two factors seemed to result in S&D’s lower score compared with BCRS. On the one hand, respondents sometime misunderstood that

the questions were about the business model of their client on which they worked with the clients. On the other hand, S&D respondents felt that the business model of their unit was given by the higher management of the company; they themselves, however, could not change the entire business model except for some slight marginal changes. These two factors suggest that the CIM tool is probably better to be used on the entire company level instead of the business unit level in this research.

The third aspect which can provide explanations for the results inconsistency is the particular characteristics of S&D and BCRS. Differences on the main business and functions of the two business units may be able to explain the appearance of larger innovation capacity accompanied with lower innovativeness measurement score.

The biggest difference between dimensional scores of innovativeness of the two business units lies in product innovativeness. The characteristics of the two business units can provide some explanations for it. The Sales force helps translate IBM's technology to clients in terms of adding value to their companies. Working individually with client operational managers or in teams, the sales professionals help clients get the most out of their IT investments. S&D is a highly matrix organizational with sales people aligned by industry, client, geography, and product. Specialists will be brought in during the sales cycle if an opportunity has a certain focus. These two characters were reflected by its high values on the two innovation capacity dimensions 'network' and 'capability'. However, according to the description of S&D respondents, their business unit does not participate in development of innovative products or service solutions. Nor can it influence the R&D activity much in other business units. What S&D mainly does is to observe the markets and to perceive profitable opportunities, and then to look at the products and capabilities of other business units in IBM to see whether the products and capabilities can be turned to solutions for the market needs. The relatively low value on 'resource' in S&D's innovation capacity is consistent with the complaints from the respondents in the successive discussion after questionnaire in this research. S&D respondents believed

that their business unit does have large potential to innovate, as it was reflected in the Innovation Capacity Test, but was hindered by the rest of the company on their performance. According to the complaints, it often happened that when people in S&D perceived an attractive market need which could not be met by existing products or solutions, they could not get people from corresponding departments to develop new products or solutions for it.

BCRS, on the other hand, combines business and technological experts to help keep customers' business running. Their services include recovery services, consulting service, and managed continuity service. Although BCRS is not engaged in developing separated new technological products, its business often calls for redesign or implementation of new systems and new combinations of technological products or expertise. This probably explained why the respondents from BCRS generally had higher perception on product innovativeness.

In addition to the difference on product innovativeness, another interesting gap is the extremely different opinions on opportunity windows, a reflection of the newness of market-oriented approaches. The lower score of S&D on this metric is inconsistent with its high value on its innovation capacity dimension 'network', which consists of variables linked with external environment (customer orientation, collaboration, and external communication). Opportunity windows are closely connected with product innovativeness as well. Therefore, the discrepancy of S&D and BCRS on product innovativeness can partly explain the occurrence of their big difference on opportunity windows. Moreover, the blame of S&D's respondents on the other parts of the company in the results discussion can also provide explanation. The respondents thought that they had perceived many opportunities on the market, but other departments in the company could not translate the opportunities into something they could do.

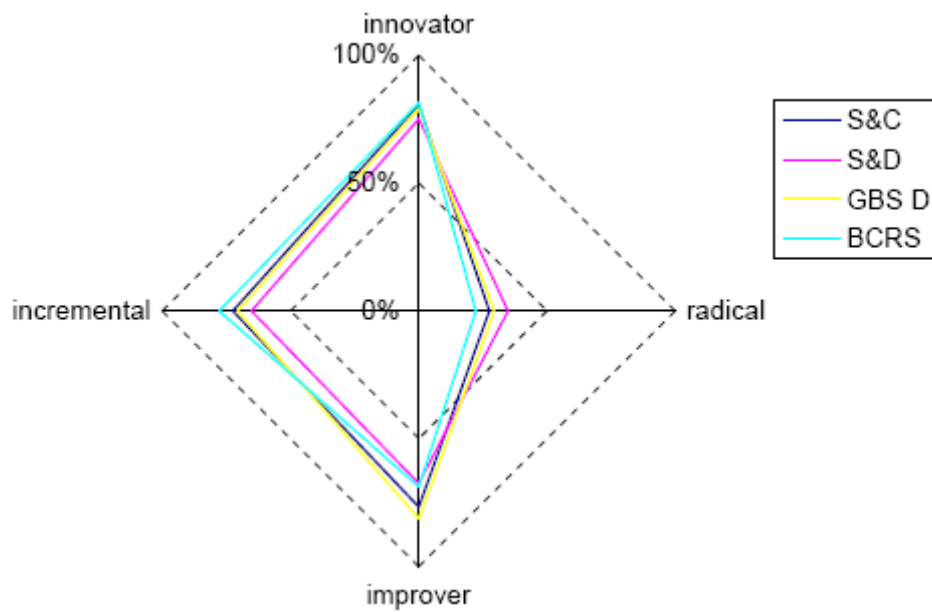
Apart from the discussion around the measurement of innovativeness in this research,

there is another interesting phenomenon: In the Innovation Capacity Test, S&D scored fairly high (80% innovative fit to best practice) on items of internal communication (Reijzen, 2006). However, the discussions with respondents from S&D and other business units showed that the cooperation between S&D and other business units were not quite good. Their views on innovation perception and opportunity windows differed greatly. When the Innovation Capacity Test showed that the communication channels and atmosphere were good, the effect of the communication turned out to be poor. Improvements on internal mutual understanding seem to be necessary.

To conclude on the analysis above, both the characteristics of the CIM tool and the two business units provide part of explanations of the inconsistency between the results of Innovation Capacity Test and Company Innovativeness Measurement. However, these explanations are not fully conclusive yet. When the results of Strategy Fit Analysis of Aydinoglu's research are taken into consideration, probably more indications could be obtained. In the next section, the results of CIM and SFA will be analyzed together to find clues about the connection between innovativeness and strategy fit.

5.5 Strategy fit and innovativeness

The questions for company innovativeness measurement (CIM) in this research were put in a combined questionnaire together with the questions for strategy fit analysis (SFA) in Begum Aydinoglu's research. The SFA results illuminate two aspects in a company's strategy from respondents' answers: the emphasis on different types of innovation projects (radical or incremental), and the type of innovation strategy adopted by the company (operating as an innovator or an improver). Theoretically, an "innovator" strategy accompanied by emphasis on radical innovation projects, or an "improver" strategy together with major focus on incremental innovation projects, is a strategic fit (Aydinoglu, 2007). The other combinations of strategy and mostly focused project type are not viewed as fitting well.



	S&C	S&D	GBS D	BCRS
radical	27.50%	34.78%	29.41%	22.22%
incremental	72.50%	65.22%	70.59%	77.78%
innovator	80.60%	75.10%	79.00%	81.50%
improver	76.67%	67.50%	81.25%	68.75%

Figure 22: SFA results of the four business units (Aydinoglu, 2007)

Figure 22 displayed the results of the four business units in SFA. It can be perceived from the radar graph that BCRS put more effort on incremental innovation projects than the other three units, while its effort on radical innovation projects was the least among the four. As for the strategies of the four business units, all of them appeared to be adopting both innovator strategy and improver strategy at the same time. BCRS showed stronger ‘innovator’ character than the others, while GBS Distribution sector scored highest on the dimension of ‘improver’. In general, the shapes of the four business units on the radar graph are similar. When being scrutinized, GBS Distribution sector seems to be the only one which can be somehow categorized as ‘strategic fit’ – its stronger ‘improver’ character compared with its ‘innovator’ intendency is consistent with its significant focus on incremental innovation projects. The other three business units appear to have slightly different degree of ‘unfit’ in their strategy – while they seemed to be more like an innovator in their strategy, they

obviously put a lot more effort on incremental innovation projects.

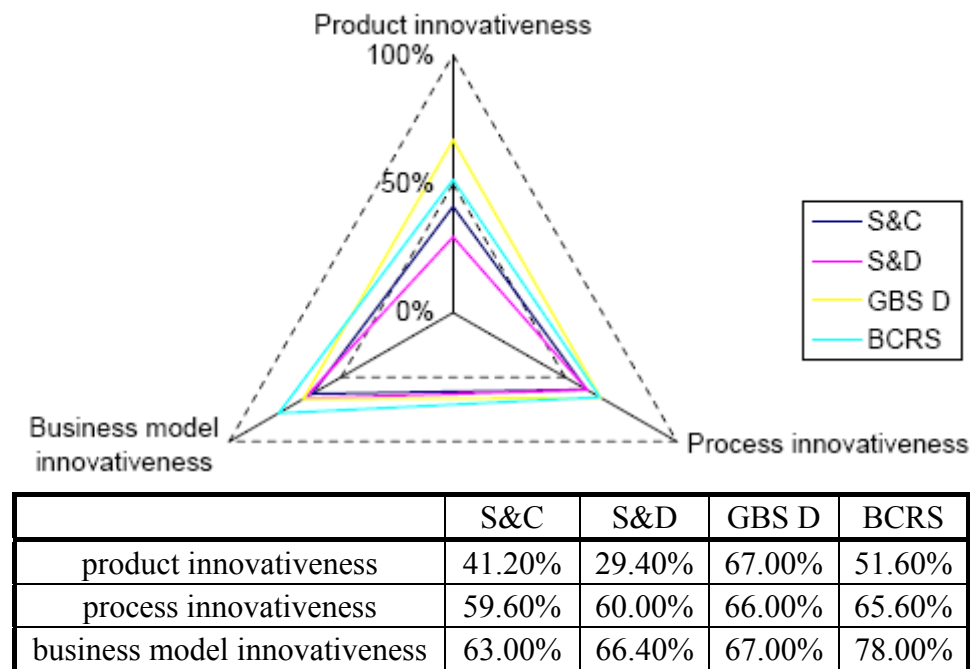


Figure 23: CIM results of the four business units

When combined these SFA results with the CIM scores of the four business units (see Figure 23), some clues can be found to explain the CIM results. For example, GBS Distribution, which appeared to be the most strategically ‘fit’ business unit as mentioned above, got relatively high scores on all the three dimensions. It was the best on both product innovativeness and process innovativeness, and was only exceeded by BCRS on business model innovativeness. However, until now there is not a clear and indisputable threshold on the percentage of innovation projects for the judgment of radical innovation project focus. Therefore, it is still far from persuasive to conclude that better strategy fit leads to higher innovativeness degree.

BCRS scored higher on the dimension business model innovativeness perhaps because of its highest value on the innovator strategy dimension in SFA. With less ‘innovator’ character than BCRS, GBS Distribution sector and S&D both have lower scores on business model innovativeness. S&C, however, appeared to be an exception. It scored second highest on the innovator strategy dimension in SFA but lowest on

business model innovativeness dimension in CIM. Currently only four comparison groups have taken part in SFA, which is not sufficient to conduct a statistical linear regression on the results. When more data is available, the guess here on the relation between innovation strategy type and business model innovativeness probably will get more support.

S&D and BCRS are the two business units involved in the analysis on the connection between innovation capacity and innovativeness. To study the influence of strategy fit on innovativeness and its relation with innovation capacity, the results of these two business units in the three researches were put together for specific analysis (see Figure 24).

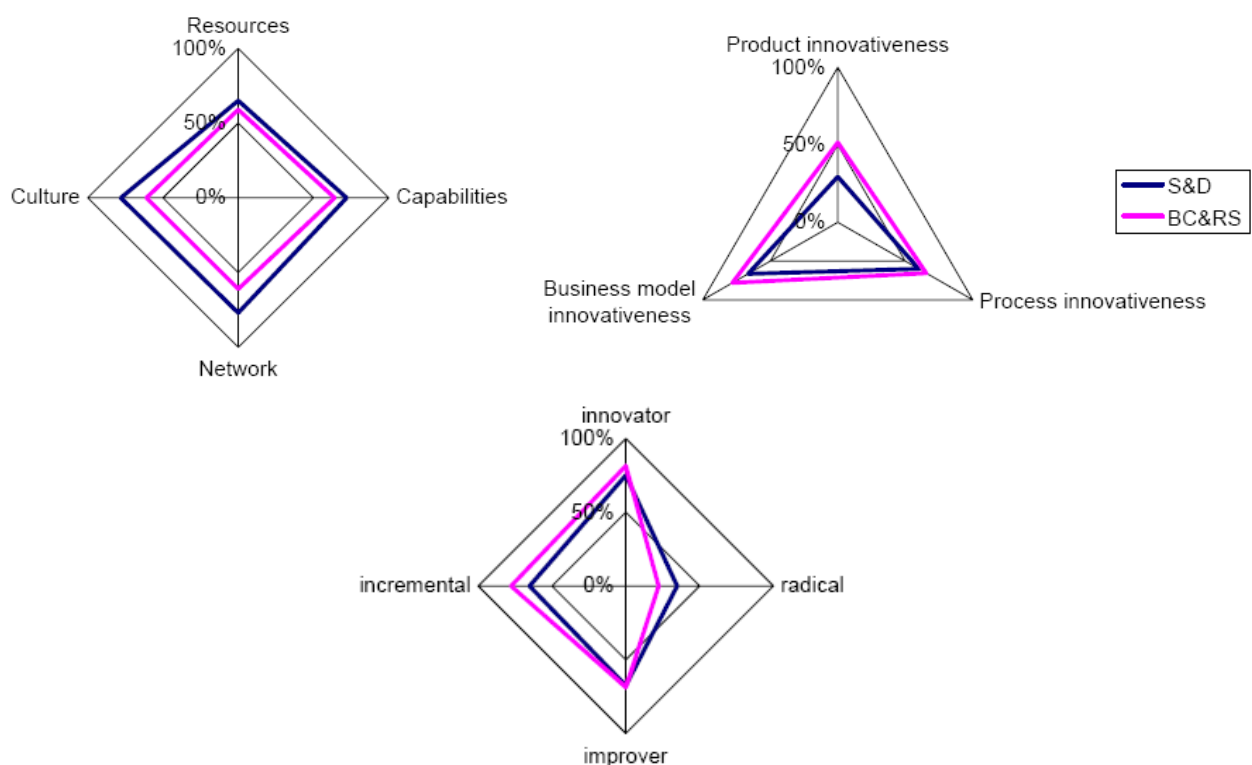


Figure 24: The results of S&D and BCRS on innovation capacity, innovativeness, and strategy fit

In general, both S&D and BCRS have ‘unfit’ phenomenon between their innovation strategies and focused innovation projects. On the one hand, innovation strategy and strategy fit seems to have some impact on the innovativeness of a business unit here. As mentioned above, BCRS outperformed on business model innovativeness perhaps

because of its stronger tendency towards ‘innovator’. And maybe this tendency can also explain its higher scores on the other two company innovativeness dimensions. However, its higher score on product innovativeness than S&D does not confirm with its more focus on incremental innovation projects. Due to the limitation of time and the consideration of judgment problem, introduction of basic/significant innovations was not included in the metrics of product innovativeness here in CIM research. Probably the exclusion of such a metric resulted in the inconsistency. On the other hand, no clear indication can be found that strategy fit degree also influence the relation between innovation capacity and innovativeness. Comparing the SFA results of the two business units, it is hard to tell which of them had better strategy fit. Maybe with more data from different business units or companies it will be possible to find sufficient clues to form a hypothesis.

6 CONCLUSIONS

In this chapter, the conclusions of this research will be drawn to provide answers to the research problems and the following four questions: What are the achievements of this research? What can the CIM results of IBM Netherlands tell their managers? What are the limitations of this research? What are the possible further steps based on this research in the future?

6.1 Achievements of the tool

This research formed a 3-dimensional conceptual model of company innovativeness (see Table 18) based on previous relevant literature, and developed a derived tool from this model to measure company innovativeness as a multi-dimensional concept.

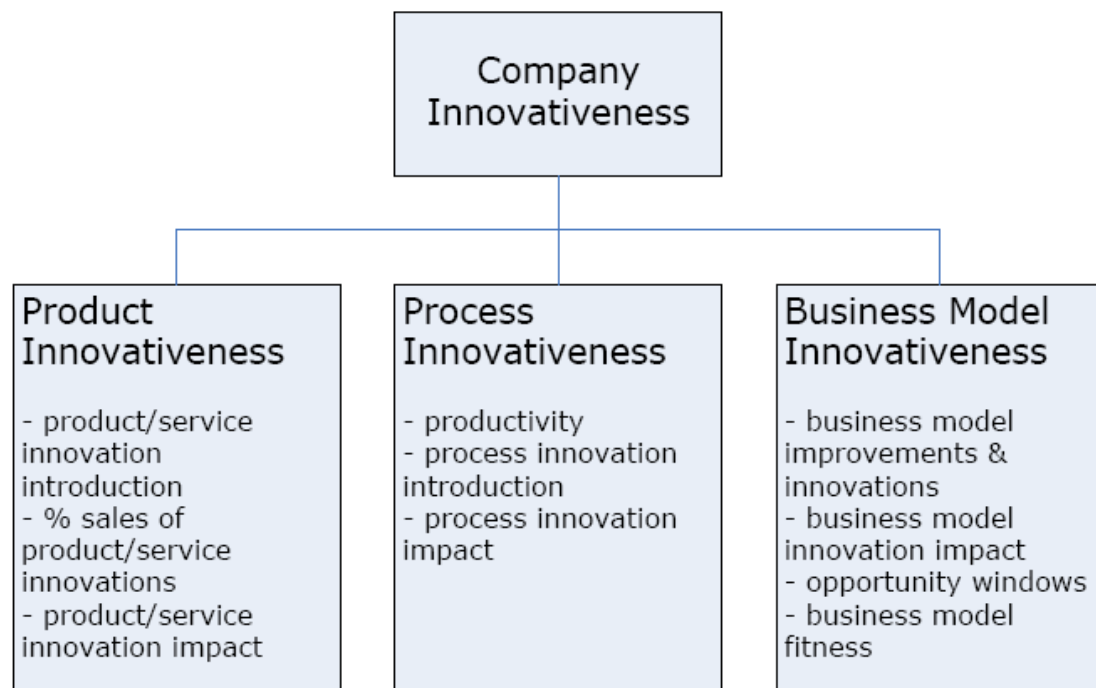


Figure 25: Conceptual model of company innovativeness

To facilitate the studies on the linkage between innovation capacity and innovativeness, company innovativeness in this research is defined as *the actual performance of a firm's innovation activities, which is measured by the innovation output indicators*. This definition of company innovativeness helps to avoid being confounded with the concept of innovation capacity, which is from a perspective of

innovation inputs. A three-dimensional conceptual framework was proposed in this research for the conceptualization and measurement of company innovativeness. The selection of dimensions and their metrics were based on the references from previous relevant literature following the criteria generated from the definition of innovativeness, the scope of the research, and the limited time and resources for the research. The metrics of these three dimensions cover the measures of 6 categories of innovations in companies: product innovation, service innovation, process innovation, management & culture innovation, policy & society innovation, and business model innovation. This multi-dimensional framework does not only consider the newness of the deliverables and the operation processes of a firm, but also the innovativeness of its business model, including its market oriented activities and organizational policies. An assessment tool in questionnaire form was developed in the research based on this framework. The tool was designed to be applicable to IBM Netherlands and therefore could be analyzed together with the results of Innovation Capacity Test developed by Reijzen in 2006. Consisting of innovation output indicators, the tool offers the possibility to check the actual impact of innovation capacity on the innovativeness degree of a company.

The feedbacks from the respondents in pilot testing and the formal application in the 4 business units showed that the tool basically does measure the actual performance of the innovation activities in their business units. In the successive discussion with respondents after the survey through questionnaire, it was confirmed that the measurement model basically covers all the aspects related with innovation outputs, and that the measurement results basically reflect the reality.

When being combined with the results of Innovation Capacity Test and Strategy Fit Analysis, the CIM tool was able to provide more insights on the innovation activities in the company and some indications on the linkages between innovation capacity, innovation strategy, and innovativeness as well. Although the practical tool was designed especially for IBM Netherlands, the overall underlying theoretical

framework can also be applied on other companies after some slight changes of the metrics in the measurement model and some adjustments of the form of questions and statements in the practical questionnaire.

In conclusion, this research is able to provide solution to the central research problem by answering the four sub-questions (see Table 18). Both the scientific goals and the practical goals identified at the beginning of the research were met at the end as well.

Sub Research Question	Answer
What is an appropriate definition of company innovativeness?	Company innovativeness in this research is defined as the actual performance of a firm's innovation activities, which is measured by the innovation output indicators.
What are the dimensions of company innovativeness?	Product innovativeness, process innovativeness, and business model innovativeness.
How can these dimensions be measured?	They can be measured through a 49-question questionnaire on the basis of 36 metrics for the 4 dimensions. (The questions are enclosed in Appendix 2.)
What indications about the relationship between innovation capacity and innovativeness can be perceived?	Larger innovation capacity does not necessarily lead to higher degree of innovativeness. Company innovativeness appears to be influenced by its specific business, innovation strategy and strategy fit degree as well.

Table 18: Sub-questions of the research problem and the answers to them

6.2 Limitations of the research

The first weak aspect of this research is the limitations of the practical test samples. First, the sample sizes in this research are all very small. Therefore statistical tests are unsuitable here and the internal validity of the research results is limited. In particular, only two business units involved in this research had participated in the Innovation Capacity Test of Reijzen (2006) before. This heavily hindered the study on the relation between innovation capacity and innovativeness. Therefore, the internal

validity of the research is low due to the lack of statistical support to a causal relationship between the two variables. Second, the demographic composition of the samples (the four business units) differs a lot (see Table 19). As it is shown in 5.2, in general managers gave more positive answers than ordinary employees, and respondents with longer job experience in the company were more conservative in their perceptions on the actual performance. These factors which can bias the final results had better be gotten rid of through unifying the demography of samples. Last, and most important, the innovativeness measurement model formed in this research seemed to be not fully appropriate for application on a business unit level. The measurement tool is developed on an overall company level, which requires the metrics to cover all aspects that may be relevant for innovation activities within a firm. Some business units of IBM Netherlands in this research, although having relatively high degree of autonomy, are still not involved in all the innovation activities along an entire value chain. This limited the respondent rates of the questions and possibly biased the measurement results, which influence the comparisons both across business units and with results of other researches.

	S&C		S&D		GBS D		BC&RS	
Total respondents	6		5		4		4	
Managers	0	0%	2	40%	2	50%	2	50%
Non-managers	6	100%	3	60%	2	50%	2	50%
Age above 40	0	0%	4	80%	4	100%	2	50%
Age below 40	6	100%	1	20%	0	0%	2	50%
Job experience > 6 yr	1	16.67%	3	60%	3	75%	3	75%
Job experience < 6 yr	5	83.33%	2	40%	1	25%	1	25%

Table 19: Demographic characteristics of the respondents from the 4 business units

The second aspect with big limitations in this research is the data collection method. All the results were obtained through the questionnaire, in which respondents gave their answers based on their own estimation and perception. This method confined the research on its objectivity and had the risk of self-report nature. Especially for the measurement of productivity in process innovativeness, the perception of respondents, although can reflect the reality to a certain extent, is after all less precise than calculations based on financial data. Besides, people generally have difficulty in

estimating numbers asked by the questions. Non-manager employees seemed to have difficulty in estimating the number of patents, perceiving the introduction of different type of innovations, and giving overview on the improvements of the business model. Questions related with sales, for example the percentage of sales from new-to-the-market innovations, turned out to be difficult for most respondents who did not work with relevant financial figures frequently, even if some of them are managers. These problems need to be taken into consideration in further tests and applications of the CIM tool.

The third limited aspect of this research is the lack of instant oral explanation and direction in the processes of filling in questionnaire. Due to the limited time for the research and the difficulty on the accessibility of many respondents, only 5 out of the 19 respondents answered the questionnaire with the researcher by their sides or over phone call to help them understand the contents correctly. In 4.3 in Chapter 4, it has been noticed that the lack of instant oral explanations probably resulted in the unsatisfying respondent rate of some part of the questionnaire. The ratings given to the evaluation questions of the questionnaire have relatively high standard deviation value. This suggested that the opinions of the respondents on the relevance and clarity of the questionnaire differed a lot. Some questions were easy to understand to people who are familiar with terms and concepts in innovation management, but turned out to be hard to understand to people who have not been intensively involved in relevant activities. Moreover, the same concept might be understood differently by different people. For example, the successive discussions showed that respondents' opinions differed on whether repackaging of the existing service elements could be viewed as a service innovation. Again these discrepancies point to the importance of instantaneous communication between the researcher and the respondent during the process of filling questionnaire. The analysis in 5.1 in Chapter 5 showed that respondents who could ask for oral explanation when filling in the questionnaire gave higher ratings on the evaluation questions.

When investigating the feedback on the measurement tool in details, it is obvious that the measurement of product innovativeness is weaker than that of the other two dimensions. The second and the third limitations mentioned above can mostly explain this – questions on product innovativeness involved many estimations of number and percentage, and people’s judgments on innovation latently as well (whether it is an innovation, whether it is new to the market, etc.). In addition, the metric ‘introduction of basic/significant innovation’ was ruled out in this research due to the high costs of time and effort and the judgment problem. This weakened the assessment of radical degree of product/service innovation activities. It also influenced the analysis together with the results of Strategy Fit Analysis, which can show the weights given to incremental and radical innovation projects by the business unit.

Although having higher respondent rates and less differed responses than product innovativeness metrics, the measurement of business model innovativeness has some limitations as well. A large part of the metrics in this dimensions were based on the literature on business model evaluation. This research domain is fairly new and far from mature, in which only a few articles can be referenced and even fewer can be applied in this research. Besides, the concept of business model is generally perceived from an overview perspective in the company, which in general is relatively easy for top managers to estimate but hard for ordinary employees to provide precise perceptions. This, again, points to the problem of demographic sample composition mentioned in the beginning of this part. Another confusing point is that some respondents who worked with clients on improving their business model felt unclear whether the questions were measuring the performance of their clients’ business model or their business unit’s own model. Although in the direction part of the questionnaire it has already been stated “about **YOUR** business unit in **Netherlands**”, still respondents seemed to have confusions. This feedback from respondents also suggests the importance of instantaneous explanation of the researcher while the respondent is answering questionnaire.

6.3 Reflection from the CIM results of IBM

The CIM results based on the answers of 19 respondents from the 4 business units showed that IBM Netherlands performed best on business model innovativeness among all the three dimensions of company innovativeness. Besides, the higher score of process innovativeness compared with that of product innovativeness indicates that the company was actually better at improving operational excellence and efficiency rather than introducing new services and solutions. Although the company claimed that their strategy is to pursue the leadership on new service products, their actual strong points in their innovation performance lie in their operational process and business model.

When looking at the detailed scores of sub-dimensions, it can be found that the weakest aspect in the company innovativeness of IBM Netherlands is the introduction of new products or services. However, in the meantime, the highest sub-dimensional score is on opportunity windows, which is about the potential opportunities of the company on the market. This implies that IBM Netherlands was not very successful in translating the market opportunities into innovative solutions or products that they can offer their clients. Through the discussion with respondents on the results, the internal collaboration and mutual understanding between business units turned out to be responsible for this problem. Besides, the need for training on understanding the company and the concept of innovation better was also reflected through the results and the discussion on them.

A detailed report of the CIM results of the four business units is enclosed in Appendix 1. And the corresponding suggestions to the top management of IBM Netherlands based on the result analysis are enclosed in Appendix 5.

6.4 Suggestions for successive studies

In 6.2 it has been stated that the biggest limitation of this research is the small number of the participants. To improve the quality of the study on the tool developed in this research, more respondents need to be involved. The number of respondents had better be larger than 30, which is the least number required for valid statistical tests. In addition to the advice on the sample size, some more suggestions on other aspects for further researches are concluded here in this part.

6.4.1 Possible refinements of the tool for further tests

As mentioned in 6.2, due to limited time and accessibility, some measurement questions were ruled out and some had to be replaced by less objective substitute ones. In the further test and application of this company innovativeness measurement tool, these questions should be used if sufficient time and resource is available.

In the measure of product innovativeness, the metric ‘basic/significant innovations’ were taken out due to its high cost on time and effort and the judgment problem it might introduce. If time allows in the future study on this measurement tool, it is better to apply this metric in, especially when the Strategy Fit Analysis is again involved in such a study. The judgment of basic/significant innovation then should be based on the innovation project typology of Griffin and Page (1996), which is used in the Strategy Fit Analysis. Then two points need to be noticed in the application:

1. The typology of Griffin and Page (1996) needs to be simplified a bit.

To reduce the time and difficulty for respondents to judge, the three types ‘addition to existing lines’ (AEL), ‘product improvements’ (IM), ‘product repositions’ (RP), and ‘cost reduction’ (CR) had better be grouped together as ‘incremental’. Then the respondents will not be bothered with distinguish these four types of innovation projects. The crux is to differentiate the more radical innovations, ‘new-to-the-world’ (NTW) and ‘new-to-the-company’ (NTC), from the more incremental innovations.

2. The self-report phenomenon needs to be avoided as much as possible.

If the respondents are asked to take part in both the Strategy Fit Analysis and the Company Innovativeness Measurement in the future study, then the risk of self-report will be introduced by applying the typology of Griffin and Page (1996) in CIM tool as well. One solution is to ask different respondents from the same business unit or company to participate in the two tests separately. Another solution is to separate the questions for the two tests instead of using the combined questionnaire like in this research if only the same respondents are accessible. Then the intervening time between the two tests had better be a bit longer (for example, one month) to reduce the influence as much as possible.

In the measure of process innovativeness in this research, perception questions were used instead of calculation of financial figures due to the inaccessibility of the data during the research. If it is possible to get the necessary data in the further study, it is better to use the more objective calculation methods. The article *The Productivity and Governance of Company-Specific Knowledge* written by M. A. Zegveld in 2004 can be used as the reference for the required types of data for and the formulations of the calculations.

6.4.2 Suggestions for further applications of the tool

In the future application of the CIM tool, three aspects need to be paid attention to in the process of using the questionnaire.

First, the measurement tool had better be applied on the company level. In this research, it has already been noticed that respondents found some questions not applicable to their business units since the relevant activity is not within their major responsibility. Therefore, it is better to have respondents with different backgrounds and job responsibilities to compose the sample from one company. By doing so,

researchers will be able to get as many questions to be answered as possible. In addition, comparisons between the responses of different demographic groups can often provide useful indications about the internal cooperation of the company.

Second, the questionnaire and the way to use it can be improved. In this research, a combined questionnaire was used for both SFA and CIM, which made the questionnaire a bit too long. In future application, the CIM questionnaire had better be used separately. With the length of 49 questions, the time for respondents to finish the questionnaire will be reduced a lot. Respondents will probably be more patient to read the questions and directions, and therefore understand them better. In addition, as it has already been mentioned in 6.2, it is better for the researcher to provide instant explanation and elaboration to the respondents when they are filling in the questionnaire. Respondents can be invited to a face-to-face meeting or a conference phone call, so that they can ask the research for help as soon as they have any understanding problem. This will help a lot to increase the respondent rate of the questions and to avoid misunderstanding of the questions. Besides, the form of the questionnaire can be improved by introducing the use of some software widgets or macros to make it more user-friendly, especially to people who work with similar software intensively.

In addition to the process of using questionnaire, the demography of the sample also needs attention. According to the findings in this research, managers generally have more positive perceptions than ordinary employees, and people with longer job experience in the company seems to be more conservative to give positive answers than their less experienced colleagues. To balance the difference between those groups of respondents, the composition of respondents had better be differentiated. Managers need to be involved because of their better overview than many non-manager employees, although they are often a bit over-optimistic. Besides, it is better to have people who often work with the financial figures of the company or business unit to participate as well. Some questions in the questionnaire are related with numbers such

as sales percentage and sales growth. Sometimes even the manager is not very clear about the situation since he/she does not get in touch with relevant figures frequently in daily work. Therefore it will be very helpful if someone in the company or business unit who intensively work with those relevant figures can be reached. No matter how the sample is composed of different respondents, the demographic composition of comparison units or groups (like the four business units in this research) had better be unified as much as possible.

One principle criterion for the design of the CIM tool in this research is applicability to IBM Netherlands. Therefore, all the questions in the questionnaire were formed based on the consideration of the particular characteristics of IBM Netherlands which mainly operates in the service sector. If the tool is going to be applied on IBM's clients, especially companies who operate in manufactory sectors, then two changes on the questionnaire are necessary: First, the measure for the innovativeness degree of core machinery used by the company need to be added into the metrics of process innovativeness. This metric was proposed in the research of Avlonitis et al (1994), but was ruled out in this research because it is not applicable for IBM Netherlands. Second, the statements and questions have to be reformulated to fit in with the situations of a manufactory company. For example, in the question on sales generated from innovations, "services introduced in 2004 – 2006 that were new to the market" needs to be changed to "products introduced in 2004 – 2006 that were new to the market". Another example is the change of description of some process innovations and market innovations. "New or significantly improved processes for providing services" should be changed to "new or significantly improved processes for manufacturing products". And "repackaging of service elements or new elements in service package(s)" can be replaced by "new packaging design(s) for the products".

One more suggestion on the application of the CIM tool on other companies is about the result calculation methods. In this research, all the metrics for the same dimension were given the same weight in the calculation of the dimensional score. And when

generating the overview of the company innovativeness of a business unit, the default weights of all the three dimensions were also the same. However, for companies which have different strategic focuses and goals, the three dimensions of company innovativeness and their metrics are probably of different importance degree. This kind of differences has been noticed during the analysis and the discussion on the results in this research. But it has not been involved in the calculation of the results. In the further application of the tool on other companies, the researcher can consider to decide the weight of different dimensions or metrics based on the particular strategy or conditions of the company. But the weight change should be made carefully and cautiously. The researcher can use literature review, expert interview, and discussion or workshop with managers from the involved company for the decision on the weights.

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APPENDICES

Appendix 1: Application results

Strategy and Change

Strategy and Change (S&C) is a sub-unit of Global Business Services department. In this research there were 6 respondents from this business unit invited to participate, all of which are not managers. 5 of them had been working in the company for less than 6 years. The table in the right showed the CIM scores of S&C. Marked by

	S&C
product innovativeness	2.06
product/service innovation introduction	1.10
% sales of innovations	1.67
product/service innovation impact	3.42
process innovativeness	2.98
productivity	3.32
process innovation introduction	2.92
process innovation impact	2.70
business model innovativeness	3.15
business model innovations	2.81
business model innovation impact	2.99
opportunity window	3.87
business model fitness	2.95

red boxes in the table, the scores on “product/service innovation introduction” and “% sales of innovations” are very low compared with scores on other sub-dimensions. In the results discussion with a respondent from this business unit, these two low scores were thought of confirming with the reality in S&C.

The following radar graphs displayed the dimensional scores and sub-dimensional scores for all the three innovativeness dimension of S&C. The shadow area in every graph represents the CIM scores of S&C. The red triangle in every graph was drawn out based on the average scores of all the 4 business units involved in this research on the corresponding dimensions/sub-dimensions.

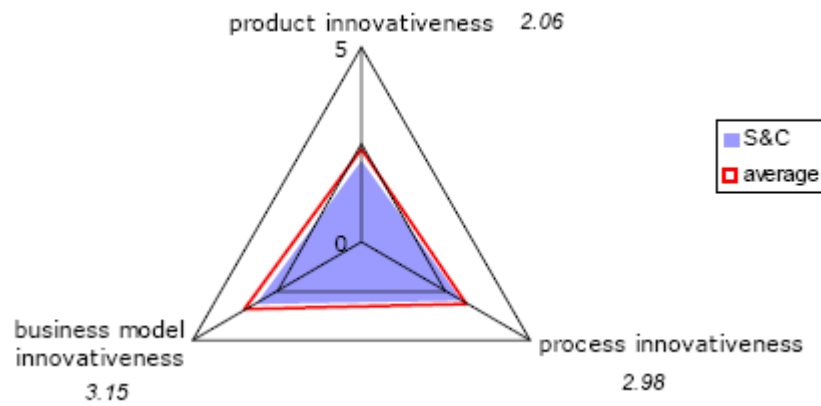


Figure: CIM dimensional scores of S&C

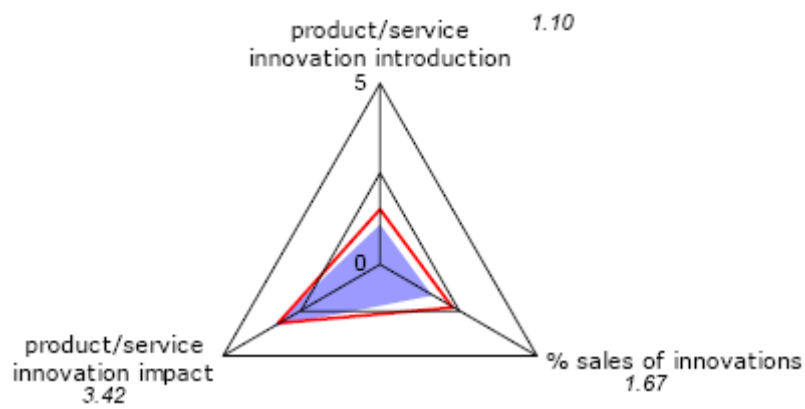


Figure: Sub-dimensional scores for product innovativeness of S&C

When talking about the overall low score on product innovativeness, the respondent invited for the results discussion said that S&C mainly focused on improvement (IM) and additional-to-existing-line (AEL) innovation projects. In addition, the respondent thought that “product/service innovation impact” had perhaps been even overestimated.

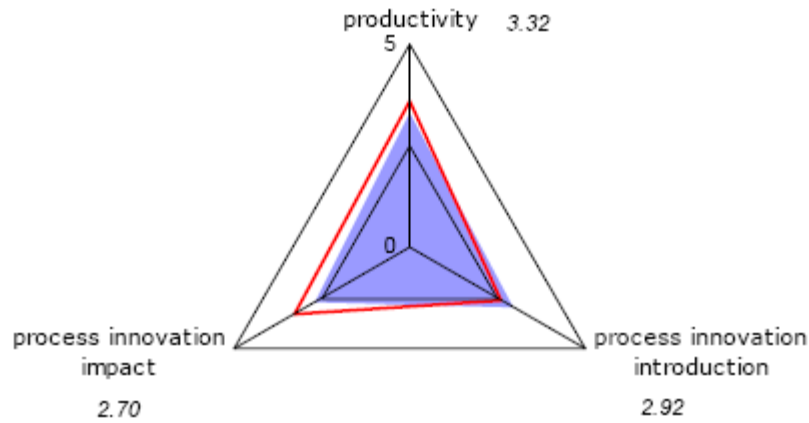


Figure: Sub-dimensional scores for process innovativeness of S&C

As for the process innovativeness, the respondent thought the scores basically were consistent with the reality.

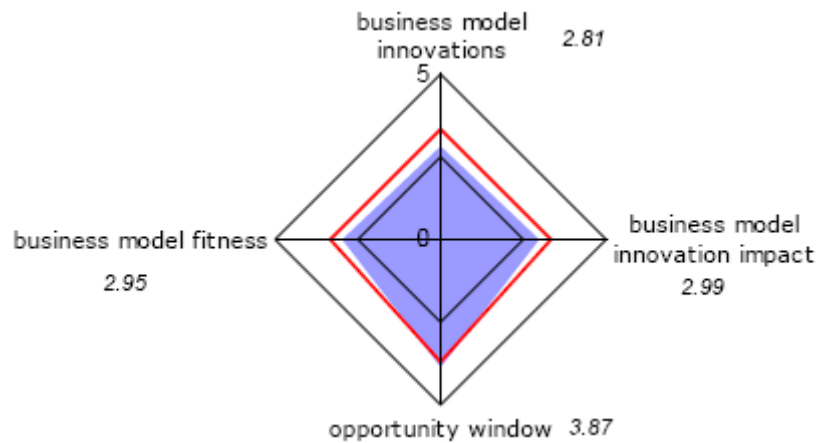


Figure: Sub-dimensional scores for business model innovativeness of S&C

When discussing on the scores of business model innovativeness, the respondent thought that business model innovativeness was considered on a very high level, which is hard for ordinary employees to give precise estimation. Although the score on opportunity windows was the best among the 4 sub-dimensions, this sub-dimension still needed to be improved according to the opinion of the respondent. He thought that employees in the business unit should be better trained to perceive the opportunities in the market, and to know their own company IBM better.

Sales and Distribution

Sales and Distribution (S&D) is a client-based business unit. It is one of the two business units which also took part in Innovation Capacity Test in Reijzen's research in 2006. 5 respondents from this business unit answered the CIM questionnaire, 2 of which are managers and 3 of which had been working in the company for

	S&D
product innovativeness	1.47
product/service innovation introduction	1.25
% sales of innovations	0.50
product/service innovation impact	2.67
process innovativeness	3.00
productivity	3.66
process innovation introduction	2.22
process innovation impact	3.13
business model innovativeness	3.32
business model innovations	3.55
business model innovation impact	3.73
opportunity window	2.75
business model fitness	3.25

more than 6 years. The table above showed the CIM scores of S&D. The scores on “product/service innovation introduction”, “% sales of innovations”, and “process innovation introduction” were fairly low, especially that of the second item.

The following radar graphs displayed the dimensional scores and sub-dimensional scores for all the three innovativeness dimension of S&D. The shadow area in every graph represents the CIM scores of S&D. The red triangle in every graph was drawn out based on the average scores of all the 4 business units involved in this research on the corresponding dimensions/sub-dimensions.

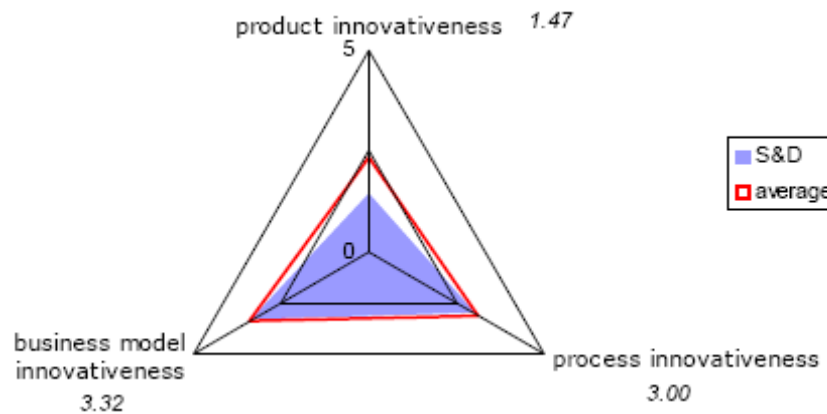


Figure: CIM dimensional scores of S&D

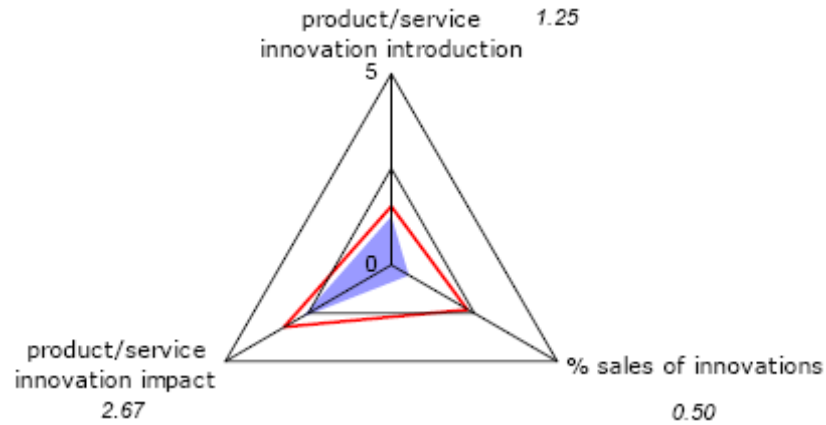


Figure: Sub-dimensional scores for product innovativeness of S&D

In the results discussion with a respondent from S&D, the low scores on product innovativeness were viewed as correct. When talking about the extremely low score on “% sales of innovations”, the respondent thought that innovations generally take time to be really profitable and always starts with small revenues. The poor performance on innovation introduction was viewed as influenced by other business units and the clients. The respondent complained that due to the measurement system driven by revenue in other business units, it was hard to attract them to work on radical innovations. In the mean time, it was also hard to introduce big changes to clients without attractive revenue increase in short run.

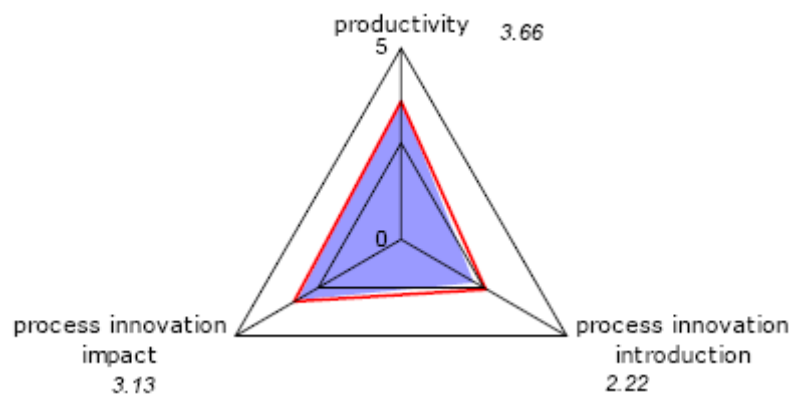


Figure: Sub-dimensional scores for process innovativeness of S&D

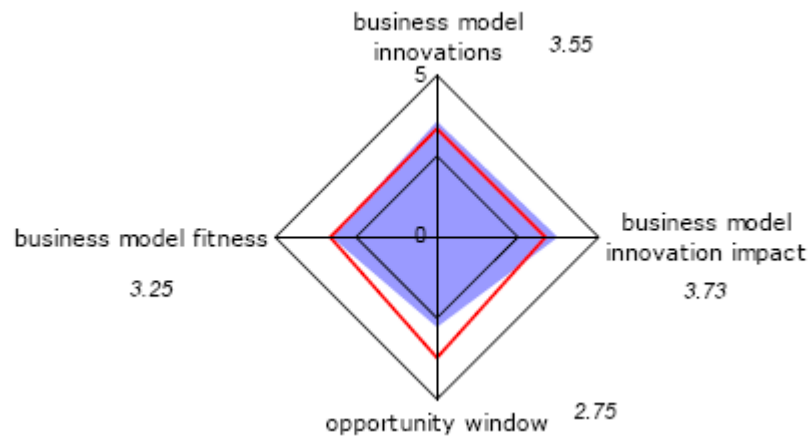


Figure: Sub-dimensional scores for business model innovativeness of S&D

In the discussion on the business model innovativeness scores, the respondent expressed opinions on three aspects: First, the scope of the questions on business model innovativeness were not clear to them, since they often felt unclear whether they were asking about their own business model or the business model of their client which they worked with the client to innovate. Second, the business model of S&D was given, which means that they could only make some marginal changes instead of change the entire model of the overall strategy. Third, the opportunities perceived by S&D often turned out to be not interesting to other business units, so they cannot be translated into real opportunity windows.

In general, the respondent thought that S&D does have potential to innovate, but its performance was hindered by other business units. And people in S&D had to spend a lot of time to work with the rest of the organization.

GBS Distribution sector

This business unit is the distribution sector of Global Business Services (GBS) department. Its major responsibilities are similar to that of S&D. However, different with S&D, GBS Distribution sector is more solution-based. 4 respondents from this business unit answered the CIM questionnaire, 2 of which are

managers. And 3 out of the 4 people had been worked in the company for more than 6 years. The table above showed the CIM scores of GBS Distribution sector. In general, all the scores appeared to be satisfying except the one for “process innovation introduction”, which is a bit low.

	GBS D
product innovativeness	3.35
product/service innovation introduction	3.00
% sales of innovations	4.00
product/service innovation impact	3.06
process innovativeness	3.30
productivity	3.47
process innovation introduction	2.75
process innovation impact	3.67
business model innovativeness	3.35
business model innovations	3.32
business model innovation impact	3.17
opportunity window	3.58
business model fitness	3.31

The following radar graphs displayed the dimensional scores and sub-dimensional scores for all the three innovativeness dimension of GBS Distribution. The shadow area in every graph represents the CIM scores of GBS Distribution. The red triangle in every graph was drawn out based on the average scores of all the 4 business units involved in this research on the corresponding dimensions/sub-dimensions.

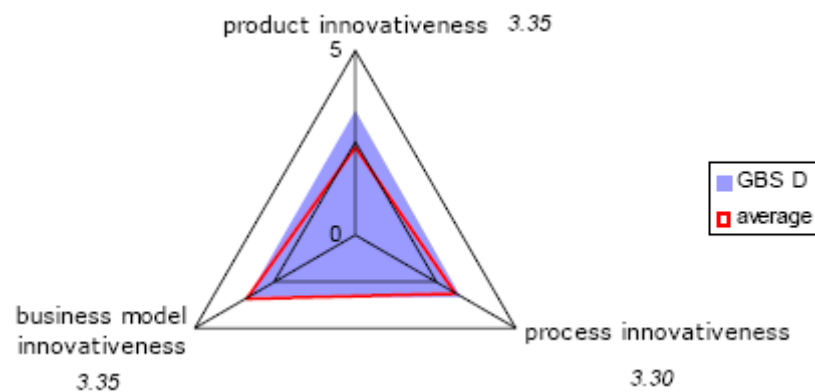


Figure: CIM scores of GBS Distribution

Compared with the average performance, GBS Distribution had above-average scores, especially on product innovativeness.

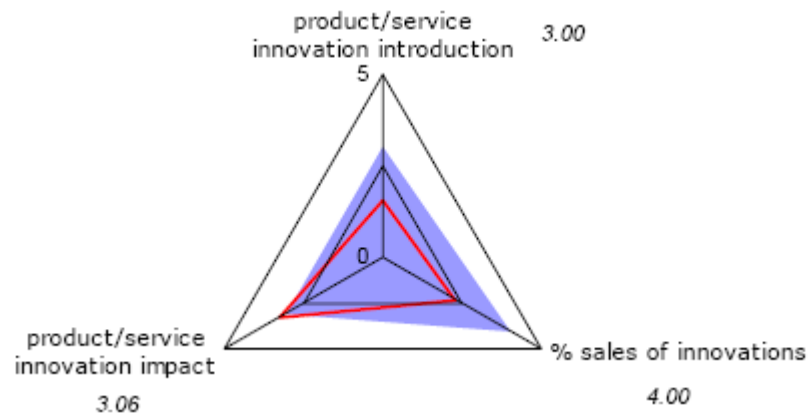


Figure: Sub-dimensional scores for product innovativeness of GBS Distribution

In the results discussion, the invited respondent thought that the score on “% sales of innovation” should be lower concerning the reality. Still, the respondent thought that, just like the scores showed, on product innovativeness the opinions of GBS Distribution and S&D differed a lot, which suggests that people from S&D should understand innovations better.

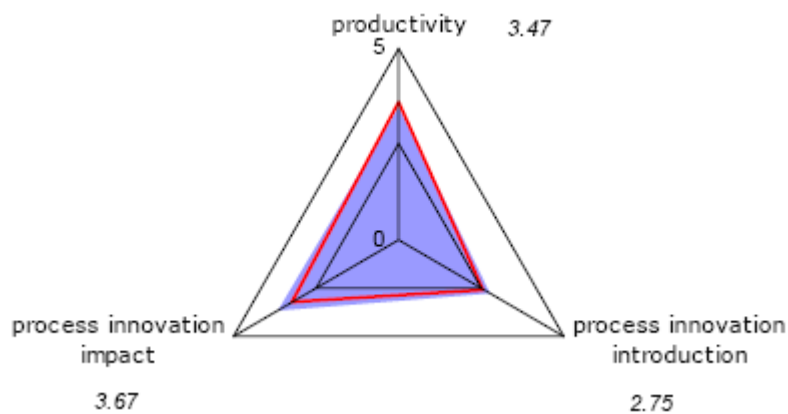


Figure: Sub-dimensional scores on process innovativeness for GBS Distribution

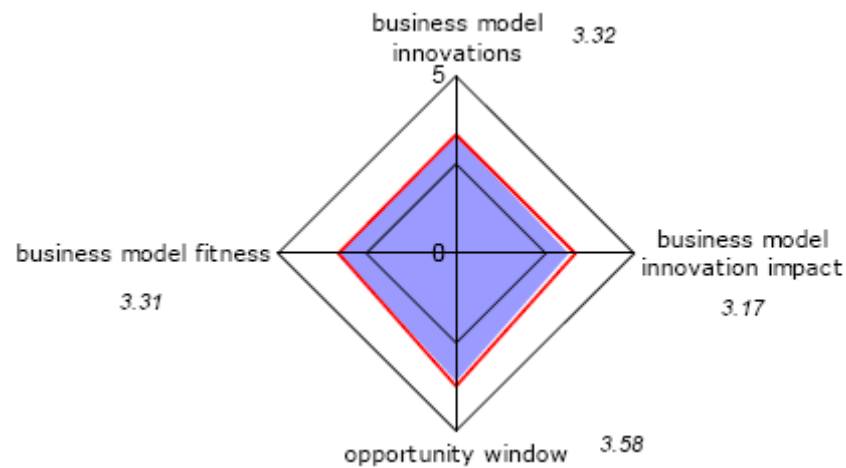


Figure: Sub-dimensional scores for business model innovativeness of GBS Distribution

When talking about business model innovativeness, the respondent from GBS Distribution thought that the opportunity windows are really large but S&D failed to following up. He suggested that there should be more knowledge transfer to S&D from their business unit in order for better cooperation between the two units. Besides, the respondent thought that some innovations or changes (e.g. some changes in the billing system), although not very big, can be very effective, and therefore should be paid attention to.

Business Continuity and Recovery Services

Business Continuity and Recovery Services (BCRS) is a sub-unit within Global Technology Services department. It is the other business unit which participated in the Innovation Capacity Test in Reijzen's research in 2006. 4 respondents from this business unit answered the CIM questionnaire, 2 of which are

managers. And 3 out of the 4 people had been working in the company more than 6 years. The table above showed the CIM scores of BCRS. Marked by red boxes, the scores on “product/service innovation introduction” and “process innovation introduction” were low, but the perceptions on the impact of innovations were high.

	BCRS
product innovativeness	2.58
product/service innovation introduction	0.83
% sales of innovations	3.08
product/service innovation impact	3.83
process innovativeness	3.28
productivity	3.89
process innovation introduction	2.44
process innovation impact	3.50
business model innovativeness	3.90
business model innovations	3.75
business model innovation impact	3.42
opportunity window	4.67
business model fitness	3.78

The following radar graphs displayed the dimensional scores and sub-dimensional scores for all the three innovativeness dimension of BCRS. The shadow area in every graph represents the CIM scores of BCRS. The red triangle in every graph was drawn out based on the average scores of all the 4 business units involved in this research on the corresponding dimensions/sub-dimensions.

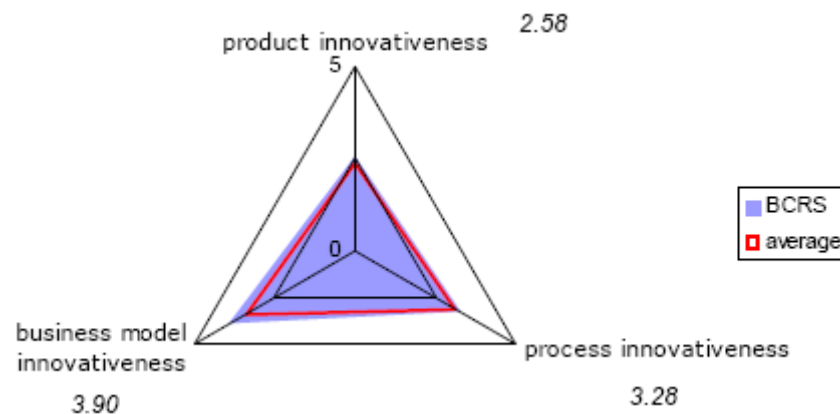


Figure: CIM scores of BCRS

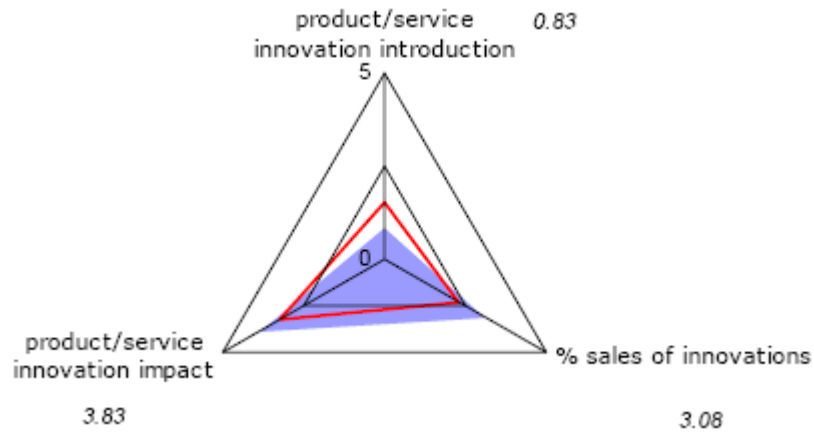


Figure: Sub-dimensional scores for product innovativeness of BCRS

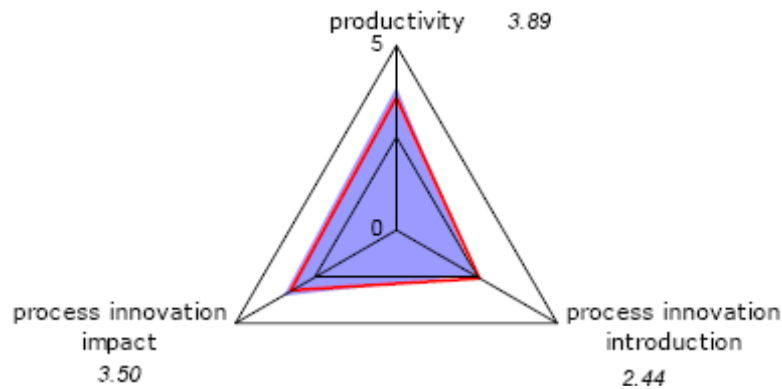


Figure: Sub-dimensional scores for process innovativeness of BCRS

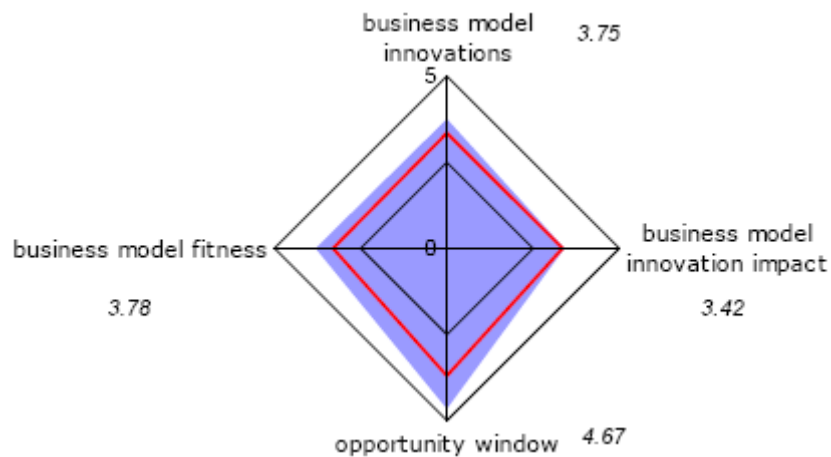


Figure: Sub-dimensional scores for business model innovativeness of BCRS

In the limited time of this research, it was not possible to arrange a results discussion with any respondent from this business unit.

Appendix 2: Questions and statements

Part I: General Information

1. Business Unit:
2. Job Responsibilities:
3. Are you a Manager?
4. Age:
5. How long have you been working in IBM?

Part II – Part IV: Strategy Fit Analysis Questions (Begum Aydinoglu's Research)

Part V: Product Innovativeness

Question/Statement	Sub-dimension	Metric	References
52. Please estimate the number of new patents that your business unit applied in 2004 – 2006.	product/service innovation introduction	# of patent applications per employee	Brouwer & Kleinknecht (1996) Kleinknecht et al (2002)
53. Did your business unit generate turnover with the following 2 categories in 2006? a) services introduced in 2004 – 2006 that were new to the market b) services introduced in 2004 – 2006 that were new to your business unit, but not new to the market	% sales of product/service innovations	% sales of innovations new to the market, % sales of innovations new to the firm	Brouwer & Kleinknecht (1996) Kleinknecht et al (2002)
54. Did your business unit apply new technologies or products from other companies into your services in 2004 – 2006?	product/service innovation introduction	% of purchased innovations	CIS 4 Harmonised Survey (2004)
55. On average, the new services introduced in 2004 – 2006 were commercially successful.	product/service innovation impact	commercial success rate	Cooper & Kleinschmidt (1995)
56. On average, the new services introduced in 2004 – 2006 have had a good technical performance.	product/service innovation impact	technical success rating	Cooper & Kleinschmidt (1995)

57. Please estimate the impact of new services introduced in 2004 – 2006 on the total turnover of your business unit in 2006.	product/service innovation impact	impact on annual total sales	Cooper & Kleinschmidt (1995)
58. Please estimate the impact of new services introduced in 2004 – 2006 on the net profits of your business unit in 2006.	product/service innovation impact	impact on annual total profit	Cooper & Kleinschmidt (1995)

Part VI: Process Innovativeness

Question/Statement	Sub-dimension	Metric	References
59. In general, people in our business unit work efficiently.	productivity	labor productivity	Brynjolfsson & Yang (1996) Frisch (2000)
60. Our business unit provides a variety of different services to our clients	productivity	differentiation	CIS 4 Harmonised Survey (2004) Zegveld (2004)
61. The innovation(s) on operation processes introduced during 2004 – 2006 have had a significant contribution to increasing our capacity to provide services.	process innovation impact	increased producing or providing capacity	CIS 4 Harmonised Survey (2004)
62. The innovation(s) on operation processes introduced during 2004 – 2006 have significantly contributed to improve our flexibility in providing services.	process innovation impact	improved producing or providing flexibility	CIS 4 Harmonised Survey (2004)
63. The expenses on exploring and deploying knowledge of our business unit have resulted in higher profits.	productivity	knowledge productivity	Zegveld (2004)
64. Compared to 2005, the service providing costs of your business unit now has (notably decreased – notably increased).	productivity	knowledge productivity	CIS 4 Harmonised Survey (2004)
65. Please estimate the percentage of employees who were involved in the development of new services or products in your business unit in Netherlands.	productivity	% of R&D employees	Frisch (2000)

66. During 2004 – 2006, did your Dutch business unit introduce any of the following 3 kinds of processes? a) New or significantly improved processes for providing services b) New or significantly improved processes for distributing services c) Other new or significantly improved processes to support your business	process innovation introduction	introduction of new manufactory or provision methods, introduction of new delivery or distribution methods, introduction of other new supporting methods	CIS 4 Harmonised Survey (2004)
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Part VII: Business Model Innovativeness

Question/Statement	Sub-dimension	Metric	References
67. Did your Dutch business unit introduce any of the following 4 kinds of market innovations during 2004 - 2006? a) Repackaging of service elements or new elements in service package(s) b) New marketing strategies, promotion media, and/or promotion techniques c) New sales channels or new concepts in service presentations d) New pricing methods	business model improvements and innovations	introduction of market innovations	CIS 4 Harmonised Survey (2004)
68. In our business unit, new knowledge in our business was explored in 2006.	business model improvements and innovations	improvements of knowledge management system	CIS 4 Harmonised Survey (2004)
69. In our business unit, existing knowledge on our business was fully deployed in 2006.	business model improvements and innovations	improvements of knowledge management system	CIS 4 Harmonised Survey (2004)
70. In our business unit, employee decision making and responsibility increased notably in 2006.	business model improvements and innovations	increase of employee decision making and responsibility	CIS 4 Harmonised Survey (2004)

71. The relations between our business unit and our customers/clients were notably improved in 2006.	business model improvements and innovations	improvements of relations with clients, other firms, or public institutions	CIS 4 Harmonised Survey (2004)
72. The relations between our business unit and other business units, firms, or public institutions involved in the market were notably improved in 2006.	business model improvements and innovations	improvements of relations with clients, other firms, or public institutions	CIS 4 Harmonised Survey (2004)
73. In 2006 our business unit entered new markets, or served new customer groups different from our previous business sector.	business model innovation impact	new markets or customer groups introduction	CIS 4 Harmonised Survey (2004)
74. The awareness of our services or business image on the market increased.	business model innovation impact	increased visibility of products or business	CIS 4 Harmonised Survey (2004)
75. The business concept of our business unit was very unique compared to other companies in the market.	business model innovation impact	business concept uniqueness	Hamel (2000)
76. Compared to 2005, our business unit now has greater benefits due to our success in keeping competitors locked out of the market.	business model innovation impact	degree of exploitation of profit boosters	Hamel (2000)
77. Compared to 2005, our business unit now has greater benefits due to providing more services.	business model innovation impact	degree of exploitation of profit boosters	Hamel (2000)
78. Compared to 2005, our business unit now has greater benefits due to emphasizing meeting the unique needs of consumers, business partners, and institutional constituents.	business model innovation impact	degree of exploitation of profit boosters	Hamel (2000)
79. Compared to 2005, our business unit now has greater benefits due to our focus on markets where there was not much competition.	business model innovation impact	degree of exploitation of profit boosters	Hamel (2000)
80. In our business unit, the access to key information about clients, services, markets, and costs was improved compared to 2005.	business model innovation impact	improved access to key information	Weill and Vitale (2001)

81. Our business unit has practical opportunities to enter new market(s).	opportunity windows	new opportunity windows on new markets	Cooper & Kleinschmidt (1995)
82. Our business unit has practical opportunities to introduce new kinds of services other than existing ones.	opportunity windows	new opportunity windows on new product or service categories	Cooper & Kleinschmidt (1995)
83. Compared to 2005, our business unit had more close and stable relationships with our clients now.	business model innovation impact	level of ownership for customer relationship, data, and transaction	Weill and Vitale (2001)
84. Compared to 2005, our revenue from spin-off services or contracts with clients had increased.	business model innovation impact	level of ownership for customer relationship, data, and transaction	Weill and Vitale (2001)
85. Compared to 2005, customer satisfaction towards your Dutch business unit had (notably worsened – notably improved).	business model innovation impact	improved customer satisfaction	CIS 4 Harmonised Survey (2004)
86. Compared to 2005, the accesses of your Dutch business unit towards customer data and information had (notably worsened – notably improved).	business model innovation impact	level of ownership for customer relationship, data, and transaction	Weill and Vitale (2001)
87. The annual sales of your Dutch business unit in 2006 were (far below the target – significantly above the target).	opportunity windows	sales versus objectives	Cooper & Kleinschmidt (1995)
88. Customers receive various offerings via different channels, causing conflict with intermediaries, allies, and customers.	conflicts raising from combination of atomic models	business model fitness	Weill and Vitale (2001)
89. The core competencies (and thus culture, reward system, and structure) for one kind of our businesses are not compatible with those of another.	conflicts raising from combination of atomic models	business model fitness	Weill and Vitale (2001)
90. Different businesses of our business unit have incompatible requirements on IT infrastructure and its system architecture.	conflicts raising from combination of atomic models	business model fitness	Weill and Vitale (2001)

91. The position of our business unit gives us access to privileged or private information relative to other allies.	conflicts raising from combination of atomic models	business model fitness	Weill and Vitale (2001)
92. The 7 primary elements of a business model are: 1) Mission (strategic objectives) 2) Target Market (scope and market segment) 3) Value Proposition (product/service offering) 4) Resources (capabilities, assets) 5) Key Activities (intra- and inter-organizational processes) 6) Cost and Revenue Model (cost and revenue streams, pricing policy) 7) Value Chain/Net (alliances and partnerships) In your business unit, the alignment of above mentioned elements in 2006 was (very poor – very good). Compared to 2005, their alignment has (notably worsened – notably improved). Which aspect(s) do you think needs to be improved or refined?	degree of fitness among elements of the business concept	business model fitness	Hamel (2000)

Appendix 3: Experts invited for the reviews

Dr. Erik den Hartigh	Assistant Professor Department of Technology, Strategy, and Entrepreneurship Faculty of Technology, Policy, and Management Delft University of Technology Research Focuses: increasing returns, mass individualism, emergence
Dr. Marc A. Zegveld	Associate Professor Department of Technology, Strategy, and Entrepreneurship Faculty of Technology, Policy, and Management Delft University of Technology Research Focuses: the firm level relationship between business strategy, innovation, and productivity
Dr. J. R. Ortt	Associate Professor Department of Technology, Strategy, and Entrepreneurship Faculty of Technology, Policy, and Management Delft University of Technology Research Focuses: innovation management
Dr. Ronald Dekker	Assistant Professor Department of Economics of Innovation Faculty of Technology, Policy, and Management Delft University of Technology Research Focuses: microeconomics, economics of innovation
Djeevan Schiferli	Business Development Executive Climate & Energy IBM Netherlands
Ian Plugge	Business Advisor Strategy & Change, IOT SW Operations Manager IBV EMEA IBM Netherlands

Appendix 4: Changed questions and statements

#	Initial Statement	Rephrased Statement	Reason
53, 54	Change the sequence of these two questions.		To avoid misunderstanding
59	Generally the work distributed to our business unit could be completed efficiently	In general people in our business unit work efficiently	Too long
64	The costs per unit (provided by our business unit during 2004 – 2006 were reduced in comparison to previous years.	Compared to 2005, the service providing costs of your business unit now has (decreased – increased).	Scale change (→5)
65	Please estimate the percentage of employees who were involved in the development of new service products in your business unit	Please estimate the percentage of employees who were involved in the development of new services or products in your business unit in the Netherlands	Scale change (→5), closed statement, stress Netherlands
66a	During 2004 – 2006, did your business unit introduce any new or significantly improved processes of providing services which were new to your unit? If the answer is yes, please estimate the number of them:	During 2004 – 2006, did your Dutch business unit introduce any of the following 3 kinds of processes? a) New or significantly improved processes of providing services b) New or significantly improved processes of distributing services c) Other new or significantly improved processes to support your business	Scale change (→5), closed statement, stress Netherlands
66b	During 2004 – 2006, did your business unit introduce any new or significantly improved processes of delivering or distributing services which were new to your unit? If the answer is yes, please estimate the number of them:		
66c	During 2004 – 2006, did your business unit introduce any other new or significantly improved processes of supporting your business? If the answer is yes, please estimate the number of them:		
67a	Did your business unit introduce new service designs in 2004 – 2006	Did your Dutch business unit introduce repackaging of service elements or new elements in service package(s) during 2004 – 2006	Clear
68	In our business unit, new knowledge in	In our business unit, new	Time frame

	our business was explored during 2004 – 2006	knowledge in our business was explored in 2006.	changed
73	During 2004-2006 our business unit entered new markets, or served new customer groups different from our previous business sector	In 2006 our business unit entered new markets, or served new customer groups different from our previous business sector.	Time frame changed
74	Our services or business image were perceived more than before on the market	The awareness of our services or business image on the market increased.	Clear
76	Compared to 2004, our business unit has greater benefits due to our success in keeping competitors locked out of the market.	Compared to 2005, our business unit now has greater benefits due to our success in keeping competitors locked out of the market.	Time frame changed
77	Compared to 2004, our business unit has greater benefits due to providing more services.	Compared to 2005, our business unit now has greater benefits due to providing more services.	Time frame changed
78	Compared to 2004, our business unit has greater benefits due to emphasizing meeting the unique needs of consumers, business partners, and institutional constituents.	Compared to 2005, our business unit now has greater benefits due to emphasizing meeting the unique needs of consumers, business partners, and institutional constituents.	Time frame changed
79	Compared to 2004, our business unit now has greater benefits due to our focus on markets where there was not much competition.	Compared to 2005, our business unit now has greater benefits due to our focus on markets where there was not much competition.	Time frame changed
80	In our business unit, the access to key information about clients, services, markets, and costs was improved compared during 2004-2006.	In our business unit, the access to key information about clients, services, markets, and costs was improved compared to 2005.	Time frame changed
83	The level of ownership of your business unit for customer relationships, data, and transaction was (very low – very high).	Compared to 2005, our business unit had more close and stable relationships with our clients now.	Clear
84		Compared to 2005, our revenue from spin-off services or contracts with clients had increased.	
87		Compared to 2005, the	

		accesses of your Dutch business unit towards customer data and information had (notably worsened – notably improved).	
89	Different customers receive different offerings via different channels, causing conflict with intermediaries, allies, and customers.	Customers receive various offerings via different channels, causing conflict with intermediaries, allies, and customers.	Clear
91	The IT infrastructure necessary for one kind of our businesses leads to a system architecture that is not compatible with our other businesses.	Different businesses of our business unit have incompatible requirements on IT infrastructure and its system architecture.	Clear
93a	Do you think these 7 aspects are aligned in your business unit?	In your business unit, the alignment of the above mentioned elements in 2006 was:	Scale change (→5)
93b	If the answer is yes, then are they aligned better now than in 2004?	Compared to 2005, the alignment of the above mentioned elements now has:	Scale change (→5)
93c	If the answer is no, then which aspect(s) do you think needs to be improved or refined? Please indicate the number(s) representing the element(s)	Which aspect(s) do you think needs to be improved or refined? Please write down the number(s) representing the element(s)	Clear

Appendix 5: Suggestions to IBM Netherlands

The Company Innovativeness Measurement results of the four business units from IBM Netherlands showed that their strength in company innovativeness lies in operational excellence and innovative business model. Although it is claimed that the company's strategy was aiming at product leadership, product innovativeness turned out to be the weakest innovativeness dimension of IBM Netherlands.

Based on the measurement results and the analysis on them, I would like to give IBM Netherlands following two suggestions on improving the innovation performance of the company.

1. Employee training on understanding the company

People's perception of innovations and opportunities for innovation appeared to be a problem in the analysis of the measurement results. It has also been suggested by some respondents in the results discussion that employees in IBM Netherlands should be trained better to understand innovation as well as to learn more about their own company. In the discussions and interviews with IBM employees in this research, I found that the call for understanding the organization is even more urgent than the necessity of understanding the concepts and advantages of innovation. Many people seemed to have nearly no idea about what their colleagues in many other departments of the company are doing. The poor mutual understanding even appeared between business units which are, and should be, working very closely in their daily business, for example Sales and Distribution (S&D) and GBS Distribution sector.

Some business unit, even with good internal communication conditions, still has the problem of mutual understanding and cooperation with other units. It suggests that only providing open communication and information channels is not effective enough.

Many people mainly focus on their own jobs and do not take active actions to know and understand other business units. The large size and the complexity of the organization also increase the difficulty for employees to understand their company well.

Therefore, I would really like to suggest IBM Netherlands to provide their employees comprehensive training and introduction about the company, including its detailed organizational structure, the businesses and responsibilities of its different business units, and its innovation achievements in all aspect. Better mutual understanding and cooperation will facilitate the improvements on translating market opportunities into successful innovations. In addition, the opportunities of innovations often lie in taking advantage of new achievements in other business domain.

2. Improving the appraisal system

In the discussions with respondents, the appraisal system which is driven by revenues turned out to be a major cause of low performance on product/service introduction. In general, innovations, especially radical innovations, take time to generate really attractive returns. When the working performance is appraised mainly by revenues, employees have little incentive to innovate. Instead, they tend to work with familiar products or service solutions and familiar clients, in known markets, through traditional processes, to ensure their financial working performance.

Therefore, I would like to suggest IBM Netherlands to improve the appraisal system in many business units. In addition to revenues, the innovative ideas an employee has brought into the business unit in its daily business should also be given considerable weight in the appraisal. Bonus or some special form of award can be introduced to motivate employees to innovate.