PREFACE

This book is the result of the 8th PhD Researchers Conference on Business Economics, Management and Organization Science - in short PREBем Conference - that took place on January 26, 2005 in Amersfoort, The Netherlands. In total, the conference was attended by 65 PhD researchers, a number in which we do not even count the interested professors attending. The day started with a keynote speech about entrepreneurship. Hereafter, the NOBEM dissertation of the year prize was presented to two winners. Then, the group split up to attend three parallel workshops that focussed on the process of the PhD project, titled, How to survive a scientific debate?, Successful collaboration with companies, and Financing your future research. These process-oriented workshops were appreciated very much by the attendees. The afternoon was reserved for about 25 PhD students presenting a paper or poster. You will read more about the conference activities in this book. A selection of the best papers presented at the conference constitutes the main part of this book.

Here we would like to take the opportunity to thank all the participants of the conference, especially those who presented a paper or poster, chaired a sessions, or organized a workshop. We also thank Hēla Molijn for her support with the PREBем website. Special thanks goes to Brenda Kroeze, who supported us through the entire process of organizing the conference and producing this book.

This book brings the work of this PREBем team to a close. The conference was very successful with 65 PhD researchers attending, but, more importantly, we look back at a very pleasant time working together. We were also very grateful for the amount of positive feedback we received after the conference. Having said all this, we hope you will enjoy this book as well!

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INTRODUCTION

The PREBEM is the Dutch organization for PhD researchers in Business Economics and Management. The PREBEM is embedded within the NOBEM: the Netherlands Organization for research in Business Economics and Management. Currently, ten Dutch Universities participate in this organization. One of the activities that the PREBEM organizes is a bi-annual conference for PhD students in the Netherlands and Flanders. The general aim of this conference is to enable PhD students to present and discuss their scientific research, and to give them an opportunity to participate in the scientific debate. Another aim is to get the PhD researchers into contact with existing research networks or to facilitate the start of new research networks.

This book is the final result of the 8th PhD Conference on Business Economics, Management and Organization Science, which took place in De Observant in Amersfoort on the 26th of January 2005. This year, the conference was not organized around a central theme. This enabled all PhD students – working in the fields of business economics, management and organization science – to present their research. The result was exactly what we hoped for, a large variety of subjects and types of papers and posters. A selection of the papers is included in this book. Before briefly introducing these papers, we will summarize the activities on the conference day.

The conference
The chairman of the PREBEM team, Stephan van Dijk, opened the conference. This was directly followed by a keynote speech by Thijs Boekhoff on the topic of entrepreneurship. He showed the audience some similarities and dissimilarities between being an entrepreneur and being a PhD researcher. Thijs Boekhoff illustrated a number of facets of entrepreneurship with the founding of his own company Squarewise. After the keynote speech, the NOBEM dissertation of the year 2003 award was presented by the chairman of the jury, Prof. dr. S.W.F. (Onno) Omta. This year the award was presented to dr. Nicole Torka (University of Twente) on the thesis Flexible but committed and to dr. Ad de Jong (university of Maastricht) on the thesis One for all. All for the customer. Chapter 9 summarizes these theses.

After a coffee break the participants could attend one of the following workshops:
Financing your future research, a workshop on financing your research and European subsidies by Dr. ir. A.J.R. Zweegers (European Commission) and ir. R.J. van den Berg (Erasmus University Rotterdam).
Surviving the scientific debate, a workshop on debating techniques, effective presentation of research, and PhD defences by Dr. Suzanne van Hoek, a professional trainer.
Successful collaboration with companies, a workshop by Prof.dr.ir. Hans C. Wortmann (University of Groningen) on how to collaborate with companies in your research projects.
The morning program ended with a poster presentation session, where several PhD students presented a poster about their research.

In the afternoon, the PhD students presented their papers during six parallel research sessions. The Appendix gives an overview of all the papers and posters that were presented. Each session was chaired by an experienced senior researcher. The research sessions were organized around different themes and disciplines, that is:
Decision & Information Science – session chair: Dr. Fons Wijnhoven
Innovation & Organization – session chair: Dr. W.P.M. VanHaverbeke
Business Networks & Strategic Alliances – session chair: Mrs. Dr. C.E.A.V. Lemmens
Innovation & Intermediaries – session chair: Prof. Dr. Onno Omta
Business Economics & International Business – session chair: Prof. Dr. Marno Verbeek
Human Resource Management – session chair: Prof. Dr. Jaap Pauwe
The day was closed with drinks in the café of the Observant and a conference diner in restaurant “In den Vollen Pot”, in downtown Amersfoort.

The book
In total we received 38 extended abstracts for the conference. Considering the time and space available at the conference day, we invited 18 PhD students for a full paper presentation. This selection was based on a double blind peer review of the extended abstracts. We also invited a number of PhD students to present their abstract as a poster. From the 18 papers presented at the conference, we selected 7 for publication in this book. The selection of the papers was again based on a double review, which was a complex and time consuming task. One of the conclusions we drew from the conference was that there was not only a large variety in the subjects of the papers, but also in the research methods used. Furthermore, the papers presented clearly represent different stages in the PhD trajectory. This variety can also be found in the papers presented in this book. Therefore, we are happy to present the following papers as chapters in this book:

Luc Dorenbosch\(^1\) wrote the first chapter, in which he addresses two distinct concepts of internal consistency among human resource management practices. The chapter illustrates their differences in theoretical approach, appropriate methodology and organizational members whose perceptions determine human resource consistency.

The second chapter, by Fabienne Fortanier, covers the impact of foreign direct investment (FDI) on development. The chapter presents a framework, bringing together existing literature and considering the interactive effects of host country characteristics and FDI attributes.

The third chapter is written by Frances Fortuin, and is about the measurement of customer value in corporate R&D. In this chapter, a longitudinal study is presented with empirical data from employees of a multinational supplier company of technology-intensive industrial components.

Ferdinand Jaspers studies organizational forms for innovation in system industries, which he presents in the fourth chapter. This chapter conceptualises the organizational form as a construct with four organizational dimensions and provides a model that proposes organizational configurations for distinct types of innovation.

Oxana Kobzar took care of the fifth chapter, in which she deals with the topic of the efficiency of farm diversification. The chapter presents a new approach that analyses farm diversification as a risk-management strategy.

Web-infomediaries are the topic of the sixth chapter, by Jeroen Kraaijenbrink. From 17 critical incident interviews, insight is provided into the gaps that NPD managers face when they attempt to use external knowledge in NPD. At the same time, value adding opportunities are presented for developers of web-infomediaries.

Last but not least, the seventh chapter by Thomas Lans, presents a tool for the identification and measurement of competences of entrepreneurs in agribusiness. The tool, which is based on a triangulation of methods, was tested with 16 entrepreneurs and provided usable and valid results.

The book concludes with a chapter that is devoted to the NOBEM dissertation of the year prize 2003. It includes an explanation of the selection procedure as well as a summary of the jury-report. Furthermore, this chapter contains the summaries of the two winning dissertations of Nicole Torka and Ad de Jong. This last chapter should be a source of inspiration for all PhD researchers.

\(^{1}\) In this introduction we only mention the first author of the chapter (the PhD researcher who presented on the conference), although some chapters have two or three authors as you can see in the different chapters.
ALL FOR ONE OR ONE FOR ALL?
TWO DISTINCT CONCEPTS OF INTERNAL CONSISTENCY
AMONG HUMAN RESOURCE MANAGEMENT PRACTICES

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Abstract
A growing number of practitioners and academics endorse that the ability of organizations to align their human resource management practices (e.g. selection, rewards, promotion, training programs) with each other contributes to organizational effectiveness. Yet empirical investigation of the benefits of ‘internal consistency’ among HRM practices lacks a sound theoretical and conceptual foundation underlying the notion of how HRM practices enhance each other’s effectiveness and avoid to work at cross purposes in promoting a productive workforce. In order to refine research approaches to test the link between internal HR consistency and performance outcomes, this paper proposes three ‘conceptual anchors’ alongside which several distinct functional forms of HR consistency can be classified. We address two distinct forms more specifically and illustrate their differences in theoretical approach, appropriate methodology and organizational members whose perceptions determine HR consistency. This paper is concluded with discussing an ‘all for one’ and an ‘one for all’ track of reasoning on internal consistency, as well as future research directions in order to fine grain future internal HR consistency-research.

Keywords: Conceptualization, Internal Consistency, Human Resource Management Systems, Performance effects

1 INTRODUCTION

The concept of fit has served as an important building block for theory construction in several areas of research, including strategic management (Venkatraman 1989). Also in the field of human resource management (HRM) a stream of research aims at sets of HRM practices that as a bundle or system are complementary, which holds the claim that ‘some combination of practices have advantages above and beyond the careful application of specific [HR] technique such as sophisticated selection, pay, training or job design’ (Guest, Conway & Dewe 2004, p. 79). The compatibility of practices is referred to as ‘internal or horizontal fit’ or internal consistency among HR practices, and its synergetic advantages are frequently argued to benefit organizational financial performance, productivity or flexibility (Huselid 1995, MacDuffie 1995, Purcell 1999).

In recent years, researchers have distinguished several ‘bundles’ or systems of HRM practices, such as high performance work systems (Appelbaum, Bailey, Berg & Kalleberg 2000, Horgan 2003), high commitment/control HR systems (Walton 1985, Arthur 1994, MacDuffie 1995, Wood & Albanese 1995, Baron & Kreps 1999, Boselie 2002), high involvement systems (Lawler 1986, Vandenberg, Richardson & Eastman 1999, Guthrie 2001), market type HR systems and internal HR system (Delery & Doty 1996), human capital-enhancing and administrative HR systems (Youndt, Snell, Dean & Lepak 1996) or innovative and traditional HR systems (Ichniowski, Shaw & Prennushi 1997). The
attention for typologies of the systems mentioned above reflects a strong intuitive appeal, but few if any of the authors (except Horgan 2003) sufficiently describe when, how and why HRM practices within the system support and enhance one another (Guest 1997, Delery 1998, Guest et al. 2004). One of the underlying problems is the lack of corresponding schemes by which fit has been conceptualised and tested (Venkatraman 1989). With the goal to contribute to a more refined approach to address issues of internal fit in HRM research, the question underlying this conceptual paper is threefold:

‘What conceptual perspectives identify combinations of HRM practices that are internal consistent? On what specific grounds do they differ? And what research implications result from these conceptual differences?’

For this purpose the first section contains an outline of the underlying assumptions of internal fit issues in strategic HRM research in contrast to other perspectives that have developed in the years.

Second, this paper proposes three key elements for mapping distinct types of internal fit and its appropriate way of testing. Already, Van de Ven and Drazin (1985) discuss the need for a careful conceptualisation of internal HR-consistency by arguing that inadequate attention to specifying the form of fit could fundamentally alter the meaning of the theory itself. Additionally, Schwab (1980) and Kristof (1996) remark that imprecision in a constructs definition can result in contradictory operationalizations, inadequate measures and even conflicting results. By discussing three conceptual anchors we address distinct theories underpinning the ‘origins of synergy’ (Chadwick 2000) within HR systems, methodological approaches that are appropriate for testing these theories and the possible differences between management and employees in judging consistency among HRM practices.

Finally, we discuss two possible tracks of reasoning on internal consistency, as well as future research directions in order to fine grain future internal fit-research in the field of human resource management.

2 INTERNAL HR CONSISTENCY IN STRATEGIC HUMAN RESOURCE MANAGEMENT RESEARCH

The notion of HRM practices being dependent on each other in order to be effective entered the research field of strategic HRM while it is assumed that an organization can distinguish itself competitively from other firms through its HRM system. Examining the organizations’ employment, work or HRM systems as a whole contrasts to the traditional employee-orientated functionalistic view of HRM which emphasizes the separate functions concerned with, for example, selection, reward, training and development and each independent relationship with organizational effectiveness (Wright & Boswell 2002). Strategic HRM, however, refers to the overarching issue of how employers can effectively deploy and align multiple HRM practices with one another, with business planning or strategy more generally (Sisson in Turnbull & Blyton. 1992) in order to contribute to business-driven goals (e.g. productivity, financial performance) rather than worker outcomes (Ferris, Arthur, Berkson, Kaplan, Harrell-Cook & Frink 1998). The past decade, this topic has drawn a significant amount of academics with a primary interest for theories, models and empirical studies examining the link between approaches to HRM and significant variations in (business) performance (Boxall & Purcell, 2003). Next to applications of transaction cost theory, agency theory or resource dependence theory (Wright & McMahan 1992), the ‘behavioural’ perspective (Schuler & Jackson 1987, Wright et al. 1992) has gained popularity especially when dealing with the human side of the enterprise. In this view there is consensus among SHRM researchers on the main assumption that HRM practices and systems do not lead directly to firm performance. Rather they influence firm resources, such as the human capital of the firm, or employee attitudes and behaviors. It is these employee attributes that ultimately lead to performance (Delery 1998). The intermediate linkages and processes, through which
HRM systems affect organizational effectiveness, have challenged researchers to define and examine their rationales that open ‘the black box’.

A key assumption in viewing internal HR consistency as a condition that optimizes the effectiveness of HRM stems from the supported notion that individual HRM practices that make up a system can complement, reinforce, substitute for, or even conflict each other (Wright & Boswell 2002, Delery 1998, Ostroff & Bowen 2000, Horgan 2003). Ichniowski et al. (1997) already pointed out: ‘When examining practices separately this carries the implicit assumption that effects of HR decisions are additive. And yet HRM practices are interrelated and should interact or work together in achieving their effects; therefore, investigation of the effects of individual HR practices is incomplete, and erroneous conclusions may be drawn’. Avoiding the deployment HRM practices that work at cross-purposes places internal fit as a competitive feature besides other modes of theorizing in strategic HRM literature (Delery & Doty 1996).

One of these modes is the universalistic or additive approach, in which it is assumed that a range universally applicable (best) HRM practices independently add up to employee performance and organizational performance (Pfeffer 1994). Here, an effective system is a summation of HRM practices that are considered to be most effective for the particular functional area it aims at.

Another mode is the contingency-fit also referred to as ‘external or vertical fit’. Here, organizations should match their HRM systems with the overall business strategy, (production) technology or the institutional context (Paauwe & Boselie 2003, Harrell-Cook & Ferris 1997) in order to gain competitive advantage (Baron & Kreps 1999, Wood 1999).

As both modes contribute to the understanding of the HRM-performance link, this paper solely focuses on the concept of internal consistency among HRM practices, while we are interested in the logic of internal relationships within the organization of human resources. Baron, Hannan & Burton (2001) and Baron et al. (1999) argue that organizations can benefit from a coherent, internally consistent and well-understood philosophy and set of practices governing human resource management because (1) the efficiency of technical complementarities (2) learning is simplified and accelerated, and (3) an organization can readily differentiate itself from other employers resonating behavioural scripts or blueprints familiar to prospective and current employees.

The issue of consistency increasingly gains attention when applying it to issues of organizational, economic and societal changes. For example, Edwards (2003) remarks that as organizations more and more shift away from a coherent model of employment relationships (often characterized by internal labour markets), transition-models emerge and HRM policies possibly get increasingly ‘eclectic’ while dealing with changes of external labour markets, experimenting with new ways of working, adapting to changing legislation and regulation, and changing their internal corporate structures. Also the competing pressures for internal human resource investments with an increasing focus on stakeholders external to the organization (stockholders, financial markets), constrains the investment in the alignment of HRM practices (Harrell-Cook et al., 1997). Despite the proposed benefits of internal HR consistency, an increasing number of studies indicate a lack of consistency, more fragmentation, and a pick-and-mix-approach to managing human resources (Truss, Gratton, Hope-Hailey, McGovern & Stiles 1997, Wood & de Menezes 1998, Marchington & Grugulis 2000, Grimshaw, Ward, Rubery & Beynon. 2001). Empirically, Truss et al. (1997) and Grimshaw et al. (2001) already detect to some degree the deployment of contradictory HRM practices in UK industries. But before researchers can elaborate on the side effects of eclecticism in managing employees, there is still a clear need for a proper conceptualization of internal HR consistency itself in order to make sense of its outcomes and to adequately compare the empirical results from HRM research.
3 THE CONCEPT OF INTERNAL HR CONSISTENCY

As such, the goal of this paper is to contribute to a more refined approach to address issues of internal fit in HRM research, while literature on the multi-faceted concept of consistency has included multiple ways of going about its meaning and functional form. Although over the recent years the relationship between several types of HRM systems (for example, high commitment, market type HR systems) and performance have been examined, most of these cases used classifications of HR systems that were ex-post derived from the empirical data at hand and give them a weak theory-driven conceptual foundation (Guest 1997, Delery 1998, Tsui & Wang 2002). According to Purcell (1999) and others, there is little agreement among researchers on what theoretical basis can be given for consistent combinations of HRM practices (MacDuffie 1995, Guest 1997, Ostroff & Bowen 2000) also very little has been done to test internal consistency (Purcell, 1999), and little is known about which consistent HRM practices lead to which outcomes (Dyer and Reeves 1995, Becker & Gerhart 1996). Additionally, a number of academics call for the introduction of the employee perspective as the missing link in understanding the effects of consistency among HRM practices (Guest, 1999, Ostroff & Bowen 2000, Tsui & Wang 2002, Wright & Gardner 2003). This has led us to outline the discussion on distinct functional forms of internal HR consistency alongside three ‘conceptual anchors’. Based on primarily the work of Venkatraman (1989), Kristof (1996), Chadwick (1999) and Bowen & Ostroff (2004) the conceptual anchors are defined to adequately differentiate between functional forms of fit that underpin the following essential questions in the conceptualisation of internal consistency in HRM systems:

- Which theoretical form of consistency is examined?
- Is its degree of consistency determined by its system-attributes or by its outcomes?
- And is the judgment of consistency provided by management or by the employees?

Stepwise, we will discuss each conceptual anchor (as depicted in Figure 1) representing considerations to take into account when studying the complexities surrounding research on internal HR consistency and performance. For each of the three anchors we will provide two alternatives, inherently resulting in 8 ‘tracks’ to approach research on HR consistency. In the following pages, the two most opposite tracks will be examined more closely.

![Figure 1: Three conceptual anchors of HR consistency](image)

4 CONCEPTUAL ANCHOR 1: THEORETICAL MODELS OF INTERNAL HR CONSISTENCY

Viewing the various elements involved in the management of human resources, like selection procedures, reward and appraisal systems, training and development plans or job designs, it is not hard to imagine there is a great complexity involved in the alignment of each of these elements into a coherent HR system. As it is fruitful to examine which combined practices are appropriate, theoretical
models of consistency do not refer as much to specific variables that are internally consistent, as it does to the approaches one can take in examining the relationships among HRM practices. Authors like Joyce, Slocum & Von Glinow (1982), Drazin and Van de Ven (1985) and Venkatraman (1989) have provided useful frameworks to study competing conceptual approaches to fit. To determine useful approaches for combining the characteristics of an HRM-system, we will discuss two theoretical models: (1) multiplicative models of internal HR consistency and (2) configurational models of consistency.

To indicate the conceptual differences between the two models we refer to the distinct conceptualisations of complementary and supplementary fit in the person-environment fit literature (see Kristof 1996). As our interest goes out to the compatibility and consistency between HRM practices, Kristof (1996) and colleagues (Muchinsky & Monahan in Kristof 1996) already conceptualised compatibility in two different ways. Adjusting these two notions to our framework would result in studying complementary HR consistency, which occurs when distinct HR-characteristics ‘make whole’ the environment and add to it something that is missing. As such, this type is the functional form in the multiplicative model. Additionally, supplementary HR consistency occurs when a HR system characteristic ‘supplements, embellishes, or possesses characteristics which are similar to other characteristics in the HR system’ (Kristof, 1996; p. 3) and fits the configurational model.

4.1 Multiplicative model of consistency: complementary fit

According to Drazin et al. (1985) the multiplicative model (what they call the interaction approach) of consistency treats the anatomy of an organization (or HRM system) as being decomposable into elements that can be examined independently. Internal HR consistency, therefore, refers to the interaction between distinct components of the IIHRM-systems or bundles of HR practices within the system in a way ‘one HR-policy enhances the effectiveness of others’ (Purcell 1999, p. 27). Complementary consistent HR practices provide for each other’s conditions most appropriate to their functioning as a whole. In line of this theoretical reasoning, several HR theories have emerged that describe distinct elements in the content of HRM systems and the way they interact as intermediating processes towards employee and organizational effectiveness.

A very basic but popular theory is the AMO theory of employee performance. In this theory the performance of people is a function of an HRM system that secures the employees’ (A)ility, (M)otivation and (O)ppportunity to do so. Its internal logic refers to bundles of HRM practices aimed at ensuring that employees can do the job (through e.g. selection, adequate training and education), will do the job (through e.g. job security, individualized performance appraisal and reward, promotion from within) and are organized in a way they are able to use their abilities and have the opportunity to influence their rewarded job performance (through e.g. job control, flexible or team based job design, participation in decision-making). Boxall et al. (2003) and also Delery et al. (2001) explicitly note that the idea of employee productivity is best served by the systemic interactions among these bundles of HRM practices. Various accounts of High Performance Work Systems draw on the AMO mechanism (see Boxall et al. 2003, Ramsey, Scholaris and Harley 2000, Appelbaum et al. 2000, Delery & Shaw 2001, Gardner, Moynihan, Park & Wright 2000, Guest 1997, Delaney & Huselid 1996)

4.2 Configurational model of consistency: supplementary fit

In contrast, supplementary consistency among HRM practices refers to HRM practices that fit together because they share similar fundamental characteristics (Kristof 1996). Other than the multiplicative approach to consistency, the configurational approach addresses multiple HRM practices as one single pattern and rejects the decomposition of HRM into elements that can be examined independently. In
general, this view asserts that efficacious relationships between systems of HRM and organizational performance stems from tight overlapping integration among a firm’s HR practices. Already, Chadwick (2000) refers to this as *virtuous overlap*. Supplementary consistency is accomplished when the HRM practices in place congruent upon their cultural or goal orientation. Theoretical approaches assert the effectiveness of this functional form of consistency through its alignment of individuals’ values about the central objectives of the system (Chadwick 2000). In this sense, HRM systems could be viewed as mechanisms to transmit beliefs and values of the organization, which shape its character (Peters in Ferris et al. 1998). In general, several configurational models of HRM could be equally effective towards organizational effectiveness, as long the HRM practices share the same characteristics.

Theories on HRM that focus on utilizing practices with an underlying set of values are found in organizational culture and climate literature (e.g. Denison 1990) and assumes HR effectiveness through shared employee perceptions of an organizations’ culture. In theories of how organizations deal with employees, one of the applications of supplementary HR consistency can be found in distinguishing HR systems either with an individualistic or collectivistic nature that promote and encourage a culture of individual versus collective interests, and competitive versus cooperative behaviours (Robert & Wasti 2002, Ramamoorthy and Russell 1998). As depicted in Table 2, two classifications were made to examine HRM practices consistent with the underlying values that fit the dimensions of either *individualism* or *collectivism*.

<table>
<thead>
<tr>
<th>Individualistic HR systems</th>
<th>Collectivistic HR systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual focused job design</td>
<td>Group focused job designs</td>
</tr>
<tr>
<td>Emphasis on individual achievements</td>
<td>Emphasis on group achievements</td>
</tr>
<tr>
<td>Individual incentive schemes</td>
<td>Group incentive schemes</td>
</tr>
<tr>
<td>Formal appraisal processes with feedback about performance</td>
<td>Informal appraisals</td>
</tr>
<tr>
<td>Merit-based hiring and promotion</td>
<td>Hiring and promoting individuals on the basis of their loyalty and seniority</td>
</tr>
</tbody>
</table>

*Table 1: Classifications of individualistic-collectivistic HRM practices (based on Ramamoorthy and Russell 1998)*

It is assumed that HRM systems, which include contradictory values, may be ineffective. For example Ramamoorthy et al. (1998, p. 572) argue that on the one hand the individualized reward systems emphasizes the individual needs over group needs of the employee. On the other hand, a team-based job design emphasizes group needs over individual needs, as people are more dependent on each other in achieving goals. These two conflicting dimensions would enhance the risk that collectivistic needs diminish in favour of the individual needs. Eventually resulting in employees not contributing to the effectiveness of a team-based job design.

4.3 Complementary fit versus supplementary fit

Comparing the two distinct ‘origins of synergy’ among HRM practices (Chadwick 2000) it could be argued that the underlying theories described conflict with each other. The AMO-theory for example emphasizes individualized performance pay to motivate individuals, while at the same time emphasizing flexible and team-based job design to provide opportunities for the optimal utilization of employee skills and abilities. Comparing this reasoning to the supplementary HR consistency of individualistic or collectivistic values, this would however be an inconsistent situation.

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5 CONCEPTUAL ANCHOR 2: THE CRITERION OF INTERNAL HR CONSISTENCY

Having identified the two theoretical approaches to how HRM practices construe an internally consistent HRM system, it leaves open the question of whether its degree of consistency is determined by its system-attributes or by its outcomes? According to Venkatraman (1989) this has critical implications for the theoretical underpinning of the internal consistency concept as well as testing its effects, while it separates the existence of consistency from the effects of consistency. It refers to the possibility of an organization to align its HRM practices towards the accomplishment of one specific goal (e.g. employee performance, flexibility or health) or to the notion that effects of internal consistency are generalizable to multiple performance measures. The main question refers to whether or not the concept of internal HR-consistency under study is anchored to a particular criterion? To adopt a criterion-specific or criterion-free conceptualisation, scholars must choose if they want predict a particular outcome by the interaction between HRM variables or want to determine the degree of consistency among the HRM system attributes before relating it to one or multiple outcome variables.

To relate this conceptual anchor to the complementary and supplementary approach to consistency we discuss two different schematic representations of consistency based on Venkatraman (1989).

5.1 Fit as Moderation: Criterion-based consistency

Figure 2a represents the model for what Venkatraman labels ‘fit as moderation’, which theoretically nicely matches the multiplicative approach to internal HRM consistency. An important aspect of this functional form is that a significant interaction effect is the indicator for consistency defined in this multiplicative way (see Delery 1998). Here, consistency derives its meaning through its anchor with a particular criterion (Venkatraman 1989, p. 425), as such we speak of criterion-based consistency.

Returning to the AMO-framework of performance, testing this theory would provide a good example of a proposed interaction between HRM practices aimed at enhancing employee ability, motivation and opportunity as it is specifically tied to the criterion of employee performance. In this case the contribution of internal HR consistency would be measured by explicitly using a three-way interaction term in a regression analyses on performance, as it does not assume that other critical HR goals of are also met. This issue addressed by for example Ramsey et al. (2000) and Pececi (2004) who argue that High Performance HR systems do not guarantee, for example, employee well being because of the possibility of unhealthy spin-offs such as workload intensification and work-family conflicts.
Similarly, HRM practices associated with employee well being may not be associated with performance.

5.2 Fit as Covariance: Character-based consistency

Figure 2b presents a conceptual model labeled ‘fit as covariation’. Chadwick (2000, p.4) notes that this methodology is based on the shared variance of the characteristics of a set HRM practices, nicely matching the notion of supplementary HR consistency. Here, the shared variance of a set of HRM practices could represent the latent, underlying architecture, philosophy or character that ties a set of HRM practices together (Chadwick 2000, Delery 1998). As already mentioned, this more character-based view on consistency is closely tied to the culture or climate of the work setting (e.g. Schneider, Wheeler & Cox 1992). In this view HRM systems influence employee attitudes and behavior, as well as organizational outcomes, intermediated by a shared employee interpretation of a certain work climate (Bowen & Ostroff 2004, Ferris et al. 1998, Guzzo & Noonan 1994). As such, Bowen & Ostroff (2004) argue that consistency among HRM practices in reinforcing a certain climate, avoids a ‘weak situation’ in which ambiguities promote counterproductive variability in employee work behavior or unintended sense making. The extent to which HRM practices in an organization share a similar underlying character, for example collectivism, would be the main research goal. Without a specific criterion, the focus is on effects of employee attitudes and behavior due to the HR (in)consistency itself, other than the consistency determined by specifying its criterion.

6 CONCEPTUAL ANCHOR 3: PERCEPTIONS OF INTERNAL HR CONSISTENCY

Our last conceptual anchor focuses on whether to include an ‘executers’ (management) or a ‘recipients’ (employees) perception of HRM in making sense of internal consistency. In most strategic HRM research, data on HRM systems is collected through managerial information on the HRM practices in place. But being the primary recipients and consumers of HRM, employee reactions to a set of HRM practices can be helpful if we want to gain a fuller understanding of the HRM phenomenon (Guest 1999). While research in the field of organizational behaviour and industrial psychology sufficiently relates employee perceptions of work and organizational characteristics to attitudes and individual performance outcomes, employee perceptions of consistent combinations of HRM practices and organizational outcomes are less integrated. Consequently, one could distinguish a managerial and employee perspective on HR consistency for several reasons.

First, supplementary HR consistency is viewed as a linking mechanism to outcomes that builds shared, collective perceptions, attitudes and behaviours among employees (Bowen & Ostroff 2004). Its effect is only interpretable through the degree of variance that exists among the perceptions of a group of employees of a particular value underlying an HRM system. As such, taking into account employee perceptions of well-communicated values is an inherent aspect of testing the effects of supplementary HR consistency.

Second, management and employees may in fact differ in their beliefs about what processes are consistent towards performance goals. As high performance management systems gain popularity among managers, the deployment of a consistent HR system aimed at enhancing skills, motivation and opportunity may, however, elicit a ‘weak situation’ when containing mixed elements of collectivism and individualism. As collectivism is more grounded on egalitarianism, conflicting elements of individualism may provoke employee perceptions of ambiguity and fairness, while for them it is not clear what the employer is like and what is expected (Bowen & Ostroff 2000).

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1 Venkatraman (1989) also distinguished the useful concept of ‘fit as profile deviation’, which asserts the degree of adherence to a specified theoretical ideal-profile that has an significant effect on a particular criterion. For reasons of parsimony we will not specifically address this functional form in this paper.
Therefore, the managerial logic of tying HRM practices to a certain criterion of performance (like the AMO-framework does) may invoke dysfunctional ambiguity when taking into account the supplementary consistency among HRM practices that only can be determined through shared employee perceptions of the HRM-system’s character.

7 DISCUSSION: ALL FOR ONE OR ONE FOR ALL?

Although several empirical examinations of the effects of HR systems are around (e.g. Arthur 1992, Huselid 1995, Youndt et al. 1996, Boselie 2002), conceptualisations are predominantly empirically derived and few sufficiently describe how the HRM practices within the system support and enhance one another (Delery 1998). We presented three conceptual anchors one could take into consideration when examining issues of internal HR consistency, starting off with distinguishing two ‘origins of synergy’ (Chadwick 2000): complementary and supplementary HR consistency.

To illustrate complementary HR consistency, we used the basic AMO-framework underlying the notions of High Performance HR Systems, which recognizes distinctive HRM practices that combine into bundles at the level of ability, motivation and the opportunity to contribute to specifically the criterion of operational performance. The criterion-specificity of this theory, and as such the interpretation of consistency, is related to the second conceptual anchor. Here we argue that internal HR consistency effects can only be determined when anchored to a specific criterion. Both data on HRM systems (ability, motivation and opportunity-enhancing HRM practices) and operational performance could be obtained on a managerial level. We classify this line of reasoning on consistency as ‘all for one’, while we suggest this consistency-type articulates a synergetic effect of multiple HR system components towards one specific criterion.

A recent article by Guest et al. (2004) tests this line of reasoning by thinking out loud: ‘does a low use of HRM practices associated with a high performance system imply a limited use of a high performance approach, or does it at the same time imply a different HR system?’ (p. 81). When an AMO-framework serves as the theoretical assumption, a limited use of practices associated with a high performance system (implying that it does not fulfil all three AMO-components) would lead us to conclude they do not or negatively interact towards performance. This differentiates the complementary consistency-approach from an additive approach, which proposes a positive correlation between the number of independent AMO-based practices present in the organization and operational performance (but inherently conflicts with the used theory).

But could a low use of high performance practices then imply a different HR system? We suspect it could. As we discussed the notion of supplementary HR consistency, also its character could tie a system together. Other practices than specifically AMO-based practices could be considered theoretically consistent as well. Supplementary HR consistency proposes a strong culture or climate within a work setting (Denison 1990, Schneider et al. 1992, Ferris et al. 1998, Bowen et al. 2004) that mediates the relationship between HRM systems and employee attitudes and behaviour. In this view, one expects an effect of multiple HRM practices through a ‘strong situation’, which can be caught in the degree of within-group agreement among employees about what the organization is like in terms of its values (Bowen & Ostroff 2004). The internal consistency itself is determined by employee perceptions and not by anchoring consistency to a specific criterion. Consequently, we classify this line of reasoning on consistency as ‘one for all’, while we suggest this consistency-type can benefit or constrain multiple goals through the degree of variance of one climate perception (e.g. collectivism or individualism) among employees.
Taken together, Figure 3 shows our two most opposite tracks of consistency reasoning in human resource management. Here, the 'all for one'-track refers to the notion of complementary consistency of multiple components that interact with each other towards one criterion (as in the AMO-framework). Alternatively, the 'one for all'-track articulates the consistency of one shared perception on the work climate not tied to a specific criterion but rather generalizable to a set of employee outcomes (as in the work climate framework).

"ALL FOR ONE"

Complementary HR Consistency ➔ Criterion specific ➔ Management Perception ➔ Operational Performance

CONCEPTUAL ANCHOR 1 ➔ CONCEPTUAL ANCHOR 2 ➔ CONCEPTUAL ANCHOR 3 ➔ PERFORMANCE OUTCOMES OF INTERNAL HR CONSISTENCY

Theoretical Approach ➔ Criterion-Specificity ➔ Actor Perception

Supplementary HR Consistency ➔ Criterion-free (Character) ➔ Employee Perception ➔ Attitudinal Outcomes

"ONE FOR ALL"

Figure 3: Two tracks of reasoning on internal HR consistency

8 FUTURE RESEARCH DIRECTIONS

Joyce et al. (1983), Drazin et al. (1985) Venkatraman (1989), Kristof (1996) and Chadwick (1999) all point out that testing only one form of (HR) consistency often leaves more questions unanswered than resolved. Consequently, adequate consistency research calls for testing competing theories and methodologies in the same dataset. To eventually provide some insight into if and which functional form of HR-consistency is most significant towards organizational effectiveness, the two competing tracks of reasoning as presented could be tested simultaneously addressing several research goals.

First, naturally there are more examples of theory available that fit the either notion of complementary or supplementary consistency than the two presented in this article. As such, further research efforts could include already existing theories on what ties HRM practices together and emphasize possible conflicting theoretical mechanisms when examined on the level of actual HRM practices. Illustrative are conflicts due to competing goals in which different compositions of HR systems are relevant to different measures of effectiveness. For example, short-term and long-term goals of productivity and innovation respectively, demand a different focus on the organizations' HR activities and are hard to pursue equally effective at the same time.
Second, as displayed in Figure 3 supplementary and complementary HR consistency may predict particular dependent variables. Kristof (1996) already made this possibility explicit in the context of person-organization fit. But it could be applicable to HR consistency in the way complementarity consistency focuses on the functionalistic complementarities among employee attributes (ability, motivation, opportunity) needed to contribute to their daily operational performance. In contrast, supplementary HR consistency focuses on the way employees have a shared sense of what the organization is like in terms of its values and goals. Here, consistency may predict a stronger effect on more affective, attitudinal outcomes such as employee commitment and job satisfaction, or skepticism and mistrust, but a lesser effect on operational performance because this notion is more ‘distally removed from the daily work behaviors’ (Kristof 1996, p. 31).

Similarly, researchers do not agree on the fact if the affective attitudinal outcomes also affect operational performance. For instance, Peccci’s (2004) preliminary findings (using the UK-based WERS98 data) suggest that the set of HR practices that help to maximize employee well-being are not necessarily those that make up supposedly more highly effective high performance work systems. As such, he emphasizes the decoupling of economic and social effects of HR practices. Within the framework presented in this paper, it could be suggested that different forms of consistency within the same set of practices have either economic or social effects. Testing this hypothesis would contribute to this notion.

In contrast, assuming that affective employee attitudes do mediate the link between HRM and operational performance, the effects of the two functional forms could be integrated by stating that complementary HR inconsistency leads to operational performance when HRM practices share underlying values. It could be tested whether the two consistencies have an additive effect on operational performance.

A third research goal, that follows the theories used, is including both a management and employee perceptions of HRM systems as we argue that they both are the primary agents in the effectiveness of competing consistency models. It would provide an adequate opportunity to include workers perceptions in research on HRM and performance, as they are now often ‘muted’ in this debate (Guest 1999).

Last, to control for the fact that HRM practices may differ across sub-units and functions within an organization (Lepak & Snell 1999, Wright et al. 1999), it could be more appropriate to test HR consistency effects on a sub-unit level of analysis by including unit-(HR) managers and measures of shared perceptions employees within the sub-unit under study.

To conclude, by contributing to a more refined approach to the complex matter of internal HR consistency, this paper supports the notion that HR consistency is not uni-conceptual. Scholars are encouraged to, for example, make distinctions between the two functional forms of consistency discussed in this paper and to examine both conceptualisations in the same dataset, to include both economic and social outcomes, and to obtain data from both managers and employees. However, it should be emphasized that the proposed two tracks of reasoning do not embrace all possible ways to go about the concept internal HR consistency. As already mentioned other tracks of reasoning could result from the different considerations represented by each conceptual anchor. However, the aim was to introduce to two substantial different views on incorporating the concept of internal consistency in HRM research and to provide some useful considerations to take into account in the development of adequate research designs.
References


THE IMPACT OF FOREIGN DIRECT INVESTMENT ON
DEVELOPMENT: THE ROLE OF FDI CHARACTERISTICS

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Abstract

The impact of foreign direct investment (FDI) on host country economic growth and development has triggered considerable controversy, in academia as well as in civil society and politics. The current empirical evidence concerning the FDI-development relationship is far from conclusive and debate on the ultimate costs or benefits of foreign investment for host country development is yet undecided.

This paper reviews the existing literature, which is dominated by inputs from development economics, macroeconomics and industrial economics. It is argued that lacunas exist due to the failure of systematically taking into account host country characteristics, and, in particular, the attributes of the foreign affiliate that is created by the foreign investment. An inclusive framework for analyzing the impact of FDI on development is then introduced, which brings together the existing literature and explicitly takes into consideration the interactive effects of host country characteristics and FDI attributes. Based on that framework, some concretely elaborated suggestions for future research are presented, which should lead to more insightful explanations for the observed differences across the macro-studies concerning the relationship of FDI and development.

Keywords: Foreign Direct Investment, FDI characteristics, Development, Multinational Enterprises

1 INTRODUCTION

The impact of foreign direct investment (FDI) and multinational enterprises on host country economic growth and development has triggered considerable controversy, not only in academia but also in civil society and politics. On the one hand, the rise in world-wide FDI since the 1980s has been hailed by many as a felicitous process that prospers economic growth, in particular in developing countries. FDI has been considered to be an important means inter alia to complement domestic savings, to transfer skills and technology, to improve competition and to increase the quantity and quality of employment; thus leading to increased economic growth and social development. On the other hand, however, multinational enterprises (MNEs) have been accused of crowding out local firms, of using technology that is inappropriate for local circumstances, and of transfer price manipulation (and thus reducing the tax base). However, the empirical evidence that underpins either of these claims (some recent examples include Borensztein et. al., 1998; Carkovic and Levine, 2000; Liu et al., 2001; Markusen and Venables, 1999; Aitken and Harrison, 1999) is far from conclusive, as noted by e.g. Caves (1996), Rodrik (1999), and Meyer (2004). In more popularising publications (Korten, 1995; Hertz, 2001), the potentially damaging effects of FDI (and the strategies of large multinationals) on the natural environment and social welfare have also been stressed.

The real net costs or benefits of MNEs for a host country have proven extremely difficult to estimate and are still subject to debate. This paper gives a systematic overview of both the theoretical perspectives and the empirical evidence that has been brought forward over the years in the academic debate concerning the relationship between FDI and host country (sustainable) development. This
review of the academic literature shows that the benefits of FDI for development are not as clear-cut and automatically as sometimes suggested. Instead, two factors strongly influence the extent to which FDI may be beneficial for host country development. The first includes host country characteristics such as absorptive capacity, trade policy and institutional quality. The second factor refers to foreign investment attributes, including for example the type of activity that is carried out, the motive for the investment, or the country of origin. Especially the latter group of variables – the FDI attributes – has not yet received much attention in the (predominantly economic) research on the FDI-development nexus. Yet, the results of the few initial studies indicate that this is a promising area for further research.

Consequently, in section 3, a conceptual model is introduced that brings together the existing literature and explicitly takes into consideration the interactive effects of host country characteristics and FDI attributes. This conceptual model serves as the basis for concretely elaborated suggestions for future studies. It is argued that an incremental and explorative approach, moving in consecutive studies from a more macro level of analysis with coarsely defined FDI characteristics based on secondary data, towards a more micro level of analysis with more finely elaborated affiliate attributes and primary data, is appropriate to address the current ‘missing links’ in debate on the relationship between FDI and development.

2 LITERATURE REVIEW

2.1 Mechanisms

Empirical studies focusing on the impact of FDI have almost always directly related FDI to a specific outcome variable. The specific mechanisms through which FDI may impact development are barely addressed (Alfaro and Rodriguez-Clare, 2004). However, a good understanding of the impact of FDI on development necessitates a grasp of the underlying processes that shape this relationship. In addition, the distinction is vital from a government policy perspective (Chung et al., 2003). Measures to stimulate the overall inflow of investment undoubtedly differ from those promoting the transfer of technology or the creation of linkages.

Four mechanisms through which FDI impacts development can be distinguished, including size effects, technology transfer, competition, and the creation of ‘linkages’ with local buyers and suppliers.

Size effects refer to the extent to which the production base of the host country may be expanded by the inflow of FDI. By adding to the host country’s savings and investments, FDI may enlarge the production base at a higher rate than would have been possible if a host country had to rely on domestic sources of savings alone. FDI could thus build up sectors or industries in which local firms have not invested, or enlarge the scale of existing plants or industries. Through its size effects, FDI may also salvage and recapitalise inefficient local firms, thereby assuring that the scale of production at least not decreases.

Multinational firms are key actors in creating and controlling technology. Their affiliates can thus be an important source of knowledge for firms in a developing country. Technology transfer occurs when managerial skills, products or production processes are transferred – intentionally or unintentionally – from MNE affiliate(s) to local firms. For example, MNEs can provide technical assistance to raise the quality of the suppliers’ products. Exposure to the (superior) technologies of the MNE could induce local firms to update their own production methods. Technology transfer and ‘spillover effects’ can also arise from labour migration of MNE-trained workers to local firms.

If however technological upgrading becomes too dependent on decisions of foreign MNEs, the growth of a local innovative basis could be impaired. In addition, MNEs are often blamed for failing to adopt
their (capital-intensive) technologies that can sometimes be inappropriate for developing country (labour-intensive) contexts. Finally, as discussed in more detail in section 5, an important determinant of the size of the realised spillovers is the capacity of the local firms to ‘absorb’ the foreign technology.

An investment of an MNE in a local economy can stimulate competition and improve the allocation of resources. This may be especially the case when MNEs enter industries where high entry barriers reduced the degree of domestic competition (e.g. utilities). However, fears are often expressed that MNEs with their superior technology, greater possibilities for utilising economies of scale and access to larger financial resources may out-compete the local, often much smaller firms (‘crowding out’). In a strict economic sense, the substitution of inefficient local firms does not have to be problematic, as long as local firms are replaced by competing, more efficient firms. Yet, crowding out could imply an increase in market concentration, with the associated increased risk of market power abuse, appropriation of monopoly rents and deterioration of resource allocation. Crowding out may have considerable negative social and political consequences as well. These potential crowding out effects need not be limited to product market competition alone, but can also extend to e.g. capital markets (credit). If FDI is financed by local borrowing, credit constraints for local firms could well increase (Harrison and McMillan, 2003).

The linkages of the MNE affiliate with local buyers and suppliers form the main channel through which inter-industry spillovers occur. Backward linkages are sourcing relations with suppliers, and are created when MNE affiliates buy their inputs from local firms. This can not only raise the overall output of local supplier firms, but also their productivity and the quality of their products, as MNEs might provide technical and managerial assistance or assist in purchasing raw materials and intermediary goods. Forward linkages refer to relations with buyers – either consumers or other firms using the MNEs intermediate products as part of their own production process. Buyers of MNE products could benefit from products with lower prices or better quality, and – in Business-to-Business relationships – from the marketing knowledge of the MNE.

2.2 Effects of FDI on the economic dimensions of development

The effect of FDI on the economic dimensions of development has been studied extensively in the academic literature (mainly the field of economics). While most empirical studies implicitly refer to one or more of the four mechanisms described above, they commonly related FDI directly to specific economic indicator to measure the benefits (or costs) of FDI for host countries. The three indicators that are most often include economic or productivity growth, domestic investment, and trade.

Domestic productivity growth – the growth in productivity of local firms – is often seen as the indicator that assures that local firms have been able to successfully deal with, and benefit from, the entrance of an MNE. Whether caused by enhanced competition, technology transfer or linkages, productivity growth means that local firms have been able to upgrade their efficiency and product quality. In contrast, decreasing productivity indicates that demand for products by local firms stalled.

The results of empirical studies on the impact of FDI on productivity often contradict each other (e.g., Borensztein et. al., 1998; Carkovic and Levine, 2000). As a crude generalisation, one could say that the evidence shows that the impact of FDI on productivity in most (Southeast) Asian countries has mainly been positive (e.g., Liu et al. (2001)); while the impact has been predominantly negative for the majority of Central and Eastern European countries (e.g., Konings, 2000, Mencinger 2003). The effect of FDI on productivity growth of local firms in Latin American countries varies (e.g., Ramírez, 2000; Aitken and Harrison, 1999).

The level and growth of domestic investment and capital accumulation refers to the extent to which FDI complements or substitutes domestic investment. The size and growth of the domestic capital base determines for a large part the extent to which FDI is growth-enhancing. Decreases in domestic
investment means that local firms have been crowded out, while increases imply that local firms have been able to make the additional capital investments in order to keep up with the MNE affiliate.

Evidence regarding the impact of FDI on domestic investment is less controversial than that for productivity. Most studies found a positive, if weak, impact of FDI on domestic investment (Borensztein et al., 1998; Bosworth and Collins, 1999). Some regional differences were found though: in Asia positive effects appear to have dominated (Agrawal, 2000), while in Latin America, effects have been rather negative (Agosin and Mayer, 2000).

Trade and (local) linkage creation are basically two sides of the same coin. The share of inputs an MNE needs that is not bought locally (i.e., through backward linkages), should be imported. And the proportion of sales that is not distributed locally (i.e. through forward linkages), is – by definition – exported. Yet the dynamics of the relationship between FDI and trade are intricate. Inward FDI may form a substitute for the imported products that previously served the market, or be complemented by additional imports when local inputs are not suitable. FDI may generate additional exports if aimed to be an export platform, or decrease exports when taking over a viable exporting domestic firm and producing for the domestic market only, serving previous export markets from other affiliates.

Whether FDI is associated with a net increase or decrease in a country’s trade balance is still not settled conclusively. It is usually assumed that especially in Asian countries, FDI has triggered exports, although Ernst et al. (1998) showed that this was only the case for low tech products in countries with weak domestic business sectors. In Central and Eastern Europe, evidence on the effect of FDI exports is mixed (e.g., Hooley et al., 1996; Hoekman and Djankov, 1997).

The net effect of inward FDI on exports should always be seen in balance with the imports these inward capital flows trigger. Since many empirical studies have found evidence of the creation of backward linkages with suppliers (e.g., Alfaro and Rodriguez-Clare, 2004), imports would appear to be relatively low. However, studies often find a negative impact of FDI inflows on trade balances (De Melo and Fukasaku, 2000), in particular in Export Processing Zones (EPZs). However, over time, these negative effects are generally reduced (Fry, 1996).

2.3 Effects of FDI on the social and environmental dimensions of development

Whereas the effects of FDI on economic growth have received considerable attention, the effects of FDI on social and environmental issues have largely remained unstudied. This is likely at least partly due to the difficulties in quantifying such effects and finding enough reliable and comparable data to analyse. This section reviews the (sometimes scarce) empirical findings on three of the most often discussed topics: employment and wages, inequality, and the natural environment.

Foreign firms are generally shown to create direct and especially also indirect employment (Görg, 2000), though it has been argued that their use of relatively (to local standards) capital intensive technology reduces this possible effect on employment. In addition, MNE affiliates pay – on average – higher wages than local firms in developing countries, either because they are more productive or to prevent employees from switching jobs to domestically owned competitors (Globerman et al., 1994). However, although MNEs generally pay higher wages to all their employees in comparison to local firms, skilled employees benefit more (Lipsey and Sjoholm, 2004; Feenstra and Hanson, 1997). As a result, wage inequality between high skilled and low skilled employees is sometimes increased.

One of the most debated issues regarding the impact of FDI on employment and wages has been the quality of the employment, rather than its quantity or remuneration. Especially in cases where governments compete to attract FDI, labour standards may be less vigilantly enforced. However, there is little evidence to suggest that there is a ‘race to the bottom’, whereby developing countries lower their labour standards to attract FDI, or that employment conditions in MNEs are generally worse than in local firms – though there is no evidence for a ‘race to the top’, either.
Perhaps the most hoped-for effect of FDI in developing countries is the alleviation of poverty and the diminishing of (excessive) income inequality. These are generally not a direct effect of FDI, but could result from FDI-induced growth. Systematic evidence on the effects of FDI on income distribution and poverty in developing countries is severely limited, and dated. Among the most recent studies is Tsai (1995), analysing the effect of FDI on Gini-coefficients in the 1970s. The study contested earlier findings that FDI and inequality are positively related, and argued that these results were caused by geographical differences in both inequality and FDI. Even when considering more indirect ways, the effects of FDI on income inequality are inconclusive. A review of the literature on growth and inequality by Bigsten and Levin (2000) concluded that as of yet, no systematic pattern of change in income distribution during recent decades, or any systematic link from growth to inequality could be established. While the incidence of poverty proved to be reducible in case of sufficient economic growth (e.g., Dollar and Kraay, 2000), this is not necessarily the case for income inequality.

The net effect of FDI on the natural environment consists of the sum of negative size effects and positive technology and competition effects. Foreign investment may lead to increased production of polluting goods or to an expansion in industrial activity. But to the extend that FDI enhances competition and involves the use of more efficient technologies, the environmental impact of that production could be (relatively) reduced. In one of the very few empirical studies that relates FDI to environmental outcomes, Talukdar and Meisner (2003) analysed data on carbon dioxide emissions for 44 developing countries in the 1987-1995 period, and found that emissions are reduced with increased shares of foreign direct investment vis-à-vis domestic investment, implying that foreign firms are less polluting than domestic firms.

As with employment, the debate on multinationals and the environment has mainly revolved around the role of environmental policy competition as determinant FDI flows, instead of around the impact of FDI on overall pollution. Empirical research showed that the risk of relocation of activity towards low standard countries is rather small (e.g., Wheeler, 2001). Yet, while there are no indications of a real ‘race to the bottom’ in environmental standards, some evidence exists that competitiveness concerns have dampened governments’ enthusiasm to raise environmental standards (see Nordstrom and Vaughan, 1999).

2.4 Explaining the diverging results: the role of host country and FDI characteristics

The diverging empirical results for virtually all dimensions of development, triggered several studies to look for an explanation for these differences. For example, a particularly interesting result was obtained by Görg and Greenaway (2001), who conducted a meta-analysis of 31 leading studies on productivity spillovers due to FDI, and concluded that the research design of the study crucially affected whether or not significant positive spillovers were found. Most studies that found a positive relationship were based on cross-sectional data, while studies using panel data (which are generally considered superior), found either insignificant or even negative spillovers.

Others have focused on more substantive explanations. In particular, the literature suggest that (at least) two intervening variables moderate the relationship between FDI and development, and that therefore should be taken into account when examining this relationship. These groups of variables include (1) host country characteristics and (2) foreign affiliate attributes.

Host country characteristics have already received some attention in the recent empirical literature in economics, mainly in the context of ‘thresholds’ – particular minimum values that countries should have achieved on certain variables before FDI can have a positive effect on (economic) development. Host country characteristics (including government policy) determine the so-called ‘absorptive capacity’ of a host country – the capacity to actually reap the potential benefits of FDI. It implies that a particular foreign investment could have a beneficial impact in one country, while the same investment may have detrimental effects in the next. Examples of such host country characteristics that have been shown to moderate the effect of FDI on development include institutions (Rodrik,
1999), openness to trade (Balasubramanyam et al., 1996), financial market development (Alfaro et al., 2001), and technological development (Borenstein et al., 1998).

The second variable constitutes the attributes of the foreign affiliate. Introducing FDI attributes implies that FDI is no longer seen as a uniform flow of investment across borders, but instead as a multidimensional ‘package’ of resources. The inclusion of FDI characteristics in analysing the relation between FDI and development is new terrain. No theory has yet been developed that proposes a ‘definite’ list of important FDI characteristics that are important. This implies that studying these characteristics will result in research with a relatively explorative nature; and that every selection of foreign affiliate attributes is destined to remain ‘random’ or eclectic. A long list can be made of potential attributes that could influence the extent to which the effects of FDI are truly advantageous. Lall (1995) for example mentioned inter alia the size and mode of entry, the nature of the (production) techniques chosen, the trade orientation, the place of the affiliate in the global production network and trade strategies of the parent company. Other dimensions may include the type of activity that takes place, or the aim with which the investment is made.

Stressing the importance of including foreign affiliate attributes or FDI characteristics is not only valid for intuitive reasons (e.g., the impact of a $1m investment in a computer chips manufacturing plant is not likely to be the same as, say, a $1m investment in an ice cream distribution centre), but also for methodological ones (unless it is proven at the micro level that foreign subsidiaries are all similar in behaviour and impact, one cannot generalise at the macro level to assume homogeneity of FDI flows). In addition, the entire field of International Business (and Business and Management studies in general) is based on studying differences across firms and investments, although linking the range of organizational, managerial, and strategic characteristics that are identified are mostly related to firm performance, rather than ‘host country performance’.

Although studies are still extremely scarce (partly due to data-constraints), some first results clearly suggest that investment with different characteristics indeed have diverging development consequences. For example, Mencinger (2003) found that the negative causal relationship between FDI and growth in eight transition economies can be explained by the mode of entry of FDI. FDI in transition economies had been predominantly acquisitions (of which the proceeds were spent on consumption rather than investment) and not greenfield investments. Kearns and Ruane (2001) found that in Ireland, the scale of R&D activity of foreign affiliates is positively related to job creation rates. And Egelhoff et al. (2000) related FDI characteristics to trade patterns, and found that industry, subsidiary size, and parent country all significantly influence the size and patterns of trade.

2.5 Summary and Conclusion

The growing importance of FDI in the economies of many developing countries has raised important questions concerning the economic, social and environmental consequences of those investments. The overview of the academic (empirical) literature on the FDI-development relationship shows that it is highly unlikely that those questions can ever be answered with simple generalizations and sweeping statements. Table 1 gives an overview the evidence found so far. It shows at present, on hardly any of the specified dimensions, sufficient and conclusive evidence exists. Most research efforts have remained concentrated on the economic dimensions of development, instead of on the social and environmental issues. And though host country characteristics have already received considerable attention, more research is still necessary.

But judged by the (almost) empty cells in the last column of the table, the development effects of different types of FDI have received the least empirical consideration. An important reason is that the debate on the impact of FDI on development has taken place mainly in (macro) economics, where taking into account affiliate characteristics (and business strategy) is less of an issue of attention. Yet given the results of the few initial studies reviewed here, it appears that taking into account the
differences in FDI characteristics in future empirical research is bound to enhance our understanding of whether, to what extent, in what way, and under what conditions, FDI contributes to development.

<table>
<thead>
<tr>
<th>Dimension of development</th>
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<td></td>
<td>Overall</td>
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<tr>
<td>Economic</td>
<td></td>
</tr>
<tr>
<td>Productivity</td>
<td>Mixed. Cross-section data studies tend to (strongly) overstate positive effects in comparison to panel data studies (that find no, or negative effects).</td>
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<tr>
<td>Domestic inv.</td>
<td>Small but generally positive</td>
</tr>
<tr>
<td>Trade</td>
<td>Generally positive on exports, but often coupled with large imports. Over time, trade balance effects improve.</td>
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<tr>
<td>Social</td>
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<tr>
<td>Employment</td>
<td>Positive for quantity of employment. Pay higher wages than local firms; yet skilled workers benefit more</td>
</tr>
<tr>
<td>Inequality</td>
<td>B.R. Inconclusive, no particular pos or neg effects found.</td>
</tr>
<tr>
<td>Environment</td>
<td>B.R. MNEs are relatively less polluting than domestic firms</td>
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</tbody>
</table>

Notes:
N.R.: Not Researched – i.e., there appears to be no research done in this area
B.R.: Barely Researched – i.e., statements in these cells are based on only one or very few studies

*Table 1* The effect of FDI on development: what do we really know?

3 **FRAMEWORK, METHODOLOGY AND CONCRETE RESEARCH PLANS**

Figure 1 gives a conceptual framework that summarises the theoretical and empirical findings reviewed above and that explicitly takes into consideration the interactive role of host country characteristics and FDI characteristics in the FDI-development relationship. It highlights how development – which can include a multitude of economic, social and ecological dimensions at both the local as well as the more macro level of analysis – can be influenced by FDI with various characteristics (arrows [1a] and [1b] in figure 1). These two arrows represent ‘sum’ of the size, technology transfer, competition and linkages effects as reviewed in section 2.1. These effects do not depend on the inflow of FDI, but also on the characteristics of the host country in which the inward investment occurs (arrows [2a] and [2b] in figure 1), which also have an independent effect on local
firms and development (arrows [3a] and [3b]). Finally, a set of control variables – that differ according to the specific dimension of development that is focused on – is included (arrows [4a] and [4b]).

The relative simplicity of the framework should not hide that the relationship between FDI and development remains an extremely complex one. The FDI-development nexus involves a multitude of dimensions and characteristics, and ultimate causes and consequences are sometimes difficult the separate. The challenge is to translate this framework to a series of ‘manageable’ research projects, that are on the one hand focused and specific but on the other hand still ‘broad’ enough to capture the essence of the proposed framework: the inclusion of both affiliate attributes and host country characteristics in explaining the relation between FDI and development. To do so, this Ph.D. research plans to proceed as follows:

First of all, this Ph.D. research will focus on a small selection of the many economic and social dimensions of development. The main dependent variables of the empirical research projects will be productivity growth, export competitiveness, and (relative) wages.

Secondly, as these three dependent variables have already received considerable attention in economics, the empirical (quantitative) studies that I plan to conduct will build upon models already defined in that field, whilst incorporating the new interactions with host country and FDI characteristics. For example, in the case of productivity growth, this would imply an extension of the kind of productivity growth equations (standard production functions) that are currently used. Research that currently tests the impact of FDI on productivity growth usually includes (besides control variables) one particular variable that captures the share of foreign investment (in total assets or output) to assess the effect of FDI on productivity. The ‘FDI share’ variable is currently sometimes interacted with a specific host country characteristic. It seems that FDI characteristics could be interacted with the ‘FDI share’ variable in much the same way.

Figure 1. The impact of FDI on development: a conceptual framework
This is a very general model (to be further elaborated to correct for autocorrelation and endogeneity) that depicts the type of (time fixed effects) regression analysis that will be conducted:

\[ Y_{it} = \alpha_i + \beta_1 CONTROL_{it} + \beta_2 FDIshare_{it} + \beta_3 C.CHAR_{it} + \beta_4 F.CHAR_{it} + \beta_5 INTER_{it} + \epsilon_{it} \]

where \( Y \) represents the outcome variable (so either productivity growth, export competitiveness or (relative) wages); \( CONTROL \) represent the set of relevant control variables (literature based) for each individual dependent variable; \( FDIshare \), \( C.CHAR \) and \( F.CHAR \) refer to the share of FDI in production, host country characteristics and FDI characteristics, respectively; while \( INTER \) refers to the two-way and three-way interactions between \( FDIshare \) and \( C.Char \); \( FDIshare \) and \( F.Char \); and \( FDIshare \), \( C.Char \) and \( F.Char \).

3.1 Data and empirical analysis

Given that there is no ‘list’ of characteristics to begin with, an incremental (and perhaps even rather ‘pragmatic’) approach is proposed by starting from relatively coarse-grained to more finely-defined FDI characteristics, and by moving from a relatively macro towards relatively micro levels of analysis in consecutive stages. The literature on the relevant host country characteristics is followed as much as possible, and include known measures for trade openness (sum of trade as percentage of GDP), absorptive capacity (secondary schooling enrolment), and institutional quality (ICRG indicator) in each of the empirical studies. The aim is to move towards the micro level of analysis (and finely-defined FDI characteristics) as much as possible while maintaining a certain scope and international comparability (i.e. no individual case studies or analyses of country-specific census data).

A first study will therefore examine how the country of origin of FDI influences the relationship between FDI and productivity growth. Country of origin effects – even in a seemingly ‘global’ age – have been extensively documented, and continue to influence a large range of strategic and organisational characteristics of MNEs (see e.g. Harzing and Sorge, 2003). Yet, the country of origin of FDI has not yet been linked to the consequences of that FDI for development. It is possible to analyse this relationship at the national (macro, or cross-country) level for a considerable set of countries and time periods, given the presence of secondary data (by Statistics Offices for (most) of the largest FDI home countries).

While this makes for a very feasible first ‘go’ at exploring the influence of FDI characteristics on the FDI-development relationship, the country of origin of FDI is not a very specific definition of the exact kind of characteristics of FDI that are involved. Therefore, in the consequent studies I will move from national-level outcome variables towards sector-level outcome variables.

Thus, the next stage of the research encompasses a set of studies that analyse the relation between FDI and development at the sector level, tying together FDI characteristics measured at the sector level to outcome variables measured at the sector level. In this stage of the research, it is possible to use existing (i.e. secondary) data for a first exploration of the issues and dynamics involved. Concretely, this stage involves a match of mainly economic characteristics (capital intensity, productivity, R&D intensity, labour costs, all measured at the sector level) of US investments in developing countries, with sector outcomes (productivity, exports, wages), while correcting for shares of other (for example European and Japanese) FDI in the sector.

The third stage continues to focus on the same sector level outcomes, but tries to explain these with more detailed (i.e. micro) data of foreign affiliates attributes. By aggregating all the heterogeneous investments that compose an inflow of FDI, we can gain insight into how micro-level characteristics affect sector-level outcomes. The activities in developing countries of a sample of the world’s largest MNEs are documented (in collaboration with the SCOPE Research Centre of Erasmus University). While this may seem a daunting task, it is worth considering that many processes and variables measured at the macro (or sector) level are in fact largely shaped by only a small number of corporate actors. For example, the top 500 largest MNEs are responsible for 90% of FDI and 50% of world trade.
(Rugman, 2000). Focussing on the activities of these largest firms in developing countries (even if limited to certain sectors and certain countries) would make it possible to both examine the relationship between firm strategy and foreign affiliate characteristics, and the effects of FDI with such different characteristics for development. Data that will be collected include the exact type of activity that takes place, and the position of the affiliate in the intra-firm network of subsidiaries.

4 SUMMARY AND CONCLUSION

This paper developed an inclusive conceptual model to grasp the complexities of the relation between FDI and development. The model is based on a review of the literature in development economics, industrial economics and international business. It highlights how the dimensions of development (economic, social and environmental) are influenced by FDI via size effects, technology transfer, competition and linkage creation. The model also pinpointed the two main variables that moderate the relationships: the characteristics of the host country in which the inward investment occurs, and the strategy of the MNE that determines the characteristics of the foreign affiliate including its position in the overall MNE’s internal and external network of business and other partners.

At present, on hardly any dimension or causal relationship specified in the model, sufficient and conclusive evidence exists. Partly this is due to the complexity of the problem and the difficulty in gathering more micro-level data. But another important reason is that the debate on the impact of FDI on development has taken place mainly in (macro) economics, where taking into account business strategy is less of an issue. As discussed, affiliate characteristics and their relation to development are the main elements in the framework on which research has been most scarce. Empirical research along the lines proposed on the differences that exist in development impact across subsidiaries with different characteristics and in diverging host country settings should lead to insightful explanations for observed differences across the macro-studies for the relationship of FDI and development.

References


MEASURING CUSTOMER VALUE IN CORPORATE R&D

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Abstract

A number of authors have developed instruments to assess and improve R&D quality, e.g. Foster et al. (1985), Morbey (1988), Zirger and Maidique (1990), Brown and Gobeli (1992), Szakonyi (1994) and Gerritsma and Omta (1998). However, as yet, no yardstick is available for gauging and comparing the customer perception of the value of a corporate R&D lab. It is the aim of the present paper to fill up this gap by the development and testing of an instrument for assessing customer value of corporate R&D. The instrument is based on the customer value map developed by Haar et al. (1990) to assess the value of innovation services. The two basic features of the model are the definition of customer value in terms of the comparison of the intended value by the corporate R&D lab with the desired value by its internal customers, and the identification of possible gaps between these two. The model is operationalized by selecting those aspects that define customer value for the internal business customer: 1) alignment to business needs, 2) timeliness of R&D, and 3) level of R&D-BU communication. A measure for overall customer value is constructed by combining the weighed assessment of the performance in six technology fields, ranging from fundamental research via applied research to R&D service tasks. It is concluded, that, although assessing customer value in an R&D environment is very complicated, it is possible to do so by systematically evaluating and comparing the quality perceptions of both the internal customers and the self-perception of the R&D staff.

Keywords: Customer value, TQM, R&D

1 INTRODUCTION

Today’s markets are characterized by fierce global competition and increasing customer demands. One strategy that can be adopted to survive and flourish in such an environment is to attain product superiority through conducting superior R&D. Watson (1993) emphasizes the importance of R&D by stating: ‘Companies that want to compete successfully must offer quality beyond competitors, technology before competitors and cost below competitors’ Having identified R&D as an important driver of business success, researchers and managers turned their interests to the improvement of its organization and performance. A number of authors have developed methodologies to assess the quality of the R&D process, e.g. Foster et al. (1985), Morbey (1988), Zirger and Maidique (1990), Brown and Gobeli (1992), Szakonyi (1994), and Gerritsma and Omta (1998). In addition, research was initiated to obtain measurement tools, which monitor the performance of corporate R&D.

In the 1980 and 1990s many European and US firms adapted total-quality management processes to deploy the ‘voice-of-the-customer’ (e.g. Hauser and Clausing 1988). However, operationalization of the quality concept in an R&D environment is complicated. Unlike the quality of goods, which can be measured objectively by such indicators as durability and number of defects, the quality of a research lab is very difficult to assess. As yet, no yardstick is available for gauging and comparing the customer perception of the quality of the central R&D lab. The purpose of this paper is to fill this gap by:
1) describing the development of a multiple-item scale for measuring R&D quality, and 2) discussing the results of a longitudinal study in the corporate R&D lab of a large multinational supplier company in the automotive industry, in which this scale was applied as a steering instrument.

2  THEORETICAL BACKGROUND

Although the concept of customer value is somewhat ambiguous in nature, most authors agree that it has to do with a trade-off between the benefits and the sacrifices, such as cost and time spent (e.g. Gale, 1994, Gallagher, 1997, Kim and Mauborgne, 1997). One could say that customer value drives customer satisfaction by delivering the value that customers want. Customer value may change over time. For example, as the experience with a product increases, the need for service and consulting may decrease. Evaluating the above, it can be stated that companies deliver value, and customers choose that value that best fits their needs. But the trade-off between benefits and sacrifices is complicated by differences in customer perception (Woodruff and Gardial, 1996). This is even more so for the R&D environment, which is the focus of the present study. In absence of objective measures, an appropriate approach for assessing the quality of a firm’s corporate lab is to measure the customers’ perception of its quality (Van der Haar et al. 2001). Because the distance between the corporate lab and the external customer or end-user is often indirect and intermediated by the customer oriented staff, the contact with the internal customers in the BUs and marketing is used as a proxy.

![Diagram](image)

**Figure 1. The conceptual model for the customer value instrument**

The customer value model, used in this study, is based on the customer value map developed by Haar et al. (1990) to assess the value of innovation services. The two basic features of the Customer Value model are the definition of the service quality in terms of the comparison between the expected and the perceived benefits for the customer, and the identification of the gaps between these two in the delivery process. It is the difference between the expected and the perceived benefits that determines whether a customer is satisfied or not. Because one of the most important aspects of quality of corporate R&D is the alignment with the business unit interests, the self-assessment of different aspects of quality by the corporate R&D staff is compared with an assessment of the same aspects by the most important internal customers in the Business units (gap analysis).
The model is operationalized by selecting those aspects that define customer value for the internal business customer: 1) alignment to business needs, 2) timeliness of R&D, and 3) level of R&D-BU communication. A measure for overall customer value is developed, constructed by combining the weighed assessment of the performance in six technology fields, ranging from fundamental research via applied research to R&D service tasks.

3 CONSTRUCTION OF THE CUSTOMER VALUE QUESTIONNAIRE

The construction of the Customer Value Questionnaire starts from the observation that to obtain optimal R&D performance, you need an optimal customer focus. This is reflected in the following definition of performance (Omta 2002): ‘Using the combined resources of all the participants in the supply chain in the most efficient way to provide high quality, cost-effective customer service.’ This means that first, a corporate R&D lab should ensure to provide the customers with what they want. To do this, it must increase its effectiveness by doing the right things, with the right quality. Then, the central R&D lab should seek ways to improve the efficiency of doing so (doing the right things right, at the right time etc.). An open communication structure with the (internal and external customer) will help to increase effectiveness, e.g. by improving the balance of the expected and the perceived value of the customer. The equations presented below show these assumptions in a mathematical form.

Performance = f (effectiveness, efficiency) + µ
Efficiency = f (R&D scheduling, managing R&D capabilities, costs) + µ
Effectiveness = f (objectives, timing, quality) + µ = f (customer communication) + µ

Based on literature review and expert inquiry, items representing the various variables within the four dimensions were generated to form the initial pool for the customer value instrument. The process resulted in the generation of 61 items (approximately 15 items per dimension). The 61-item instrument was subjected to two stages of data refinement. The first stage focused on (1) condensing the instrument by retaining only those items capable of discriminating across respondents having different value perspectives, and (2) examining the dimensionality of the scale and establishing the reliabilities of its components. The second stage was primarily confirmatory in nature and involved re-evaluating the condensed scale’s dimensionality and reliability by retesting the scale. Some further refinements to the scale occurred in this stage. The Customer Value Questionnaire uses five-point and seven-point Likert-scales, ranging from strongly agree to strongly disagree, with no verbal labels for the intermediate scale points in order to assess R&D performance, effectiveness, efficiency and customer communication. These dimensions are operationalized as follows.

Performance
- Relative importance of the corporate R&D lab’s objectives
- The lab’s perceived performance per objective
- Objective weighed performance, the lab’s achievements weighed for the relative importance of its objectives

Effectiveness
- Alignment of R&D projects to business priorities
- Alignment of R&D projects to market needs

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1 The parameter µ reflects the residual variation, for instance caused by the omission of certain parameters, or the natural variation in the study population, or errors in the measurements as a result of the imperfect correspondence between constructs and operationalizations.
Efficiency
- R&D Timeliness, the number of projects which are perceived to be delivered before or conform the agreed date, including:
  - Start-up time lag
  - Throughput time
  - In-time deliverance

Communication
- Customer communication, i.e. regular project progress reports and information meetings between the laboratory and customers to assess:
  - Market and competitor information
  - Quality aspects and analysis of complaints
  - Project communication improvement

The core of the Customer value Questionnaire has remained unchanged, although some minor changes have been introduced in the 5 years that the longitudinal study was conducted. If necessary, scales were rotated, in order to ensure that a higher assessment in all cases reflects a more positive judgement of the item at issue. In all cases Cronbach’s α is sufficiently high (> 0.72) to warrant confidence in the internal consistency of the different dimensions. To improve the clarity of the presentation, the 5- and 7-point Likert-scales were recalculated to 10-point scales. For the analysis of the gap between the assessments given by respondents from the Business Units and the self-assessments given by the R&D staff, two-tailed t-tests were used. Non-parametric analyses of group means, using the Kruskal-Wallis test, did not alter the conclusions.

4 METHOD OF DATA COLLECTION

The data were collected in a multinational supplier company of technology-intensive industrial components for different industries, especially automotive. The company employs about 40,000 employees worldwide, working at 83 production sites in 24 countries. The annual sales volume in 2002 amounted to about US$ 5 billion, with an operating profit margin of about 8%. In 1997, 1998, 2000 and 2002 the Customer Value Questionnaire was sent to the staff of the corporate R&D laboratory and those staff members of the business units, who are in (regular) contact with this lab. Table 1 shows the number of questionnaires sent out and the response rates of BU staff and staff of the R&D laboratory.

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<td>402</td>
<td>277</td>
<td>165</td>
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<td>R&amp;D staff</td>
<td>100</td>
<td>97</td>
<td>75</td>
<td>47</td>
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<tr>
<td>Resp. rate of BU staff</td>
<td>63%</td>
<td>48%</td>
<td>36%</td>
<td>28%</td>
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<tr>
<td>Resp. rate of R&amp;D staff</td>
<td>70%</td>
<td>70%</td>
<td>67%</td>
<td>70%</td>
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<tr>
<td>Total response rate</td>
<td>65%</td>
<td>51%</td>
<td>43%</td>
<td>38%</td>
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Table 1. Study population and response rates 1997-2002

The number of questionnaires sent out in 2002 was clearly lower than in the preceding years. For the part that was sent to the staff in the Business Units, this was due to the fact that a more stringent
selection of BU participants was made, only those persons were selected that had actual customer contact with the corporate lab in the past 2 years. For the corporate laboratory itself the lower number of questionnaires sent out can be attributed to a considerable staff reduction in 2001. The response rate shows a negative trend over the years, caused by a drop in the response rates of the BU respondents. This may be due to a certain level of questionnaire fatigue, although even the last rates can be considered sufficient for this type of research. Because the profile of the respondents from the Business Units in terms of country, function and position has remained constant over the years, we expect the drop in response rate does not create a serious bias in the results.

5 RESULTS

Relative importance of R&D objectives

Respondents were asked to rate the importance of a number of R&D objectives of the corporate laboratory using 5-point Likert-scales. These objectives were the following:
- Expanding the company’s technology knowledge base
- Developing new technology in a product/process area
- Offering new technology for cost reduction
- Translating existing technology in a new product or process area
- Developing new product or process tests
- Contributing to the improvement of product or process designs

The results show a clear decline in the gap between the self-assessment of the R&D staff and the BU’s assessment of the relative importance of the different objectives of the corporate R&D lab. The gap has shrunk from very significant on 2 of the 6 objectives in 1998 (‘translating existing Technology in New Product/Process Design’ and ‘Contributing to the Improvement of Product/Process Design’) to no significant differences in 2002. Interestingly, the opinion of the BU’s concerning the importance of fundamental research and technology development increased over the years. Apparently, the alignment between the BU’s and the central lab has converged.

The perceived R&D performance

The data show that the BU assessment of the laboratory’s performance has gradually gone up since 1997 on most objectives. Longitudinal analysis of the gaps between the lab’s self-assessment and the judgement of the BU’s show that the lab. staff has acquired a more realistic self-image of its performance in 2002, where in the first years the lab’s staff’s self assessment was clearly higher than that of the BU’s on all 6 objectives, and these differences were all very significant except one (‘Expanding the company’s Technology Knowledge Base’), in 2002, the only significant gap between the lab’s assessment and that of the BU’s was a gap on the two design items, where the lab’s self assessment was lower than that of its customers.

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2 The items measuring the objectives are based on the variables used in a large survey of Stanford University, under the authority of the Industrial Research Institute, including more than 200 R&D Centres of major US companies.
Figure 1. Overall perceived performance of the corporate R&D lab
(Light dotted areas = assessment by the staff of the corporate R&D lab, left slanted areas = BU assessment.)

Figure 1 combines these data in the overall perceived performance. The longitudinal data show a steady progress in the laboratory’s overall performance as perceived by its customers: from 5.8 in 1997 to 6.4 in 2002. The self-assessment stayed constant at about 6.8.

Alignment to business needs

Figure 2. Corporate R&D lab’s alignment with BU needs
(Alignment of important technologies: light dotted areas = the corporate R&D staff’s opinion, left slanted areas = the opinion of the BU staff. Alignment to market needs: intense dotted areas = the corporate R&D staff’s opinion, right slanted areas = the opinion of the BU staff.)

As can be seen in figure 2, the BU assessment regarding the alignment of the corporately funded R&D projects improved from below 6 in 1997 to about 7 in 2002, what is in line with the self assessment of the R&D staff. This can, at least partly, be attributed to the fact that in 1998 a business unit funding system was introduced, in which part of the R&D projects of the central laboratory were directly funded by the Business Units.
R&D timeliness

The overall picture on timeliness presented in figure 3 shows that the steady increase from 1997 to 2000 of the appreciation of the quality of the laboratory's time management has come to a halt in 2002. These results show that the instrument can be used as an early warning system that indicates where management attention is urgently required.

Figure 3. Timeliness of Project Execution (R&D cycle time: few dotted areas = the corporate R&D staff's opinion, left slanted areas = the opinion of the BU staff. Alignment to market needs: intense dotted areas = the corporate R&D staff's opinion, right slanted areas = the opinion of the BU staff.)

R&D Communication

Figure 4. Importance of staff exchange (Light dotted areas = assessment by the staff of the corporate R&D lab, left slanted areas = BU assessment.)

The data presented in figure 4 show, that the divisions highly value regular contacts with the R&D Center, and that their opinion on staff exchange as a means to foster communication has improved over the years. In contrast to this, figure 5 shows, that in the case of direct communication of the R&D staff with the end-users, the gap between the R&D Center and the BU's widens over time. The BU's are clearly not in favor of the idea of R&D staff having regular contact with end-users.
6 DISCUSSION AND CONCLUSIONS

The presentation of the results of each of the four surveys led to intense discussions at the corporate R&D Centre, first at the management level and then in the quality circles. After each survey a number of improvement actions were introduced. The results of the successive survey provided the feedback on the effects of the former actions and input for further actions. For instance, based on the results of the second survey, it was decided to change the existing R&D funding structure from a 100% corporate funding to a mixed funding structure, in which 50% of the total R&D budget is allocated to the Business Units, which from then on could procure their own projects at the R&D centre. The positive effect of this measure in terms of alignment to business unit interests can be clearly observed in the successive surveys (see figure 2). In this light the finding, that the opinion of the BU’s concerning the importance of fundamental research and technology development increased in the surveys after the introduction of Business Unit funding is interesting. It can be interpreted as an expression of the BU’s growing concern about the negative side effect of this measure: the substantial drop in corporate R&D funding has put the execution of more fundamental research projects at risk.

The feedback on the gaps between the Business Units assessments and the lab’s staff self-assessment proved to be a powerful tool to motivate the R&D staff to change its attitude towards its customers. Where in the first surveys still a considerable gap between BU and R&D centre assessment could be observed, and many BU respondents complained about the ‘head in cloud’ mentality of the R&D centre, the results of the later surveys showed, that together with the disappearance of the gap, the BU’s appreciation for the centre, as expressed in the overall perceived performance has improved considerably (see figure 1). The gap analysis also proved to be useful in the opposite direction: In the most recent survey the sudden widening of the gap on timeliness of project execution was caused by the steep drop in the lab’s staff self-assessment on this item (see figure 3). This finding served as an early warning signal that something had happened in the internal processes. Indeed, the management indicated, when confronted with the results, that the internal project planning system urgently needed revision. The instrument made it possible to detect the problem, before it had done serious harm to the relations with the internal customers.
We think, that these observations indicate, that the instrument, if used in a framework of a consistent TQM policy, is reliable. The clear trends in the longitudinal data series also give an indication of its robustness: it does not seem to be much affected by other factors that might be influenced by the (changing) circumstances than the factors measured.

From the findings of this study it can be concluded that:
- it is possible to measure in-company customer value of R&D;
- that such measurement is a fruitful way of assessing R&D quality;
- that the information provided by the instrument can be used as a steering tool in R&D management, provided it is embedded in a consistent TQM policy;
- that the power of this instrument is enhanced by a systematic measurement of the gap between the customer's perception of R&D quality and the self-perception of the R&D staff.

References


ORGANIZATIONAL FORMS FOR INNOVATION IN SYSTEM INDUSTRIES

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Abstract

In this study we develop a model of organizational forms for innovation in system industries. System industries deliver product systems that are composed of technologically diverse components. Over time product systems evolve by innovations that cause major or minor changes to the system's architecture, interfaces and components. We take the perspective of the product system firm, the firm that designs, integrates and commercializes the product system. Contingent on the degree of change of the product system, the firm is faced with specific requirements in terms of coordination, appropriation and learning. The organizational form has to provide the firm with the capacity to match these requirements. In this study the organizational form is conceptualized as a multidimensional construct. We identify four organizational dimensions and we develop a model that proposes organizational configurations for distinct types of innovation.

Keywords: Organizational form, innovation, product systems, system industries, configurations

1 INTRODUCTION

Product systems are increasingly important in today's economy. Product systems are products composed of multiple, functionally interrelated components or subsystems. They are central to 'system industries' like the computer, the aviation and the telecommunications industry. Innovation in system industries is a complex matter: many technologically different and interdependent components can be involved, which have to be integrated into a working system (Brusoni et al., 2001). Furthermore, since few product system firms produce all components themselves, cooperation with other firms is often a necessity. As a result, the product system firm, which we call 'the firm' from now on, faces the challenge to design organizational solutions for its innovation efforts that allow him to deal effectively with the characteristics of those activities.

Innovation is a key element in system industries. First of all, innovation pertains to the development and commercialization of product systems themselves. Here, lengthy negotiations with competitors and standardization bodies might be required to set the 'de jure' industry standard. In still other industries alternative systems might compete head to head to set the 'de facto' dominant design. Secondly, and the topic of this study, innovation pertains to the improvement of product systems once they are introduced in the market and their basic architecture is set. Product system firms, i.e. the firms that design, integrate and commercialize product systems, can achieve competitive advantage by innovating on the component and interface technologies of their product systems. Mobile network operators for example aim to create value by developing new or improved versions of subsystems as diverse as network technologies, communication protocols, handsets, portals, and applications.

Many studies implicitly or explicitly address how to organize for the innovation of parts of a product system. Most of these studies are conceptual in nature and based on case studies (e.g. Chesbrough and Teece 1996, Sanchez and Mahoney 1996, Prencipe et al. 2003). An integrative framework and empirical
tests are lacking. The aim of this study is to add to our understanding on the organization of innovation in system industries by developing a model for the organization of innovation that is suitable for empirical testing in later studies. In this study we first identify key characteristics of innovation in system industries. This results in six types of innovation. Secondly, we discuss the organizational requirements as a result of innovation for the product system firm in terms of appropriation, coordination and learning. We adopt the contingency perspective that innovation performance depends on the extent that the organizational form matches the requirements posed by the specific innovation project. The next section introduces four organizational dimensions. Based on these dimensions the next section proposes a distinctive organizational configuration for each of the six types of innovation. Finally, we discuss our model and make suggestions for future research.

2 SYSTEM INDUSTRIES

System industries create value by combining components or subsystems into architectures that deliver a specific function (Ulrich, 1995). There is considerable research on product systems. Among others Miller et al. (1995), Hobday (1998) and Precièse et al. (2003) study ‘complex product systems’ or ‘CoPS’. Miller et al. (1995) describe CoPS as large scale, durable goods consisting of multiple, customized components and subsystems. Examples of CoPS are airplanes, telecommunications networks, electricity networks and chemical process plants. In these markets usually only a few product system firms face a small number of large buyers, e.g. airlines and telecom operators. Product system firms require deep knowledge on a range of subsystems and interface technologies to integrate and validate the system and to control the development of new subsystems. Because of the importance of these CoPS to their businesses, buyers are typically highly involved in the innovation process.

Not all product systems fit the characteristics of CoPS. Mobile phones and automobiles for example have a large number of buyers, but they do involve products that are composed of multiple, technologically distinct subsystems. To cover these product systems as well, we broadly define a product system as an architecture that links technologically distinct components into a functional whole. This definition identifies three important elements of product systems: the architecture, the components, and the linkages or interfaces between those components.

In practice, product systems are often structured hierarchically, meaning that they are composed of subsystems that are themselves also composed of subsystems, etc (Simon, 1962). Therefore, what is considered a system at one level of analysis is a subsystem at the next. The mobile handset for example is a system composed of among others a display, a SIM card, and an antenna, but the handset is also a subsystem of the larger mobile telecommunications system. At the lowest level of analysis systems consist of elementary parts that cannot be subdivided any further (Simon, 1962). Therefore, what to consider a product system and what a subsystem is a matter of definition. Many empirical studies use inconsistent definitions however as they develop hypotheses for the system as a whole and collect data at the subsystem level (Gatignon et al., 2002). This study explicitly focuses on innovation that affects the product system’s components and the interfaces between them.

3 INNOVATION IN SYSTEM INDUSTRIES

Based on the impact that innovation has on a system’s components and interfaces Henderson and Clark (1990) identify four types of innovation: radical, incremental, modular and architectural innovation. Radical innovation creates completely new component technologies and component interfaces. In contrast, incremental innovations reinforce the existing components and interfaces. The distinction between radical and incremental innovation is common in the innovation literature. Radical innovation reflects the development and commercialization of technology that creates a new market or technological subfield (Tushman and Anderson 1986). Over time incremental innovations improve and reinforce the
technological trajectory started by the radical innovation (Dosi, 1982). Radical innovation is characterized by high technological and market uncertainty, whereas the uncertainty for incremental innovations is limited because most technical problems have been resolved and the preferences of users are well-known. Radical innovation is typically associated with the development of new systems. In line with Henderson and Clark (1990) we apply it to describe innovations that significantly affect the existing product system’s components and interfaces. Hence, these innovations are also characterized by high levels of technological and market uncertainty, but only relative to the uncertainty for the system as a whole.

Henderson and Clark (1990) move beyond this common distinction and introduce modular and architectural innovation. Modular innovation pertains to technologically new components that reinforce the existing interfaces. As long as these interfaces are adhered to, components can be based on different technologies and still be compatible with the rest of the system (Schilling, 2000). An example is the replacement of CRT computer screens by LCD screens. In contrast, architectural innovation has minor consequences for the component technologies involved, but radically alters the way components are linked. Henderson and Clark (1990) stress that changed interfaces make the firm’s architectural knowledge obsolete. Firms might find it very hard to learn about new linkages, because these firms are typically organized around component interfaces, which determines the firm’s communication channels, information filters, and problem-solving routines. Hence, it could take incumbents considerable time to realize the implications of architectural change.

The term ‘architectural innovation’ implies that it affects the product system’s architecture to a certain extent. We should make a clear distinction however between a system’s architecture and its interfaces. The architecture is the design of the product system that defines which subsystems constitute the system and how they are interconnected by means of interfaces. A product system is therefore actually built from components and interfaces. On the one hand, radical change to a system’s architecture can leave its interfaces unaffected. In the PC industry for instance a range of components can be ‘mixed and matched’ into architectures with different functionality and cost characteristics (Baldwin and Clark, 1997). On the other hand, substantial change to existing interfaces does not necessarily result in a fundamentally different architecture. Architectural innovation pertains to changes in the design of the entire system, with major or minor consequences for its components and interfaces. In this paper we use the term ‘architectural innovation’ in a slightly more narrow sense, referring to innovations that predominantly cause interface changes.

Henderson and Clark focus on the situation that the components affected by the innovation are the product system firm’s own components. Especially in system industries it’s plausible however that the firm does not produce every subsystem itself. Hence, innovation could require changes to components that reside external to the focal product system firm. Teece (1996) proposes a model that includes this possibility, as he incorporates the ‘locus of existing capabilities’ for existing capabilities. External capabilities are not owned by the focal firm, but are readily available in the marketplace. Typically, these capabilities are based on mature technologies and involve low levels of uncertainty and asset specificity. In contrast, internal capabilities are owned by the firm itself. Internal capabilities are generally difficult to procure in the market as a result of their asset specificity and/or strategic importance to the performance of the system as a whole. This distinction largely corresponds to the distinction between peripheral and core components made by Gatignon et al. (2002). Core components are crucial to the performance of the product system and tightly coupled with other components. In contrast, peripheral components are loosely coupled and their strategic importance is limited.

Based on the degree of interface change and the degree of component change combined with the locus of existing capabilities, we can identify six types of innovation for a system’s components and interfaces (see Figure 1). The six types of innovation are an extension of the four types of innovation proposed by Henderson and Clark (1990). Following Teece (1996) we can make a distinction between incremental changes to internal or external component technologies for incremental and architectural innovation. Internal incremental innovation reinforces the product system firm’s own component technologies as well as the interfaces with adjacent components. External incremental innovation reinforces component technologies that exist outside the firm and leaves the interfaces between these external assets and the rest
of the product system unaffected. Similarly, internal architectural innovation involves minor changes to the firm’s component technologies, while the interfaces with the rest of the system change radically or must be created. External architectural innovation pertains to completely new interfaces for only slightly adjusted external components.

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Based on Henderson and Clark (1990) and Teece (1996).

*Figure 1. Types of innovation affecting the components and/or interfaces of a product system*

4 ORGANIZING FOR INNOVATION: REQUIREMENTS TO ACHIEVE FIT

The central proposition made by contingency theorists (e.g. Thompson 1967, Burton et al., 2002) states that a better match or fit between task characteristics and the organizational form improves performance. Each type of innovation as identified above confronts the innovating firm with unique requirements. The organizational form for innovation has to provide the firm with the capacity to deal with those requirements as good as possible. According to Gulati and Singh (1998) appropriation and coordination are two distinct organizational requirements (see also Van den Ende, 2003). Appropriation is mainly an economic issue addressed by transaction costs economists and industrial organization researchers (e.g. Teece, 1986), whereas coordination is essentially an administrative problem addressed by organization theorists (e.g. Thompson, 1967). In this study we add learning as a third requirement for the organizational form. Below we discuss the three organizational requirements in greater detail, as well as the contingency factors that cause them and their implications for the organizational form. The next section deals more extensively with the organizational form for innovation.

**Appropriation**

Appropriation refers to the extent that innovators are able to capture a fair share of the profits from their innovations. In system industries the innovation process often requires the involvement of buyers, suppliers and/or competitors (e.g. Miller et al. 1995). As a result of their involvement these partners can acquire information on the firm’s proprietary technologies. This causes considerable appropriation concerns when these partners might use this sensitive information opportunistically. Contracts are no solution for such information spillovers due to the inherent difficulty to transact information (Arrow, 1962). For situations of weak appropriability Teece (1986) therefore proposes to internalize the innovation effort and to reduce the dependency on outside actors.

In addition to spillover risks, transaction costs economics (e.g. Williamson, 1985) points to the difficulty to write and enforce contracts for highly specific and uncertain activities. Suppliers are hesitant to commit themselves to specific innovations, which would result in a weaker bargaining position vis-à-vis the buying firm. On the other hand, innovating firms themselves might also fear hold-up strategies from its suppliers. Reliance on arm’s length relationships could therefore result in innovation opportunities being wasted as a result of underinvestment. Additionally, highly uncertain innovation activities are likely to cause redesigns and decision-making conflicts among partners. As a result, a sufficient degree of
decision-making power is needed to realize the innovation without costly and time-consuming disputes and contract renegotiations. We may conclude that increasing appropriation concerns require an increasing number of organizational safeguards and hierarchical controls (e.g. Gulati and Singh, 1998) to facilitate the innovation process and the division of returns.

Coordination

Irrespective of the appropriation concerns for the development of a component, this component needs to be aligned with the rest of the product system to perform as intended. The implementation of an insufficiently aligned component could result in the failure of the entire product system. Excessive coordination on the other hand could delay innovation projects and increase their communication costs. Tushman and Nadler (1978) view the coordination problem from an information processing perspective. According to them there needs to be a match between the information processing requirements as a result of the level of task interdependence and the information processing capacity of the organizational form. In general, the higher the level of interdependence, the more elaborate the set of coordination mechanisms should be (e.g. Thompson, 1967).

The level of interdependence is a major determinant for the information-processing requirements. Interdependence reflects the difficulty to decompose a system, which is crucial to the evolution of a system (Simon, 1962). On one extreme, integral product architectures consist of highly interdependent components. It’s difficult to separate components from these systems, because even minor adjustments require adjustments to all interrelated elements (Schilling, 2000). Such ‘systemic innovations’ (Chesbrough and Teece, 1996) require extensive information exchange to ensure that the system keeps working. On the other extreme, systems with a modular design consist of loosely coupled components that can be decomposed and recombined without the need to adjust components and interfaces. Furthermore, when the interfaces or ‘visible design rules’ of a modular system are available to the entire industry, independent firms can specialize themselves in the detailed design or ‘hidden design rules’ of component technologies (Baldwin and Clark, 1997). The interfaces serve as an embedded coordination mechanism that facilitates the specialization of labour without much information exchange and managerial effort (Sanchez, 1995). Chesbrough and Teece (1996) refer to this type of innovation as ‘autonomous innovation’, indicating that the innovation can take place in ‘self-contained’ units (March and Simon, 1958) independent from the rest of the system.

Learning

Innovation is an inherently uncertain activity. Typically, innovation processes are confronted with a lack of information to complete tasks (Galbraith, 1977). Under such circumstances decision-making is complicated because the firm has no clue about the possible outcomes of alternative courses of action (March and Simon, 1958). As indicated in the previous section, uncertainty varies with the newness of the innovation. Radical innovations are surrounded by high levels of uncertainty. As a result, there is a high need for new information to take decisions and to perform the required tasks. On the other hand, incremental innovations involve little uncertainty and require limited organizational learning.

Firms can acquire knowledge in many ways. An obvious learning mechanism is learning by doing. Simply by conducting R&D activities and market experiments firms can reduce technological and market uncertainties. Firms can also learn from external sources. Different actors in the firm’s environment, such as universities, firms from other industries, and also competitors, might possess or develop knowledge relevant to the firm’s innovation process. The organizational challenge is to identify those outside actors and to craft relationships with them. A possible solution is simply to hire external expertise. In general, more uncertain innovation efforts require organizational forms that generate and acquire a larger amount of new information to be able to innovate effectively. In sum, dependent on the characteristics of innovation in terms of asset specificity, interdependence and uncertainty, firms are confronted with the requirement to design an organizational form that accommodates appropriation, coordination and learning. Below we present several dimensions for the design of organizational forms.
5 THE ORGANIZATIONAL FORM: MULTIPLE DIMENSIONS OF INTEGRATION

Although many authors indicate that the organizational form is actually a multidimensional construct (e.g. Teece, 1996), few studies incorporate this idea in their conceptualization of organizational forms. Inspired by transaction costs economics and industrial organization literature, the organizational form is often represented by a single dimension, namely the level of vertical integration. Chesbrough and Teece (1996) for instance assign make, buy, or ally strategies to different types of innovation. The level of vertical integration is also very common in the literature on alliances. Many studies for example focus on the distinction between equity and non-equity alliances (e.g. Gulati and Singh, 1998). These studies all assume that variation in the level of vertical integration provides the firm with the capacity to deal with different organizational requirements.

In a prior study we distinguished between two separable dimensions of organizational forms, system developer involvement and integration (Van den Ende and Jaspers, 2004). Here we use more explicitly the concepts of Robertson and Langlois (1995), who distinguish between ownership integration and coordination integration as two dimensions of vertical integration. Ownership integration is the organizational dimension that should be in line with appropriation concerns, whereas coordination integration deals with coordination and information-processing requirements (see also Gulati and Singh, 1998). According to Robertson and Langlois (1995) distinctive organizational forms arise if the focal firm integrates ownership and coordination to different degrees. We extend the two dimensions of Robertson and Langlois by introducing knowledge integration (e.g. Brusoni et al., 2001) and task integration as two additional dimensions of the organizational form. Hence, we propose that distinctive organizational forms arise if the product system firm is integrated to greater or lesser degrees with respect to the following four organizational dimensions:

1. **Coordination integration**: the extent that the firm facilitates the coordination of the innovation process;
2. **Ownership integration**: the extent that the firm owns the innovation;
3. **Task integration**: the extent that the firm performs the innovation activities;
4. **Knowledge integration**: the extent that the firm acquires knowledge on the innovation.

Considering organizational forms as configurations or ideal profiles (Doty and Glick, 1994) of these dimensions of integration improves our understanding of the organization of innovation and helps us move beyond studies that address only one organizational dimension. Below we elaborate on these organizational dimensions and their relations to the different organizational requirements. The next section proposes distinct organizational profiles for the types of innovation identified above.

**Coordination Integration**

Firms can choose among a variety of coordination mechanisms to construct the organizational form’s coordination capacity (e.g. Tushman and Nadler, 1978). We do not focus on the exact number and nature (e.g. organic or mechanic) of coordination mechanisms, but in line with Robertson and Langlois (1995) we consider the level of coordination integration as the intensity of information exchange between different activities. Applied to our case we define coordination integration as the extent that the product system firm facilitates the information exchange to align the innovation with the rest of the product system. At a minimum, the firm is not involved in the information exchange between the affected elements of the product system. At a maximum, the firm installs an extensive administration of coordination mechanisms to deal with significant quantities of information.
Autonomous innovations neatly fit the existing product system’s architecture, reinforcing its interfaces. From an information-processing perspective, a low level of coordination integration should therefore be sufficient (Tushman and Nadler, 1978). A high level of coordination would result in excessive flows of information and management attention, causing extra costs, superfluous conflicts and valuable time being wasted. In contrast, systemic innovations require the creation of new interfaces. This has significant implications for all interrelated subsystems and possibly for the product architecture as a whole, especially for integral product systems. As a result, the intensity of the information exchange between the innovation activities and the rest of the product system should be high for reasons of systems integration. In sum, we propose that the organizational form’s level of coordination integration should correspond to the level of interdependence in the innovation process.

Ownership Integration

Ownership integration is defined here as the extent that the firm controls the innovation process and owns its output. As for coordination integration, we do not consider the exact number and nature of control mechanisms employed in the organizational form. In general, we assume that a higher level of ownership integration corresponds to higher decision-making power in the innovation process. Ownership integration also determines the firm’s claim on the returns on innovation, since a higher level of ownership integration increases the firm’s property rights versus other firms in the innovation process. At a maximum, the product system firm is the single owner of the innovation effort. Internal innovation projects are an obvious example. However, full ownership also pertains to innovation activities that are financed and specified by the product system firm, but that are executed by independent suppliers. In this case the product system firm bears all the financial risks and is legally entitled to the innovation’s output, but it doesn’t actually perform the detailed innovation activities. At a minimum, the innovation process takes place without any control from the product system firm. This is the case when component suppliers innovate on their own or together without any control of the system firm. In between these extremes, a medium level of ownership integration indicates that the product system firm shares ownership with one or more partners, for instance in a joint venture.

Robertson and Langlois (1995) state that the level of ownership integration and the level of coordination integration can take on different values. They illustrate this with several examples. On the one hand, independent firms that equally share the ownership over their joint effort in a network (i.e. low ownership integration) might develop extensive, hierarchy-like coordination mechanisms (i.e. high coordination integration). On the other hand, business units within a single holding company (i.e. high ownership integration) might coordinate their activities through the market mechanism (i.e. low coordination integration). In contrast to the implicit assumption in many studies therefore, control is not a prerequisite for effective information exchange. Or as Hillebrand and Biemans (2004) indicate, information might flow more easily across organizational boundaries than within the firm itself.

We propose that the level of ownership integration is largely dependent on the transaction features of the innovation activities. Under conditions of low uncertainty the consequences of component and interface change are highly predictable. Under conditions of low asset specificity, i.e. when a new technology has a wide range of commercial applications (Robertson and Langlois, 1995), the risks of a hold-up strategy are limited. Therefore limited uncertainty regarding the innovation’s components and interfaces and limited asset specificity facilitate partners to write and enforce contracts. Under conditions of low uncertainty and specificity the high-powered incentives of the market are particularly effective to realize innovations.

In contrast, hierarchy is to be preferred over arm’s length relationships under conditions of highly uncertain component and interface change and high asset specificity. Radical component innovations have a significant and largely unpredictable impact on the product system as a whole. Many redesigns are likely to be required and conflicts might arise between partners on what decisions to make. Furthermore, with high asset specificity suppliers will be reluctant to commit resources to the product system and the product system firm itself might not trust independent suppliers with the development task. Under these conditions, authority is required to prevent underinvestment and to resolve conflicts once the innovation
process is underway. In general, higher levels of uncertainty and specificity should coincide with a higher level of ownership integration for reasons of appropriation, i.e. to bring about innovation in the first place and to capture a fair share of its returns.

**Task Integration**

Task integration refers to the division of labour and is defined as the extent that the product system firm performs the innovation activities itself. A high level of task integration means that the firm’s employees perform most or all of the activities required to bring about the innovation. A low level of task integration refers to the situation where the innovation activities are carried out by external firms, such as suppliers or strategic partners. The level of task integration is in principle separable from the level of ownership integration: a single investing firm (high ownership integration) could for example source the detailed design and development work on a subsystem from an independent supplier (low task integration), or a firm could perform most of the activities itself (high task integration) while the investments are shared with other firms (medium ownership integration).

As far as the knowledge required to perform the innovation activities is strategically important and easily transferable, a high level of task integration allows the firm to prevent this knowledge from being absorbed and exploited by others. Also, if sensitive information will be created during the innovation process itself, it’s safer to exclude other firms from participation. A higher level of task integration therefore serves appropriation purposes. On the other hand, the active involvement of external actors could contribute to the reduction of uncertainty, and independent innovation at several competing suppliers allows the firm to benefit from the idiosyncratic learning process at each specialized supplier (e.g. Robertson and Langlois 1995, Brusoni et al. 2001). A higher level of task integration might therefore hamper the firm’s capacity to learn and to reduce uncertainty. In sum, a higher level of task integration enables the firm to appropriate the returns on innovation when the risk of spillovers is high, but at the same time a high level of task integration limits the firm’s capacity to learn from external sources and forces the firm to reduce uncertainty internally.

**Knowledge Integration**

Knowledge integration is defined as the extent that the firm acquires knowledge on the component and interface technologies involved in the innovation process. Again, we are interested in the overall level of knowledge integration, rather than the exact mechanisms to acquire knowledge. A high level of knowledge integration indicates that the firm absorbs all the information that is being generated during the innovation process. This is automatically the case however for internally executed activities, since a high level of task integration automatically implies the presence of learning by doing as a learning mechanism. Hence, the level of knowledge integration is equal to or exceeds the level of task integration. A low level of knowledge integration indicates that the firm neither develops this knowledge internally nor absorbs it from external sources.

Some authors suggest that modularity coincides with loosely coupled organizations, i.e. with each firm or unit operating autonomously and specializing in a specific component or subsystem (e.g. Ulrich 1995, Sanchez and Mahoney 1996). Brusoni and Prencipe (2001) however indicate that product system firms acquire knowledge on external subsystems and on interfaces for the purpose of systems integration. By knowing more than it actually does, i.e. when the firm’s knowledge boundary (or the level of knowledge integration) exceeds its production boundary (or the level of task integration), the ‘systems integrator’ firm is able to integrate the subsystems, to monitor the consistency of the product system and to control the evolution of the product system architecture (Brusoni et al, 2001). In sum, the level of knowledge integration primarily serves learning purposes. The greater the changes to component technologies and interfaces, the larger the need for the product system firm to acquire knowledge about these changes in order to maintain a coherent product system.
6 CONFIGURATIONS FOR THE ORGANIZATION OF INNOVATION

Innovating firms in system industries have to design organizational forms for their innovation efforts to achieve fit in terms of coordination, appropriation and learning. The four organizational dimensions of integration can be combined into a range of organizational configurations with a corresponding variation in organizational capabilities. On one extreme, the firm has tight control over the innovation process, performs all tasks, acquires in depth knowledge on the innovation effort and extensively coordinates it. On the other extreme, the firm does not control the innovation process, performs no activities, develops no knowledge on the technologies involved, and does not coordinate the innovation effort. Besides these extremes, a range of hybrid solutions is possible. In this section, based on the considerations of the previous sections, we construct distinct, internally consistent configurations or theoretical ideal profiles (Doty and Glick, 1994) for the six types of innovation (see also Van den Ende, 2003; Van den Ende and Jaspers, 2004).

Internal Incremental Innovation

Internal incremental innovation, external incremental innovation and modular innovation all have in common that they reinforce the product system’s interfaces. As a result, those innovations can be considered autonomous. From an information-processing perspective the level of coordination integration should therefore be low for these types of innovation. Internal incremental innovations by definition involve and exploit the firm’s own component technologies. It’s assumed that the firm owns these resources because they are highly idiosyncratic and therefore not readily available in the market place and/or because they involve core components. For reasons of appropriation, i.e. to realize the innovation in the first place and to control the evolution of its capabilities, the firm should employ a high level of ownership integration. In addition, it’s unlikely that external firms would like to take risks in the incremental improvement of the product system firm’s internal resources.

The firm should also perform most or all activities internally, because the firm’s own employees are most suited to perform the innovation activities efficiently. If external firms would perform the incremental adjustments, we can expect their lack of detailed knowledge to result in less efficient problem-solving and possibly also in crucial information spillovers. Due to this high level of task integration the firm automatically absorbs the knowledge on this innovation. As a result, also the level of knowledge integration for internal incremental innovations is high.

Figure 2 shows the resulting organizational configuration for internal incremental innovations made up from the four organizational dimensions of integration. We propose a low level of coordination integration combined with high levels of integration in terms of ownership, tasks, and knowledge. The activities require little coordination with the rest of the system, thus allowing a high level of autonomy for the firm’s own employees that perform those activities. An example of an organizational form that resembles this ideal profile would be when the firm sets up an independent, autonomous organizational unit or project team to perform the incremental innovation (see Figure 2).

External Incremental Innovation

Similar to internal incremental innovations, the requirements to align the innovation and the rest of the product system are negligible for incremental innovations to externally owned capabilities. Furthermore, the high-powered incentives of the market are particularly effective to bring about improvements to components that are readily available in the market place. A low level of ownership integration therefore suffices. Appropriation concerns are limited for these generic assets, and the owners of the relevant capabilities are best positioned to incrementally improve their assets, since they are most familiar with them. In addition, since this type of innovation is surrounded by low levels of uncertainty, it is unlikely to fundamentally affect the performance of the product system. Hence, there is no need for the product system firm to acquire in depth knowledge on these innovations. The organizational configuration for
external incremental innovations is to ‘outsource everything and anything’ (Teece 1996, p.218). These innovations should therefore be performed by suppliers.

**Modular Innovation**

Modular innovation pertains to the development of a component based on entirely new technologies. As a result, this is a highly uncertain development task. The new module operates within the limits of existing interfaces however, and can thus be integrated into the product system without much coordination effort. Brusoni et al. (2001) propose that it’s most appropriate for the firm to rely on suppliers for the detailed design of new modules. A low level of task integration enables the firm to benefit from the idiosyncratic learning process within each specialized supplier. The firm should try to develop in-house knowledge on these new technologies however to be able to integrate these new components in the product system and to learn about the evolution of the product system. By combining the distinctiveness of a low level of task integration with the responsiveness of a high level of knowledge integration, the firm retains systems integration capabilities (Brusoni et al., 2001).

Finally, it’s difficult to propose a specific level of ownership integration, since this depends on the strategic importance of the subsystem and/or the difficulty to write contracts between the system firm and potential suppliers (e.g. Teece 1996, Brusoni et al. 2001). Modular innovation of a peripheral component provides suppliers with high-powered incentives, since they do not run the risk of a hold-up strategy by the system firm. This innovation involves low asset specificity and can thus be governed by arm’s length relationships. Under conditions of medium to high levels of asset specificity however, commitment from the system firm might be required to initiate the innovation.

The organizational configuration for modular innovation first of all involves an autonomous innovation effort. Next, the level of knowledge integration exceeds the level of task integration. In addition, the level of ownership integration might vary, but shared ownership seems very appropriate (e.g. Teece 1996, Brusoni et al. 2001). A joint venture is a good example. This organizational form provides the firm with decision-making power and property rights in line with the risks it takes, it operates independent from the rest of the product system, and it allows the firm to benefit from the learning that occurs while the partner in the joint venture performs most of the activities.

**Internal Architectural Innovation**

Internal architectural innovation, external architectural innovation and radical innovation all involve the creation of new or radically altered interfaces. This has significant implications for related subsystems and possibly for the product architecture as a whole. As a result, the information exchange should be intense to adjust all affected components. Based on its in depth knowledge of the product system’s architecture, the product system firm is best positioned to play this coordinating role. Therefore, the firm should be highly involved in the coordination of the innovation process to ensure the integrity of the system as a whole. Insufficient coordination from the side of the product system firm is likely to result in project delays and possibly in system-wide malfunctions, because specialist firms lack the knowledge to innovate independently in line with the changing design rules.

Internal architectural innovation involves minor adjustments to a component already owned by the firm in combination with radical changes to the interfaces with other components. In line with the reasoning for internal incremental innovations, we propose that the firm is best positioned to perform and finance the innovation process itself and to absorb the knowledge generated in this innovation process. The latter is especially relevant since the firm has a great interest to learn about the architectural changes (Henderson and Clark, 1990). In sum, internal architectural innovation requires extensive integration on all four dimensions. An integrated internal project is a good example of this configuration, where ‘integrated’ means that all internal units with knowledge on the affected components are involved in a single, highly coordinated organizational setting.


**External Architectural Innovation**

As for modular innovations, Brusoni et al. (2001) propose that the firm's knowledge boundary should exceed its production boundary for architectural innovations. Our model allows us to develop this proposition one step further. Since the characteristics of internal architectural innovation made us propose a highly integrated organizational form, we posit that the need for systems integration is only present for external architectural innovation. Therefore we agree with Chesbrough and Teece (1996) that firms should ally 'with caution' for external architectural innovations. We are more precise however in what is meant by 'being cautious': the firm should maintain and develop in-house knowledge on the architectural innovation that is performed by external actors. Again, as for modular innovations, the appropriate level of ownership integration depends on the strategic importance of the innovation and/or on the difficulty to write and enforce contracts. A high level of ownership integration is most suitable if changes to interrelated components are likely to result in conflicts. On the other hand, ownership integration can be limited for peripheral components.

All in all, external architectural innovations require highly coordinated organizational forms and a high level of knowledge integration to align the system as a whole. Since incremental changes are required to external, generic components, the firm should let others perform these low-risk activities. The integration of knowledge next to the outsourcing of the respective activities increases the firm's ability to monitor and control suppliers (e.g. Bradach and Eccles, 1989). An internal unit that cooperates with the supplier for example ensures a higher level of knowledge integration and enables the firm to continue the project internally if the relationship with the supplier suddenly ends (Pisano, 1991). Finally, dependent on the strategic importance of the architectural change and the architectural uncertainty, the level of ownership integration could vary. Strategic alliances or inter-organizational networks are organizational forms that could fit this configuration if a medium level of ownership is sufficient. Here, the system firm shares ownership with one or more other firms that possess the affected components. As a key player in the alliance or network the product system firm is able to coordinate the innovation effort and to acquire in-depth knowledge of the architectural change.

**Radical Component Innovation**

Radical innovations involve highly unpredictable development work on radically new component technologies and on new interfaces between them. In this case the organizational form has to provide the control mechanisms to overcome hold-up risk. We can infer from this that the firm should be prepared to invest substantially if it wants to develop a radically new, systemic subsystem. In line with this reasoning, firms should also perform the majority of the tasks internally to prevent information spillovers. This also implies that the firm acquires valuable knowledge on the technologies involved. Altogether this points to a highly integrated organizational form.

An important goal of the organizational form for radical innovation is to reduce uncertainty however. One common way to generate new insights and clues about possible solutions to ambiguous tasks is to involve external firms in the innovation process however. Therefore we propose that the firm should not perform all tasks internally if the appropriation concerns allow it. The configuration for this type of innovation therefore pertains to a highly integrated organizational solution, possibly with a medium level of task integration due to cooperation with other firms. An integrated, joint project team illustrates this configuration. To reduce the extreme levels of uncertainty, knowledge on many different technologies has to be integrated into a highly coordinated innovation effort, which resides under the authority of the system firm but which is jointly executed by the firm and external firms.

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<td><strong>Joint Venture</strong></td>
</tr>
<tr>
<td>Overturned or New Interfaces</td>
<td>Radical Innovation</td>
<td><strong>Internal Integrated, Joint Project</strong></td>
</tr>
<tr>
<td>Internal Architectural Innovation</td>
<td>External Architectural Innovation</td>
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</tr>
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<td>Coordination: H</td>
<td>Coordination: H</td>
<td>Coordination: H</td>
</tr>
<tr>
<td>Task: H</td>
<td>Task: L</td>
<td>Task: L</td>
</tr>
<tr>
<td>Ownership: H</td>
<td>Ownership: L</td>
<td>Ownership: L</td>
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<tr>
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<td>Knowledge: H</td>
</tr>
<tr>
<td><strong>Internal Integrated Project</strong></td>
<td>Alliance or Network</td>
<td></td>
</tr>
</tbody>
</table>

L = Low, M = Medium, H = High

Figure 2. Model of organizational configurations for innovation at the component/subsystem level

7 CONCLUSIONS AND DISCUSSION

This study addresses how firms should organize themselves for innovations that affect the components and interfaces of their product systems. We identified six different types of innovation based on the degree of interface change, the degree of component change, and the extent that existing components reside within or outside the product system firm. We claim that each type of innovation confronts the firm with different requirements in terms of appropriation, coordination and learning. The product system firm should employ organizational solutions for each type of innovation that provides the capacity to match these requirements. We conceptualize the organizational form as a multidimensional construct. Distinct, but related dimensions of integration should be combined into appropriate organizational configurations. Based on existing studies, that use insights from transactions cost economics, information-processing theory, and organizational learning, this study developed a model or typology (Doty and Glick, 1994) of theoretical configurations for the different types of innovation.

In future research we will empirically test the organizational configurations. The contingency approach posits that deviation from a theoretical ideal type reduces organizational performance (Doty and Glick, 1994). In line with Venkatraman and Prescott (1990) multiple tests will be employed to test the negative relationship between the degree of deviation or misfit (Burton et al., 2002) and performance. An important element of our approach will be to distinguish between excessive and insufficient organizational capabilities (e.g. Reuer and Arino, 2002), since both can be assumed to have different performance implications. Excessive coordination integration for example can be expected to delay the project and to increase its costs, whereas insufficient coordination can be expected to reduce the innovation’s quality. Moreover, multiple performance indicators will be addressed, such as the quality, the time-to-market, and the commercial success of the innovation, in order to reflect the performance implications for coordination, appropriation, and learning. Finally, to further improve the robustness of the configurations, empirical data can also be used to derive and test empirical ideal profiles (e.g. Drazin and Van de Ven 1985, Doty and Glick 1994).
References


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ANALYSING THE EFFICIENCY OF FARM DIVERSIFICATION

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Abstract

This paper presents a new approach to analysing the farm-specific trade-off between expected gross margin and standard deviation. We introduce a farm risk-gradient value (RGV) based on a whole-farm optimisation using individual farm-level data. RGV is defined as the amount of lost gross margin per Euro reduction of its standard deviation. The potential impact of a farm-specific approach to the RGV is explored for arable farms using diversification as a risk-management strategy. A lower RGV represents a lower expected cost of risk offset with the change in diversification. On the other hand, a higher RGV denotes a higher cost of risk offset. Results from ten randomly selected farms are presented to demonstrate the power of the approach, and to show the importance of a farm-specific approach in risk-management. The results show that RGV is a good indicator of farm-specific risk response. Lower RGV indicates a farm with more effective gross margin change with respect to change in standard deviation of gross margin. Farms with less efficient diversification have higher RGV values. In this paper the RGV ranged from 0.29 to 3.51. This shows that there are considerable differences between farms, which should be recognised in advising farms on portfolio selection.

1 INTRODUCTION

Farmers are confronted with a continuously changing landscape of possible price, yield, and other outcomes that affect their financial returns and overall welfare (Bodie and Merton, 1998). Agricultural risks include production, price and market, institutional, human or personal, business and financial risks (Hardaker, Huirne, Anderson, and Lien, pp. 5-7). Risk-management involves the selection of methods for coping with all types of risks in order to meet the decision-maker's goal while also taking their risk-attitude into account. This means calculating the risk-return trade-off in designing risk-management strategies is an important target in agricultural business.

The portfolio modelling approach is often used to show how different combinations of activities may reduce farmers' risk more than having single activity (Markowitz, 2000, pp. 3-7). Gains in reduction of the standard deviation from asset diversification increase as the stochastic dependency between activities decline and the number of activities in a portfolio increases (Barry, Ellinger, Hopkin, and Baker, p. 222). In the application of portfolio analysis to agricultural businesses, the mix of assets should be balanced such that it provides the farmer protection and opportunities with respect to a wide range of contingencies. The farmer should opt for an integrated portfolio which best suits his or her individual risk-aversion needs. One source of information is the past performance of individual activities on a farm; another is the assessment of more subjective information with respect to future performance on a farm (Hardaker, Huirne, Anderson, and Lien, pp.5-7). However, it is rare to find studies that optimise an individual farm (Arriaza and Gomez-Limon). Most farm system portfolio analysis is based on aggregated data of grouped farm results (Ames, Reid, and Li-Fang Hsiou; Hall;
Lien and Hardaker; Gomez-Limon, Arriaza, and Riesgo). Other studies try to dis-aggregate the portfolio analysis partly (for example, by region, by farm size), thus assuming that the stochastic structure and farm structure are the same per sub-sample (Pannell and Nordblom), and that the average tendency of those farms can be analysed per sub-sample. For a useful and realistic optimisation of risk-management strategies, a farm-specific portfolio approach is essential, given the potential differences in the individual farm stochastic structure and farm constraints.

Therefore the objective of this paper is to develop such new approach to analyse the impact of using farm-specific joint distribution data in a whole-farm risk-programming model. In order to survey the farm-specific trade-off between expected gross margin and standard deviation, we introduce the farm risk-gradient value (RGV), which is based on a whole-farm optimisation using individual farm data. The portfolio is optimised for each individual farm for a range of alternative risk levels. The gradient of the efficiency frontier line is used to approximate the RGV. The potential impact on the risk efficiency of a farm-specific approach is explored for arable farms using diversification as risk-management strategy.

2 MATERIALS AND METHODS

To analyse the results and compare the differences between farm diversification strategies, four alternative gross margin parameters have been estimated. The logical structure of the analysis is shown in figure 1.

![Diagram](image)

**Figure 1. Farm diversification strategy analysis**

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$G_{nT}$ is the observed gross margin on farm $n$ in year $T$ ($T$ is the last year with an observation).

$\hat{G}_{nT}$ is expected gross margin for farm $n$ in year $T$. This value is a regressed value that has been estimated by using the GLS procedure based on a period $t$ (up to $T-1$). The expected gross margin calculation per farm based on expected values of yield, price and cost multiplied by the observed area of crop $q$ in year $T$ (equation 1).

$$\hat{G}_{nT} = \sum_{q=1}^{Q} A_{obs_{qnT}}(\hat{Y}_{qnT} \hat{P}_{qnT} - \hat{C}_{qnT})$$

where $A_{obs_{qnT}}$ is observed area for crop $q$ ($q=1\ldots Q$) at farm $n$ in year $T$; $\hat{Y}_{qnT}, \hat{P}_{qnT}$ and $\hat{Y}_{qnT}$ is the expected yield, price and variable cost respectively for crop $q$ at the farm $n$ in year $T$.

$G_{max_{nT}}$ is the maximum expected gross margin of farm $n$ in year $T$. This gross margin value is derived by linear programming (LP) using expected values of gross margin components in year $T$: 

$$G_{max_{nT}} = \max \left\{ \sum_{q=1}^{Q} A_{qnT} (\hat{Y}_{qnT} \hat{P}_{qnT} - \hat{C}_{qnT}) \right\}$$

where $A_{qnT}$ is the cultivated area for crop $q$ on farm $n$ in year $T$. So this value is derived without any constraints with respect to risk aversion and reflects the optimal plan for risk-neutral decision-makers.

$G_{min_{nT}}$ is the minimum expected gross margin when the standard deviation of total gross margin is minimised using quadratic risk programming (QRP), under the condition that all land area is used for production. Thus this optimisation reflects the optimal cropping plan for decision-makers averse to risk (i.e. minimising standard deviation of total gross margin).

QRP is based on the original Markowitz (1952) formulation of the mean-variance (E-V) framework, whereby the objective is to minimise the variance (or standard deviation) of a wealth parameter, subject to a given level of the expected wealth parameter. It can be formulated, for example, using farm-expected total gross margin as a parameter for wealth, as follows:

$$SD(G_{nT}) = \min \left\{ \sum_{q_{i},q_{j}=1}^{Q} G_{nT}^{i} SV_{nT}(q_{i},q_{j}) G_{nT}^{i}, i \neq j \right\}$$

subject to the gross margin, which is the sum of all of following components:

$$G_{nT} = \sum_{q=i}^{j} A_{qnT} (\hat{Y}_{qnT} \hat{P}_{qnT} - \hat{C}_{qnT}), \quad G_{nT} \text{ is varied}$$

where $SD(G_{nT})$ is the standard deviation of gross margin of farm $n$ in year $T$, $SV_{nT}(q_{i},q_{j})$ is the variance-covariance matrix of gross margin between activities $q_{i}$ and $q_{j}$ for the farm $n$ in year $T$, and $A_{qnT}$ is the cultivated area of crop $q$ at farm $n$ in year $T$. In addition technical constraints on farm production with respect to land, rotation and labour are accounted for.

The model optimisation part (to calculate $G_{max_{nT}}$ and $G_{min_{nT}}$) was formulated in the General Algebraic Modelling System (GAMS). $G_{max_{nT}}$ and $G_{min_{nT}}$ are used to define the risk efficiency frontier using a concept called risk gradient value (RGV). The RGV is calculated per farm (equation 4)
reflecting the gradient of the efficiency line\textsuperscript{1}. In this paper the risk gradient is defined as the difference between maximum and minimum gross margins then divided by difference between maximum and minimum standard deviations of gross margin. It represents the farm-specific trade-off between expected gross margin and standard deviation.

\begin{equation}
RGV_{nT} = \frac{\Delta G_{nT}}{\Delta SD(G_{nT})} = \frac{Gmax_{nT} - Gmin_{nT}}{SD(Gmax_{nT}) - SD(Gmin_{nT})}
\end{equation}

3 DATA AND MATERIALS

Resources

Input data concerning yields and costs were obtained from the Farm Accounting Data Network (FADN) data set (see also figure 1). The FADN data is a unique panel data set consisting of information per farm per crop in The Netherlands. For the analysis two farms were selected from the 718 available arable farms. They both suit to the following selection criteria: minimum seven years of observations are available; the land area cultivated did not change over the observed period; the land is 100% owned property; the farms grew a particular stable crop set every year during period observed.

Optimisation constraints

Some additional normative assumptions based on literature (KWIN, 2001) were made in order to optimise the farms. Cereal crops (winter wheat and summer barley) were restricted to maximum one-third of the cultivated area and tuberous crops (sugar beet, onion seed, table potato and seed potato) were restricted to a maximum three-fourth of the cultivated area. With regard to the area cultivated in tuberous, the rotation restriction for all kinds of potato could not be more than one-thirds of the total area; onion was restricted to a maximum of one-fifth of total area. Due to the quota limitation, the maximum amount of sugar beet was based on individual farm observations. The individual rotation rate was also applied for grass seed.

Most field operations have to be performed during a certain period. To take into account the peaks in labour and machine use, the year is divided into periods of two weeks. The amount of fixed labour is assumed to be 1,1 labour units (3200 h/year = 123 h/two weeks) (Wossink, de Koeijer, and Renkema). The labour supply per full-time farm worker per period is assumed to be constant over the year. In addition to fixed labour there is the option of hiring seasonal labour. It is assumed that the amount of hired labour is not restricted by the total regional supply. Seasonal labour can be employed any time of the year for 15 Euro/h, which is a typical wage earned by a 21-years-old worker (KWIN-V, 2002). A farm’s total area is one more limiting resource factor.

4 ANALYSIS OF RESULTS

Farm A is closest to an average Dutch arable farm, and farm B presents a large arable farm. They are located in different agricultural regions defined by the Central Bureau of Statistics (CBS, 1991) Farm A is located in loess-area, however farm B is located on the North part of The Netherlands on the see-clay area. They both have different production activities (tables 1 and 2).

\textsuperscript{1} Lien (2002) has presented a similar idea about the risk aversion gradient calculation. He formulated the risk aversion gradient as the difference between maximised in QRP net income and current net income per difference of between actual variance and minimised in QRP variance. The gradient of the obtained efficient frontier was used to approximate the coefficient of absolute risk aversion.
<table>
<thead>
<tr>
<th>Model</th>
<th>( G_{iT} )</th>
<th>( \hat{G}_{iT} )</th>
<th>( G_{max_{iT}} )</th>
<th>( G_{min_{iT}} )</th>
<th>( G_{iT} )</th>
<th>( \hat{G}_{iT} )</th>
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<th>( G_{min_{iT}} )</th>
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<td></td>
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<td>85</td>
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<td>114</td>
<td>87</td>
<td>243</td>
<td>266</td>
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<td></td>
<td></td>
<td></td>
<td>Cultivated land area (ha)</td>
<td></td>
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<td></td>
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<tr>
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<td></td>
<td>16.4</td>
<td>16.4</td>
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<td>5.0</td>
<td>5.0</td>
<td>25.0</td>
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<tr>
<td>Sugar beet</td>
<td></td>
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<td>8.8</td>
<td>8.8</td>
<td>8.8</td>
<td>15.0</td>
<td>15.0</td>
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<td>4.0</td>
<td>4.0</td>
<td>11.4</td>
<td>0</td>
<td>7.0</td>
<td>7.0</td>
<td>0.0</td>
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<tr>
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<td></td>
<td>14.7</td>
<td>14.7</td>
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<td>16.2</td>
<td>0.0</td>
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<td>-</td>
<td>-</td>
<td>50.0</td>
<td>50.0</td>
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<tr>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>23.0</td>
<td>23.0</td>
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<tr>
<td>Grass seed</td>
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<td>-</td>
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<td></td>
<td></td>
<td></td>
<td>1.97</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 1.** Default results from two farms studied

| Farm number | \| Farm A \| | \| predicted 1998 based on 1991-97 \| | \| Farm B \| | \| predicted 1999 based on 1991-98 \| |
|-------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| GM components | observed 1998 | predicted 1998 | observed 1999 | predicted 1999 |
|              | yield\textsuperscript{*} | price\textsuperscript{**} | cost\textsuperscript{***} | yield | price | cost | yield | price | cost |
| Winter wheat | 10042 | 0.103 | 342 | 9053 | 0.11 | 343 | 8562 | 0.12 | 673.7 |
| Sugar beet | 62542 | 0.043 | 530 | 6451 | 0.05 | 636 | 6432 | 0.04 | 568.3 |
| Onion seed | 60451 | 0.059 | 1333 | 4919 | 0.08 | 1068 | 5677 | 0.06 | 1423.3 |
| Table potato | 32267 | 0.083 | 1519 | 4635 | 0.07 | 1904 | 0.0 | 0.0 | 0.0 |
| Seed potato | - | - | - | - | - | - | - | 4015 | 0.17 | 3218.3 |
| Summer barley | - | - | - | - | - | - | - | 7632 | 0.11 | 432.6 |
| Grass seed | 1587 | 1.145 | 497 | 1711 | 1.39 | 536 | - | - | - |

\textsuperscript{1} The yield measure unit (kg/ha).
\textsuperscript{2} The price measure unit (€/kg).
\textsuperscript{3} The variable cost measure unit (€/ha).
\textsuperscript{*} Yields are de-trended using three different functional forms: linear, second and third-degree polynomial (Kobzar, Huirne, and van Asseldonk).
\textsuperscript{**} Price and cost are deflated to year T by Paasche Equation (Mas-Colell, 1995: p.37), using the consumer price index as deflator (CBS, 1993-2002)

**Table 2.** Default results of detail plans from two farms studied
Farm A produces winter wheat, sugar beet, onion seed, table potato and grass seed. The expected gross margin of farm A (T=1998) is estimated using data from the previous seven consecutive years and comparing it with the observed gross margin in year T. As seen in table 1, the observed gross margin in 1998 of farm A equals $G_{A,T} = €85,000$. It is €10,000 lower than the expected gross margin estimated from the previous seven years ($\hat{G}_{A,T} = €95,000$). The main reason for this is the difference between observed and expected prices. For four of five crops produced (winter wheat, sugar beet, onion seed and grass seed) prices were expected to be higher than those actually realised (table 2). In most cases higher yields were associated with higher variable costs. Thus these two gross margin components compensated for each other. It can be seen that the maximum gross margin value is $G_{\max A,T} = €114,000$ and the standard deviation of this gross margin equals $SD(G_{\max A,T}) = €29,300$.

Optimised gross margin value is reduced considerably (to $G_{\min A,T} = €87,000$) if the standard deviation of the gross margin is minimised ($SD(G_{\min A,T}) = €15,600$). A comparison of the crop plan of the minimum gross margin value $G_{\min A,T}$ with the observed plan in the last available year (with gross margin value $G_{A,T}$) shows that there is almost no difference between these plans (table 1). Therefore, this farm can be characterised as applying a risk-avoiding strategy. The risk gradient value is $RGV_{A,T} = 1.97$, which means that for this particular farm the cost of a unit standard deviation reduction equals €1.97.

The crops on farm B are winter wheat, sugar beet, onion seed, potato consumption, seed potato and summer barley. Estimations are based on data from 1991-1998 compared with the last available year in the data set $T=1999$. As seen in table 1, the observed gross margin value of farm B equals $G_{B,T} = €244,000$. It is lower than expected ($\hat{G}_{B,T} = €266,000$). The main reason for this, as in the previous situation for farm A, is the difference between observed and expected prices. The maximum gross margin value is $G_{\max B,T} = €274,000$. By comparing the plan of the maximum gross margin with the plan observed in the last year, it can be seen that the farmer preferred less risky production in that year. He or she rejected table potato production and preferred summer barley to winter wheat production. During this farm optimisation, the minimum expected gross margin value is $G_{\min B,T} = €245,000$. This value differs appreciably from the maximum gross margin value ($G_{\max B,T} = €274,000$). However, the standard deviations of these two measures differ less: the standard deviation of maximum gross margin is $SD(G_{\max B,T}) = €21,400$, while the standard deviation of minimum gross margin is $SD(G_{\min B,T}) = €12,600$. Therefore, this farm has a limited efficiency of diversification, reflected by a relatively high-risk gradient value ($RGV_{B,T} = 5.20$). A reduction of one unit of standard deviation for this farm costs €3.20, which is considerably higher than for farm A.
Figure 2. Relationship between standard deviation (SD of G) and mean of gross margin (mean of G) for farm A and farm B

Figure 3. More detail examples of the relation between mean of gross margin (mean of G) and standard deviation (SD of G) changes

Figure 2 depicts the efficiency frontier lines for farms A and B. Figure 3 graphically summarises the relationship between gross margin change and the standard deviation change for the farms considered.
5 CONCLUSIONS AND DISCUSSION

This paper describes a new approach to whole-farm optimisation using individual farm data to estimate the efficiency of farm diversification strategies at the individual farm-level. The RGV is a good measure of the diversification efficiency of farms as a risk-management strategy. A lower RGV represents a lower expected cost of risk offset with the change in diversification. On the other hand, a higher RGV denotes a higher risk offset cost.

The main contribution of this paper is the RGV estimation at farm-level, which makes it possible to analyse the response of gross margin with the change in standard deviation. Lower RGV denotes better farm efficiency in the sense of diversification. This means that the standard deviation can be reduced without considerable loss of expected gross margin. This methodology reflects the gross margin change in each unit of standard deviation change and we have shown that the farms have a totally different gradual decrease. Decision-makers can thus see what level of standard deviation decrease yields the most considerable change in wealth. The idea of RGV estimation can be widely used for farm diversification efficiency estimation. This study leads to a number of ideas for further research into its application. Other activities (for instance, yield insurance or price contracts) can be included in the optimisation, enabling proper estimation of the efficiency of these risk-management strategies for an individual farm.

The RGV of other farms has been analysed as well (see Appendix: tables 1A and 2A). Comparing the $G_{min_{kT}}$ with $G_{kT}$ of each farm (optimal plans are not presented), it can be concluded that those farms that have the lowest $RGV$ have the least difference between these plans. The farmers of farms II, V and VII have chosen risk-averse strategies and have the most stable diversification management. However it is noticeable that the farms with relatively high $RGV$ values (farms I, IV and B) have a set of activities that are more similar to $G_{max_{kT}}$. So, those farmers have chosen less risk-averse (more nearly risk-neutral) strategies giving close to the maximum expected gross margin. The plans of the rest of the farms (farms A, VIII, IX and X) lie somewhere in the middle of the normative optimisation range, i.e. between $G_{max_{kT}}$ and $G_{min_{kT}}$.

![Figure 1A. RGV at the individual farm-level](image)
Figure 2A. Relation between mean of gross margin (mean of G) and standard deviation (SD of G) changes at farm-level

References


DESIGNING VALUE ADDING WEB-INFOMEDIARIES: EXPLORING THE GAPS BETWEEN THE SUPPLY AND DEMAND OF KNOWLEDGE

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Abstract

Web-infomediaries bridge gaps between knowledge suppliers and knowledge demanders, using Internet technology. Although there is a multitude of methods and techniques available to realize web-infomediaries, there is little research done on what gaps they should bridge in order to create added value for their users. This article addresses this lacuna in the current literature by researching what gaps exist for knowledge demanders when they want to use knowledge from other organizations. The research is done in a field were the use of external knowledge is both highly relevant and problematic: new product development (NPD) in high-tech small and medium sized enterprises (SMEs). Because of lacking relevant theory, the research followed an inductive approach. The results of 17 critical incident interviews with engineers and NPD managers provide a classification of gaps they face when they attempt to use external knowledge during NPD. This classification provides founders and developers of web-infomediaries with a list of value adding opportunities to choose from in the early stages of a design project. Directions for research are in the realm of establishing priorities between the various gaps and establishing the feasibility of bridging them.

Keywords: External Knowledge Integration, Web-infomediaries, Supply-and-demand-gaps, Value Adding

1 INTRODUCTION

Web-infomediaries bridge gaps between actors that need knowledge and actors that have knowledge, using Internet technology. This paper reflects an attempt to establish what supply-and-demand gaps they could bridge in order to create added value for knowledge demanders. The outcome of this research is a classification of gaps that knowledge demanders face when they want to use knowledge from other organizations. This classification is useful for founders and developers of web-infomediaries in that it provides them with a range of value adding opportunities to choose from when creating their web-infomediary. Although web-infomediaries should address the needs of both knowledge suppliers and knowledge demanders, the research concentrates on the needs of knowledge demanders. This focus was made because one virtue of intermediaries is that they can choose both demanders and suppliers (Gould & Fernandez, 1989). Although, at the end, the needs of both parties should be satisfied, web-infomediary designers can start by concentrating on the needs of a certain group of knowledge demanders before they establish what knowledge suppliers are needed for that and what are their needs.

The current literature on web-infomediaries is of limited use for the purpose of this paper for three reasons. Firstly, it takes the perspective of the infomediary or the knowledge supplier and not of the
knowledge demander (Bailey & Bakos, 1997; Bakos, 1991; Janssen, 2001; Sarkar, Butler, & Steinfeld, 1998; Yoo, Choudhury, & Mukhopadhyay, 2002-3). Secondly, it recognizes which general structural and functional roles web-infomediaries can play in order to bridge supply-and-demand gaps (e.g. aggregation and matching of demand and supply), but not what this specifically means in a certain context and what it means for their design (Bhargava & Choudhury, 2004; Gümél, 1985; Rose, 1999; Womack, 2002). Thirdly, with a few exceptions (Rose, 1999; Vishik & Whinston, 1999), web-intermediary design literature focuses on intermediaries for financial and physical products rather than on infomediaries (see for example Janssen, 2001).

Since the current literature lacks relevant theory, the research followed an inductive approach. The central research question that guided the inductive research was:

What supply-and-demand gaps exist for knowledge demanders when they want to use knowledge from other organizations?

This question was answered in a field were the use of external knowledge is both highly relevant and problematic: new product development (NPD) in high-tech small and medium sized enterprises (SMEs).

2 ANALYSING KNOWLEDGE SUPPLY-AND-DEMAND GAPS

Although some inductive approaches promote starting research from a tabula rasa (Glaser & Strauss, 1967), we follow Walsham's (1995) warning against ignoring existing theory completely. Besides that it is impossible to completely ignore previous knowledge, it is not necessary or even desirable to do so. Above, we have stressed the lack of specific theory on web-infomediaries, which implies that there is a lack of theory on what supply-and-demand gaps to expect. However, there is an abundance of literature available that helps us to establish where to look for these gaps, that is, literature of the process by which organizations identify, acquire, and utilize knowledge from outside their organization. In this section, we will outline the lens we used to research this process of knowledge integration (KI). This lens was based on and explained in earlier work of the authors (Kraaijenbrink, Faran, & Hauptman, 2005; Kraaijenbrink, Groen, & Wijnhoven, 2005) As depicted in Figure 1, we distinguish three types of KI activities, and five aspects of KI.

The central cogwheel in Figure 1 depicts an iterative process of knowledge identification, acquisition, and utilization activities (following Kraaijenbrink & Wijnhoven, 2005). Identification consists of activities involved in locating relevant knowledge outside the organization. During acquisition, knowledge is transferred from a source to an organization by means of, for example, cooperation. Utilization consists of all activities in which acquired knowledge is made accessible, is applied, and is integrated in the organization.

These three types of activities connect five aspects of KI in NPD. The KI process is initiated by an NPD problem, which can originate within a company, but also from (potential) customers. Examples of NPD problems are using a new material for a product, adding new functionalities to an existing product, and making a product for a new application area. To come to a solution for the NPD problem, there is a need for certain knowledge that is not available in the company. Situations where no external knowledge is needed are out of the scope of this research, and they are also very rare in NPD (Cohen & Levinthal, 1990). The knowledge need that is introduced by the NPD problem is usually not fully specified from the start. Particularly in a creative process as NPD, it is very hard to know in advance exactly what knowledge is needed in order to solve the NPD problem. Although the knowledge need is thus not fully specified, engineers will start enquiring a number of knowledge sources to find knowledge that is relevant for solving the NPD problem. Typical examples are customers, suppliers, and the Internet (Johnson & Kuehn, 1987; Julien, 1995). At these sources, engineers will find certain knowledge that they can acquire and utilize in order to solve the NPD problem. Because, in NPD,
knowledge is often of a tacit nature (O'Dell & Grayson, 1998; Ramesh & Tiwana, 1999), acquiring this knowledge will often involve strong interaction between the knowledge source and the company. When the acquired knowledge is sufficient, there is found an NPD solution.

Figure 1. Theoretical lens: the knowledge integration process

Although this seems a rather straightforward process, the KI process is depicted as a set of cogwheels to illustrate that any change at one part affects all the other parts. Solving an NPD problem will usually involve many cycles of identification, acquisition, and utilization of knowledge. For example, when certain knowledge is found, engineers may redefine their knowledge need, or even redefine the NPD problem as they had specified it. Additionally, when engineers try to apply certain knowledge to solve the NPD problem, they may realize that they need additional knowledge of different sources. Although the exact path of the KI process will differ for each specific NPD problem, Figure 1 provides a set of activities and aspects that will appear in every KI process in NPD. Thus, it provides us with a focused lens to look for supply-and-demand gaps in KI. The next section explains how this was done.

3 METHOD

Because of the inductive theory development nature of this research, it was important to get a rich and holistic picture of the KI process in the NPD practice (Miles & Huberman, 1994). Highly intrusive techniques as participant observation are recommended for this type of research (Spradley, 1980). However, since KI is an intangible process and not performed at one point in time, it was impracticable to use this technique. Alternatively, we used the critical incident interviewing technique (Flanagan, 1954), which has proven to be useful and practical in research on information seeking (Urquhart et al., 2003). Of the available interviewing techniques, the critical incident technique is
considered to give one of the most accurate and reliable retrospective reports of processes in practice. Using this technique, interviewees are asked to describe detailed successful and unsuccessful examples of the process under study. Crucial for this type of interviews is that interviewees can concentrate on description and are not distracted by asking for explanations of their behaviour.

3.1 Interview scheme

Figure 1 was converted into a semi-structured interview scheme consisting of a general part, a critical incident part and a part for additional elicitation. The purpose of the general part of the interviews was twofold. Firstly it helped the interviewer to get a picture of the context and the general way in which KI took place in the company. Secondly, it prepared the interviewee to the type of critical incidents to be described in the second part of the interview. This part included the following topics:

- Description of the company, its products, markets, and recent and future developments.
- Description of the NPD process in the company, including the role of the interviewee.
- Description of KI in NPD, including the three types of activities and five aspects.

The second and main part of the interview was used to get a description, explanation, and reflection of at least one successful and one unsuccessful example of KI in the company. Success in this case means that the respondent felt that the concerning NPD problem in the example was solved with the help of external knowledge. Unsuccessful examples are those where the respondent felt that the problem was not solved and/or that the required knowledge was not obtained. To not distract interviewees from their description, explanatory and reflective questions where only asked after the description was given. Interviewees were asked about the following topics for each example:

- Description of KI in NPD, including the three types of activities and five aspects.
- Explanation of why they acted in the described way.
- Reflection on problems and potential improvements.

The last part of the interview was used to elicit additional details for the examples by confronting the interviewee with a number of classifications from the literature of the five aspects of Figure 1.

3.2 Sampling

The targeted interviewees were engineers and NPD managers of high-tech manufacturing SMEs. For the selection of interviewees we used the principle of theoretical sampling (Glaser & Strauss, 1967). A fundamental characteristic of theoretical sampling is that the type and number of respondents are not established in advance, but result from the theoretical need for further exploration until saturation is achieved. Guiding principles for respondent selection are minimization and maximization of differences between respondents. Following these principles we started our enquiry with a selection of four respondents in the electronics industry, two in the chemical industry, and one machine manufacturer (see Table 1). After a first analysis of the seven interviews it was concluded that there was a need for additional interviews: (1) at one similar machine manufacturer (Emotech); (2) at one similar chemical company (Eurochemie); (3) at one engineering company (Idé partners); (4) with two persons with different roles in one company (Procede); and (5) at science based instead of technology based companies in one industry (Lionix, Medspray). After analysis of these additional seven interviews, a point of saturation was believed to be reached. To examine whether this was indeed the case, three additional interviews were done in very different companies (Artecs, Genetwister, and Norit). In these three additional interviews no new gaps were identified, which strengthened our confidence to have reached a point of saturation.
<table>
<thead>
<tr>
<th>Company</th>
<th>Industry</th>
<th># Empl</th>
<th>Year</th>
<th>Job</th>
</tr>
</thead>
<tbody>
<tr>
<td>First round</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CSE</td>
<td>Electronics – optical measurement</td>
<td>2</td>
<td>1994</td>
<td>Director / engineer</td>
</tr>
<tr>
<td>Rebx</td>
<td>Electronics – analogue devices</td>
<td>1</td>
<td>1997</td>
<td>Director / engineer</td>
</tr>
<tr>
<td>Innotech</td>
<td>Electronics – control systems</td>
<td>7</td>
<td>2000</td>
<td>Director / NPD manager</td>
</tr>
<tr>
<td>MMS</td>
<td>Electronics – diagnostic</td>
<td>50</td>
<td>1988</td>
<td>Engineer / NPD manager</td>
</tr>
<tr>
<td>Dick Peters</td>
<td>Chemical – wax emulsions</td>
<td>35</td>
<td>1956</td>
<td>Engineer</td>
</tr>
<tr>
<td>Drywood</td>
<td>Chemical – coatings</td>
<td>20</td>
<td>1895</td>
<td>Engineer / NPD manager</td>
</tr>
<tr>
<td>Bouman</td>
<td>Machine – specialties</td>
<td>90</td>
<td>1990</td>
<td>Engineer / NPD manager</td>
</tr>
<tr>
<td>Second round</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lionix</td>
<td>Nanotechnology – mechan., optical, fluidic</td>
<td>16</td>
<td>2001</td>
<td>Engineer</td>
</tr>
<tr>
<td>Medspray</td>
<td>Nanotechnology – fluidic</td>
<td>6</td>
<td>2001</td>
<td>Director / Engineer</td>
</tr>
<tr>
<td>Emotech</td>
<td>Machine – coating</td>
<td>23</td>
<td>1970</td>
<td>Engineer / NPD manager</td>
</tr>
<tr>
<td>Eurochemie</td>
<td>Chemical – lubrication, cleaning</td>
<td>35</td>
<td>1991</td>
<td>Engineer / NPD manager</td>
</tr>
<tr>
<td>Idé partners</td>
<td>Engineering – industrial series</td>
<td>10</td>
<td>1990</td>
<td>Engineer / NPD manager</td>
</tr>
<tr>
<td>Procede</td>
<td>Engineering - process technology</td>
<td>23</td>
<td>1993</td>
<td>Director / NPD manager</td>
</tr>
<tr>
<td>Procede</td>
<td>Engineering - process technology</td>
<td>23</td>
<td>1993</td>
<td>Engineer / NPD manager</td>
</tr>
<tr>
<td>Final round</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Artec</td>
<td>Chemical – polymers</td>
<td>5</td>
<td>2002</td>
<td>Engineer / NPD manager</td>
</tr>
<tr>
<td>Genetwister</td>
<td>Genomics – agricultural</td>
<td>25</td>
<td>1998</td>
<td>Director / NPD manager</td>
</tr>
<tr>
<td>Norit</td>
<td>Machine – membrane filtration</td>
<td>4</td>
<td>1995</td>
<td>Director / NPD manager</td>
</tr>
</tbody>
</table>

Table 1. Profile of Respondents

3.3 Analysis

The interviews lasted between 70 and 180 minutes, with an average of two hours. Each of the seventeen interviews was recorded and transcribed completely, accounting for a total of 768 pages of double-spaced transcribed text. Supply-and-demand gaps were identified by comparing successful cases (i.e. gaps were bridged) with unsuccessful cases (i.e. gaps were not bridged). We used the constant comparison method for this analysis (Glaser & Strauss, 1967). Since we followed the principle of theoretical sampling, data collection, coding, and analysis were done simultaneously. Table 2 provides an example of how comparisons are made using the principles of minimizing and maximizing differences between cases.

<table>
<thead>
<tr>
<th>Minimize differences</th>
<th>on industry</th>
<th>on # employees</th>
<th>on year</th>
<th>on job</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSE – Rebx</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dick Peters - Drywood</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximize differences</td>
<td>(CSE, Rebx) - (Dick Peters, Drywood)</td>
<td>(MMS – (CSE, Rebx))</td>
<td>Innotech – MMS</td>
<td>Innotech – Rebx</td>
</tr>
</tbody>
</table>

Table 2. Example of minimizing and maximizing variation between respondents.

Figure 1 was used again for the coding and analysis of the transcribed texts. For each example that was described by the interviewees the sequence of activities and aspects was coded into MS Excel sheets (total number of examples: 65) Consequently, we identified words indicating the existence of supply-and-demand gaps, that is, indicating a difference between an actual and a preferred state. These words express a gap (e.g. problem, difficult, too, not, don't), a preference (e.g. want, prefer, like), or an adjustment (e.g. change, translate, adjust). As a next step, the list of identified gaps was categorized into as many categories as possible, as suggested in the constant comparison method. A final step was reducing the number of categories to a more efficient classification.
4 RESULTS

The empirical analysis of the KI process has resulted in a classification of supply-and-demand-gaps that web-infomediaries can address in order to add value for their users. Tables 3-5 provide gaps that are associated with respectively knowledge identification, acquisition, and utilization. Below, we provide a rather straightforward overview of these gaps. Moreover, we discuss the most crucial ones in some more detail. Because of space limitations we have not included the original texts of the interviews that instantiated the gaps in Tables 3-5. These texts can be requested from the first author.

4.1 Knowledge Identification

The first group of supply-and-demand gaps concern the identification of knowledge outside the company. As shown in Table 3, these gaps relate mainly to how the knowledge is organized and presented by its supplier, and to what extent the demander is able to specify his/her need for knowledge.

4.2 Knowledge acquisition

The second group of supply-and-demand gaps is associated with the acquisition of knowledge. These gaps concern the transfer of knowledge from a source to a recipient by a diverse set of media and also involve the matching of their interests. Examples of media are objects (e.g. physical products), representation (e.g. documents), and humans (e.g. by hiring somebody).

4.3 Knowledge Utilization

The last group of supply-and-demand gaps concerns the utilization of knowledge. Here we come to the question whether the knowledge is applicable for the NPD problem. Hence, it concerns issues like the level of abstraction and quality of the knowledge or information.

4.4 Crucial gaps

Although an extensive elaboration on each of these supply-and-demand gaps is tempting and interesting, it is impossible to do this within the boundaries of this paper. Nevertheless, below we discuss a number of gaps that seemed particularly important since they appeared in virtually all the interviews as very crucial in the KI process.

The first concerns the language aspect of knowledge identification. Many respondents indicated that the search for appropriate keywords to enter into a search engine was the most difficult part of the whole processes. To understand this issue, it is helpful to realise that search engines were usually used as a very first start of the KI process. At this start, respondents did not really know what they looked for, but only had vague ideas about a solution they had in mind. This implies that respondents had to think both about what they were going to look for and how they would call this. Once they had made up some terms to enter, they faced the problem that suppliers of knowledge often used different terms than they did. Only when they had found out what terms were used in the concerning domain, they could continue for a while without too many problems.
<table>
<thead>
<tr>
<th><strong>Gap</strong></th>
<th><strong>Explanation</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Information need</strong></td>
<td></td>
</tr>
<tr>
<td>Specified/unspecified</td>
<td>Querying only on specific criteria; demander wants to query in more general terms</td>
</tr>
<tr>
<td>Initial/compromised</td>
<td>Initial need of demander is not identical to final/compromised need</td>
</tr>
<tr>
<td>Objectives</td>
<td>Demander wants information for e.g. orientation and inspiration; supplier provides it for fact finding and retrieval</td>
</tr>
<tr>
<td>Learn/find rate</td>
<td>Demander wants learn/find rate X; supplier provides learn/find rate Y</td>
</tr>
<tr>
<td><strong>Portfolio</strong></td>
<td></td>
</tr>
<tr>
<td>Quantity</td>
<td>Amount of information provided by supplier is too large or too small</td>
</tr>
<tr>
<td>Diversity</td>
<td>Diversity of information provided by supplier is too large or too small</td>
</tr>
<tr>
<td>Customisability</td>
<td>Quantity and diversity of information cannot be changed while demander wants this</td>
</tr>
<tr>
<td><strong>Categorization</strong></td>
<td></td>
</tr>
<tr>
<td>Supply/demand</td>
<td>Information organized by supply structure (e.g. company); demander wants it organized differently (e.g. by product);</td>
</tr>
<tr>
<td>Categorized/not</td>
<td>Information is not categorized by supplier; demander wants them to be categorized</td>
</tr>
<tr>
<td>Single/multiple</td>
<td>Supplier provides a single categorization, demander wants multiple categorizations</td>
</tr>
<tr>
<td>Unequivocal/equivocal</td>
<td>Supplier provides equivocal categorization; demander wants it unequivocal</td>
</tr>
<tr>
<td>Standard/customized</td>
<td>Supplier provides standard categorization standards, demander wants it customized</td>
</tr>
<tr>
<td><strong>Navigation</strong></td>
<td></td>
</tr>
<tr>
<td>Horizontal</td>
<td>Demander wants links to similar information; suppliers do not provide this</td>
</tr>
<tr>
<td>Vertical</td>
<td>Suppliers offer only opportunity to browse downwards in the browsing tree; demanders also want to browse upwards</td>
</tr>
<tr>
<td>Forward/backward</td>
<td>Demanders want to know to whom their suppliers supply; suppliers don’t provide this</td>
</tr>
<tr>
<td>chain</td>
<td>Demanders want to know who supply to their suppliers; suppliers don’t provide this</td>
</tr>
<tr>
<td>Deep Internet</td>
<td>General search engines don’t search information on the ‘deep internet’. Demander wants to access multiple channels simultaneously; supplier provides one at a time</td>
</tr>
<tr>
<td>Depth/width</td>
<td>Suppliers provide deep browsing structures; demanders want wide ones</td>
</tr>
<tr>
<td>Search/browse/order</td>
<td>Demander wants search, browse, and order integrated; suppliers don’t provide this</td>
</tr>
<tr>
<td>One/variour navigation</td>
<td>Demander wants multiple ways to navigate; suppliers provide only one way</td>
</tr>
<tr>
<td>Unequivocal/equivocal</td>
<td>Demander wants unequivocal navigation; supplier provides equivocal navigation</td>
</tr>
<tr>
<td>Position in website</td>
<td>Demander wants to know its location in websites; suppliers don’t provide this</td>
</tr>
<tr>
<td><strong>Language</strong></td>
<td></td>
</tr>
<tr>
<td>Spelling</td>
<td>Supplier uses spelling X; demander spelling Y</td>
</tr>
<tr>
<td>Language</td>
<td>Supplier provides information in language X; demander wants it in language Y</td>
</tr>
<tr>
<td>Jargon</td>
<td>Supplier uses commercial name X for product with technical name Y; demander only knows technical name or general name Y</td>
</tr>
<tr>
<td>Homonyms</td>
<td>To supplier X means A; to demander X means B</td>
</tr>
<tr>
<td>Relativity of qualifiers</td>
<td>For supplier ‘heavy’ means ‘10 tons’; for demander ‘heavy’ means ‘1 microgram’</td>
</tr>
<tr>
<td>Synonyms</td>
<td>Supplier uses X to describe A; demander uses Y to describe A</td>
</tr>
<tr>
<td><strong>Missing data</strong></td>
<td></td>
</tr>
<tr>
<td>Interpolation</td>
<td>Suppliers provide discrete information (e.g. in table format); demanders want information for slightly different values (e.g. by providing a continuous graph)</td>
</tr>
<tr>
<td>Extrapolation</td>
<td>Supplier provides information about 1 and 2; Demander needs about 3</td>
</tr>
<tr>
<td><strong>Normalization</strong></td>
<td></td>
</tr>
<tr>
<td>Standard/customized</td>
<td>Demander wants information about standard components; supplier provides about customized components</td>
</tr>
<tr>
<td>Commodity/ heterogeneity</td>
<td>Products are unique (no commodities); thus they are hard to compare because they have different features</td>
</tr>
<tr>
<td>Reference norm</td>
<td>Demander wants to compare a unique case to a normalized reference case</td>
</tr>
<tr>
<td><strong>Scale advantages</strong></td>
<td></td>
</tr>
<tr>
<td>Demand</td>
<td>For 1 demander, search costs might exceed benefits; for multiple demanders that look for the same knowledge, costs are the same, but cumulative benefits are higher</td>
</tr>
<tr>
<td>Supply</td>
<td>For 1 supplier, costs of Internet presence might exceed benefits; for multiple suppliers costs are comparable, but benefits are higher (scale benefits &amp; network externalities)</td>
</tr>
</tbody>
</table>

*Table 3. Supply-and-demand gaps associated with knowledge identification*
<table>
<thead>
<tr>
<th>Gap</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Switching</strong></td>
<td></td>
</tr>
<tr>
<td>Within media</td>
<td>Supplier provides information on medium X (e.g. DOC file); demander wants it on medium Y (e.g. PDF file)</td>
</tr>
<tr>
<td>Between media</td>
<td>Demander wants information on object/representation/human; supplier does not provide this.</td>
</tr>
<tr>
<td>Information/meta</td>
<td>Demander wants to go from identification to acquisition of information; supplier does not provide these links</td>
</tr>
<tr>
<td>Information</td>
<td>Demander wants to go from information to source; supplier does not provide this.</td>
</tr>
<tr>
<td>Source/information</td>
<td>Demander has to decide when to use existing or new sources</td>
</tr>
<tr>
<td>Sources</td>
<td>Demander wants to go from one source to another (e.g. from source of representation to source of physical product)</td>
</tr>
<tr>
<td>Knowledge</td>
<td>Demander has to decide when to use existing or new knowledge</td>
</tr>
<tr>
<td>Type of knowledge</td>
<td>Demander has to decide when to use an existing or a new type of knowledge</td>
</tr>
<tr>
<td><strong>Role of actors</strong></td>
<td></td>
</tr>
<tr>
<td>Specialization</td>
<td>Supply of information by marketing, directors, or staff; demand of information by R&amp;D department</td>
</tr>
<tr>
<td>Individual/company</td>
<td>Demander wants information from individual; supplier acts as company</td>
</tr>
<tr>
<td>Employee/scientist</td>
<td>Suppliers have roles as scientists and as employees; demander wants to go from one to the other</td>
</tr>
<tr>
<td>Task division</td>
<td>Demander 1 has to cooperate with demander 2</td>
</tr>
<tr>
<td><strong>Fit of actors</strong></td>
<td>(Fit can be identical, complementary, far off, contradictory)</td>
</tr>
<tr>
<td>Interests</td>
<td>Interests of supplier and demander are not in line</td>
</tr>
<tr>
<td>Value</td>
<td>Value of information is different when published, not published, or selectively published for demander and supplier</td>
</tr>
<tr>
<td>Level of knowledge</td>
<td>Level of knowledge of supplier is X; of demander is Y</td>
</tr>
<tr>
<td>Expertise area</td>
<td>Expertise of supplier is X; of demander is Y</td>
</tr>
<tr>
<td>Domain</td>
<td>Domain of supplier is X; of demander is Y</td>
</tr>
<tr>
<td>Technological platform</td>
<td>Supplier uses another technological platform than demander (e.g. Apple)</td>
</tr>
<tr>
<td><strong>Time</strong></td>
<td></td>
</tr>
<tr>
<td>Reaction time</td>
<td>Demander wants fast response from supplier; supplier does provide this too late</td>
</tr>
<tr>
<td>Required/available</td>
<td>Demander has time t available but needs time t+1 for e.g. information seeking</td>
</tr>
<tr>
<td>Iterations</td>
<td>Information seeking requires X iterations while demander wants only Y iterations</td>
</tr>
<tr>
<td><strong>Finance model</strong></td>
<td></td>
</tr>
<tr>
<td>Supplied/demanded</td>
<td>Supplied finance model is X; demanded finance model is Y</td>
</tr>
<tr>
<td><strong>Information availability</strong></td>
<td></td>
</tr>
<tr>
<td>Required/existing</td>
<td>Demander requires information that does not exist yet (intentional and unintentional)</td>
</tr>
<tr>
<td>Required/published</td>
<td>Supplier wants to give information without giving it away completely</td>
</tr>
<tr>
<td>Required/access: source</td>
<td>Demander requires information from an inaccessible source (intentional and unintentional)</td>
</tr>
<tr>
<td>Required/access: information</td>
<td>Demander requires information that is inaccessible (intentional and unintentional)</td>
</tr>
<tr>
<td>Required/aware</td>
<td>Demander requires information of a source he is not aware of (intentional and unintentional)</td>
</tr>
<tr>
<td>Required/affordable</td>
<td>Demander requires unaffordable information (intentional and unintentional)</td>
</tr>
<tr>
<td>Required/allowed</td>
<td>Demander is not allowed to use required information</td>
</tr>
</tbody>
</table>

*Table 4. Supply-and-demand gaps associated with knowledge acquisition*
<table>
<thead>
<tr>
<th>Gap</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Application domain</strong></td>
<td><strong>Explanation</strong></td>
</tr>
<tr>
<td>Description</td>
<td>Information described for domain A but needed for domain B</td>
</tr>
<tr>
<td>Restriction</td>
<td>Information described for domain A, but its use is restricted to domain B</td>
</tr>
<tr>
<td>Projection</td>
<td>Information described for current situation, but needed for future situations</td>
</tr>
<tr>
<td>Central/side issue</td>
<td>Side issue of information for domain A is central issue for domain B</td>
</tr>
<tr>
<td>Strategic-operational</td>
<td>Information provided for strategic reasons; demanders need it for operational use</td>
</tr>
<tr>
<td><strong>Information aggregation</strong></td>
<td><strong>Explanation</strong></td>
</tr>
<tr>
<td>Single/multiple</td>
<td>Information described for single product/company, but needed for multiple ones</td>
</tr>
<tr>
<td>Part/whole</td>
<td>Information described for components/products, but needed for products/packages</td>
</tr>
<tr>
<td></td>
<td>Information described for industries/companies, but needed for companies/individuals</td>
</tr>
<tr>
<td><strong>Abstraction</strong></td>
<td><strong>Explanation</strong></td>
</tr>
<tr>
<td>Application-process</td>
<td>Supplier describes application/function/form; demander wants function/form/process</td>
</tr>
<tr>
<td>Applied/fundamental</td>
<td>Supplier provides applied information/demander wants fundamental information</td>
</tr>
<tr>
<td>Symptom/problem/solution</td>
<td>Supplier describes problem/solution; demander seeks on symptom/problem</td>
</tr>
<tr>
<td>Analysis/hypothesis/test</td>
<td>Supplier provides information on indicators; demander seeks on variables</td>
</tr>
<tr>
<td>consequences</td>
<td>Demanders want to go from analysis to hypotheses to tests to consequences; supplier does not provide these links</td>
</tr>
<tr>
<td><strong>Information quality</strong></td>
<td><strong>Explanation</strong></td>
</tr>
<tr>
<td>Correctness</td>
<td>Required/perceived/claimed/factual correctness of information are different</td>
</tr>
<tr>
<td>Completeness</td>
<td>Required/perceived/claimed/factual completeness of information are different</td>
</tr>
<tr>
<td>Certainty</td>
<td>Required/perceived/claimed/factual correctness of information are different</td>
</tr>
<tr>
<td>Depth</td>
<td>Required/perceived/claimed/factual depth of information are different</td>
</tr>
<tr>
<td>Up-to-date-ness</td>
<td>Required/perceived/claimed/factual up-to-date-ness of information are different</td>
</tr>
<tr>
<td>Stableness</td>
<td>Required/perceived/claimed/factual stableness of information are different</td>
</tr>
<tr>
<td>Specificness</td>
<td>Required/perceived/claimed/factual specificness of information are different</td>
</tr>
</tbody>
</table>

**Table 5.**  
*Supply-and-demand gaps associated with knowledge utilization*

A second – and related – important issue concerns the constant interplay between form and function during the KI process. Since NPD, almost by definition, involves finding new solutions, respondents faced the problem that they knew more or less what the solution they had in mind should do, that is they knew the function. However, they did not know what form was needed or available to fulfil that function. On the other hand, suppliers of knowledge usually described the form of a solution, and not its function. An example concerns the case when one of the respondents needed small lamps that were less vulnerable than ordinary light bulbs. He knew how large the lamp should be, how much light it should give and how much heat it was allowed to produce (i.e. its function), but not whether such a lamp existed or what it was called (i.e. its form). Only after a long search he found out that they did exist and were called high-efficiency LEDs, which was the name that was used by the supplier.

A third issue that appeared in virtually all the interviews was the use of knowledge from one domain (e.g. industry) into another domain. This is also very close to the nature of the NPD process of SMEs. What they usually do is to take a solution that is used in another industry and change it such that it can be used in the given domain. Although this is an effective way of developing new products, it involves challenges. In the source domain, products are used for certain applications and also described for that application. For example, in its original application, some small fluid container is used for the storage of insulin for diabetes patients. Consider an engineer in another industry that wants to use it as a container within a medicine sprayer. This engineer faces the problem that no one before had thought of this application for the container. Consequently, this application is not described and thus hard to find. Also, she has to translate the information that is given to this new domain.

As an addition to the three groups of supply-and-demand gaps that are listed in Tables 3-5, there was mentioned one remarkable issue that concerned each of the three stages: the KI process should be fun
to do. In terms of gaps this can be defined as a gap between the needed and supplied level of fun. Fun does not imply that websites should include all kinds of animations, or java-applications. One respondent gave an example of what was meant by fun. He thinks Google is fun because you find all kind of interesting things you were not looking for. Thus, fun is fun as long as it is functional.

5 CONCLUSION AND DISCUSSION

This paper started with the question of what supply-and-demand gaps web-infomediaries could bridge in order to create added value for knowledge demanders. Based on 17 critical incident interviews, Tables 3-5 provide a first answer to this question. The length of the list comprised of these three tables indicates that there is, in principle, a wide range of value adding opportunities for web-infomediaries. Practitioners can use this list in order to identify such opportunities. When we compare this list to current web-infomediaries, we can conclude that many of these opportunities are currently not used. For example, the translation between form and function has, to our knowledge, not been implemented in any existing web-infomediary while it has been the main principle of the Theory of Inventive Problem Solving (TRIZ) for almost 50 years now (Altshuller, 1996). We suspect this gap between theory and practice exists partly because of a lack of similar studies like this study but also because existing web-infomediaries may have good reasons for not using certain opportunities. These reasons were not explored in this study and should certainly be investigated in future research.

As any study, the current study has a number of limitations that make that we have to be careful with our conclusions. Firstly, we have only interviewed a relatively small number of interviewees, which makes that we cannot generalize to other groups of respondents. However, since, as researchers our aim is to develop theory it is not the generalizability to other groups that matters most to us, but the generalizability to theory (Lee & Baskerville, 2003). This implies that we should be able to explain what is happening within the 65 examples that were described by the respondents and why the gaps are there. Although we have not provided such explanations for all the gaps of Tables 3-5, we have explained three of them in Section 4.4. A further analysis is left to future research to be done by us and other academics. Although the generalizability to other groups of respondents is not the main interest of academics, it is of crucial importance for developers of web-infomediaries. Namely, as any intermediary, web-infomediaries can only exist when there is a critical mass of suppliers and demanders. From this perspective, it is important to find out to what extent our conclusions can be generalized to a larger group of respondents. Although we have tried to maximized the differences between the several respondents, it is still necessary to research this on a larger scale and in different industries and countries.

Another limitation stems from the research method that was followed. Although the critical incident technique is assumed to provide reliable and valid descriptions of events, it remains a retrospective method that possibly will give biased views. A central risk when reporting about the KI process retrospectively is that respondents will see the process as more structured than during the process itself. Consequently, their explanations of decisions will be more rational than they really were at the moment they were taken. However, by focusing on descriptions, the critical incident tries to address this main weakness – and we believe it does so successfully. Moreover, currently we believe there are no better alternatives available since direct observation is infeasible. However, we do suggest future research to combine the critical incident technique with other techniques, to enable triangulation of results.

A third limitation lies in the results of our study. Although we tried to be as objective as possible by using well-established classification techniques as the constant comparison method, any classification is partly subjective. This implies that Tables 3-5 includes a partially subjective view on supply-and-demand gaps. It is however not the objectivity that is most important, but the usefulness of a classification. Usefulness is related to the objective of the classification. Our objective was to provide
founders and developers with a list of value adding opportunities for web-informediaries. Since the classification of Tables 3-5 fits the process in which these opportunities appear, we believe the classification is a useful one. Of course, its usefulness needs to be tested when it is used in practice.

Because of the lack of existing theory and instruments for the design of web-informediaries and the inductive nature of this research, our results are more an initiation of further research than the end of a line of research. Hence, we suggest a number of directions for further research. This study has identified a large number of supply-and-demand gaps that are in principle value adding opportunities for web-informediaries. Future research needs to find out to what extent these are also realistic opportunities. Therefore, future research needs firstly to address the questions as to what are the size and the importance of the gaps for knowledge demanders and what is the number of knowledge demanders which face similar gaps. The larger and more important the gap, and the larger the number of demanders that face this gap, the more important and economically feasible is a web-informediary. While this study has only concentrated on knowledge demanders, such future research should also include knowledge suppliers, since web-informediaries will only be successful when also their interests are being met.

Secondly, future research should also address the question as to what extent these gaps can be bridged. As can be seen in Tables 3-5, some gaps are hard to bridge by only IT (e.g. relative meaning of words), or are hard to bridge by web-informediaries in any case (e.g. interests of actors). This does not imply that IT is useless, since it can still contribute to bridging these gaps. Whereas the analysis of supply-and-demand-gaps and the establishment of their importance can be done empirically, linking them with (IT or non-IT) solutions requires a more creative approach (Laurel, 2003). For future research we suggest the following approach: Firstly, we suggest asking practitioners to mention existing web-informediaries that they already use and (dis)like particularly. These websites can then be analysed and compared to find clues on how gaps could be bridged by IT. Secondly, we suggest asking academic and professional experts on web-informediary design to suggest what additional IT could be used to bridge the gaps. Finally, we suggest reviewing existing IS literature where solutions for bridging similar or identical gaps functions are suggested. Hence, as an important side effect of such study, existing IT-solutions will be attributed a functional role within the design of web-informediaries.

References


IDENTIFICATION AND MEASUREMENT OF COMPETENCES OF ENTREPRENEURS IN AGROBUSINESS

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Abstract

In the last decade the competence concept has become a central theme in the debate on the development of vocational education, training and organisations. Also in the conceptual domain of entrepreneurship there appears to be more interest in the competence concept. In order to use the competence concept in a learning and development perspective it is necessary to measure competences and competence development of entrepreneurs in a reliable and valid way. In this study of micro and small sized enterprises in agribusiness, we therefore tried to identify and measure the level of competence of entrepreneurs. The objectives of the study were (i) identifying and measuring the most important competences, (ii) applying them to different sub-sectors, and (iii) providing entrepreneurs with possible areas for development. Based on a triangulation of methods the assessment seems to generate results that are recognisable, usable and valid in each of the 16 cases tested. The competence profile derived provides the individual entrepreneur with further areas for development. Moreover, the profile provides clear starting points for research on factors that influence the process of competence development in the domain of entrepreneurship.

Keywords: competences, entrepreneur, assessment, agri-business.

During the last decade the issue of competence development has received a great deal of attention. This attention has mainly focussed on larger organisations, using competences to manage and implement change (Mulder, 2001). However, increasing use is being made of competences in other contexts; the competence concept has become a central theme in the debate on the development of vocational education and training, scientific education and in organisations (Mulder, 2004). There also seems to be increasing interest in the competence concept within the conceptual domain of entrepreneurship (Caird, 1992; Chandler and Jansen, 1992; Bird, 1995; Dahlqvist, 1999 and Man et al., 2002). This interest in the concept rests on the assumptions that competences are recognisable, assessable and relevant for practice, that they can be developed, learned and described on different levels, and it is supposed that there is a strong relationship between competence and organisational effectiveness (Caird, 1992).

In order to use the competence concept in the field of entrepreneurship it is necessary to identify and measure competences and competence development of entrepreneurs in a reliable and valid way. In general, new analytical frameworks and empirical research are needed to combine current thinking on entrepreneurship and competences (Dahlqvist, 1999). The identification and assessment of competences of entrepreneurs is interesting from a scientific as well as a practical point of view. If competences of entrepreneurs can be assessed unambiguously, the learning process that underlies competence development and the link between competence development, enterprise performance and
personal development can be studied in detail. However, concrete instruments to measure competences of entrepreneurs with the accent on learning and development are not yet available. Therefore, a tentative assessment procedure for the identification and measurement of competences of entrepreneurs in agribusiness was developed.

The objective of this study was to develop an assessment tool to identify and measure the level of competence of entrepreneurs in micro (0-9 employees) and small-sized (10-49 employees) enterprises in different sub-sectors in agribusiness and to test and validate the instrument in practice. The assessment tool should provide the entrepreneur with a detailed picture of his or her competences, a mirror of his or her competence profile. The profile should show the level of competence, but also indicate possible areas for further development.

The outline of this paper will be as following:

The next paragraph discusses competences in the domain of agricultural entrepreneurship. In the following paragraph the methods used for the design and procedures followed are described, after which the results are presented. The paper finishes with some points for discussion, conclusions and recommendations for further research in the field of competences and entrepreneurship.

Competence in the conceptual domain of agricultural entrepreneurship

This research focuses specifically on entrepreneurs in the agricultural sector in the Netherlands. The agricultural sector employs 50% of all the labour in the agri-food sector, and accounts for 25% of the total agricultural complex. The sector consists of numerous micro-, and small to medium sized enterprises. The primary production sector comprises dairy farms, farms with grazing stock, arable farms, field vegetables farms, farms with intensive livestock production, glasshouse and mushroom production and mixed farms (Ministry of Agriculture, Nature and Food Quality, 2004). The total population consisted of 85,500 enterprises in 2003. The environment in which these entrepreneurs operate is increasingly changing and developing, companies must adapt to the vagaries of the market, changing consumer habits, stricter environmental regulations and so on. While goals are not always clearly specified, innovation in the broadest sense receives high priority.

Running an enterprise successfully in this dynamic setting requires substantial tangible resources, such as physical or financial capital. In addition to material assets, success is also dependent on the more intangible resources embedded in the enterprise, such as the entrepreneurial capital (Erikson, 2000). From research on entrepreneurship it is known that in markets characterised by dynamic change some entrepreneurs become alert and develop knowledge, making (deliberate) information investments that others do not (Busenitz et al, 2004). In the research on the desirable intangible assets of entrepreneurs, a variety of characteristics of entrepreneurs have been examined. Entrepreneurial characteristics are approached from a number of angles in the scientific literature. Two basic approaches can be distinguished. The first focuses on personal traits and characteristics, the second on competences. Personal and psychological factors are important factors for entrepreneurial success. Some of the most mentioned traits include perseverance, energy, diligence, resourcefulness, creativity, foresight, initiative, versatility, intelligence and perceptiveness (see for instance McClelland, 1987 and Ciavarella, 2004). However, these factors are often taken as given, and it is assumed that change or improvement is difficult. The research of McClelland (1987) highlights the importance of competences extracted from behavioural event interviews, rather than merely focussing on general trait characteristics as predictors for success. Nowadays, most interpretations of competence represent an integration of knowledge, capabilities, skills and attitudes displayed in a context with an appropriate level of generality or holism (Biemans et al., 2004), rather than a merely behaviouralistic (focussing solely on the outcome) interpretation. This definition seems to be rather limited, however. Reality is much more complex and there seems to be a lot of ambiguity surrounding the definition of competence. Confusion about the concept is also exacerbated by the objectivistic drive to formulate one overarching definition of competence. Stoof et al. (2002) argue that it is not important to prove
whether the definition of competence is true or not, but whether it is adequate in the context in which it is used. Hence, it is better to work with some guidelines, rather than a stipulated definition (Biemans et al., 2004). From this perspective we would suggest that competences are:

- context-bound,
- subject to change,
- connected to activities and tasks,
- subject to learning and development processes,
- and they are interrelated.

Man et al. (2002) categorised entrepreneurial competences in six key areas of related competences. The key clusters are opportunity, relationship, conceptual, organising, strategic and commitment competences. In the literature on competence profiles of entrepreneurs and managers, several competences that meet the outlined criteria and fit in one of these six clusters can be recognised (Erkkilä, 2000; Hoekstra & Van Sluijs, 1999, Van den Tillaart, 1987, Man et al., 2002; Onstenk, 2003; Mulder, 2001; McClelland, 1987). These competences can be regarded as underlying competences. Table 1 presents an overview of the competence clusters and the underlying competences mentioned in the literature.

**Table 1. Competence clusters with description and underlying competences (after Man et al., 2002).**

<table>
<thead>
<tr>
<th>Competence cluster (Man et al. 2002)</th>
<th>Description</th>
<th>Underlying competences¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Opportunity competences</td>
<td>Competences related to recognising and developing market opportunities through various means</td>
<td>General awareness, International orientation, Market orientation</td>
</tr>
<tr>
<td>2 Relationship competences</td>
<td>Competences related to person-to-person or individual-to-group based interactions</td>
<td>Communication, Negotiation, Networking, Persuasiveness, Teamwork</td>
</tr>
<tr>
<td>3 Conceptual competences</td>
<td>Competences related to different conceptual abilities which are reflected in the behaviour of the entrepreneur</td>
<td>Conceptual thinking, Problem analysis, Vision and judgement</td>
</tr>
<tr>
<td>4 Organising competences</td>
<td>Competences related to the organisation of different internal, external, human, physical, financial and technological resources.</td>
<td>HRM/HRD, Leadership, Planning and organisation</td>
</tr>
<tr>
<td>5 Strategic competences</td>
<td>Competences related to setting, evaluating and implementing the strategies of the firm</td>
<td>Learning orientation, Management control, Result orientation, Strategic orientation</td>
</tr>
<tr>
<td>6 Commitment competences</td>
<td>Competences that drive the entrepreneur to move ahead with the business.</td>
<td>Self-management, Value clarification, Vision</td>
</tr>
</tbody>
</table>


There are a variety of methods available for developing a model of entrepreneurial competences and to assess these competences; the various methods are qualitative, quantitative, retrospective, concurrent, objective and self-report based (Bird, 1995).
Caird (1992) evaluates four research strategies for assessing competences on their suitability for identifying enterprise competences. The first strategy is the critical incidents technique (CIT) (further developed as the well-known Behavior Event Interview method by McClelland (1998)). The CIT/BEI technique focuses on the difference between average and excellent performers in a job. Besides the fact that the technique is time consuming another important point of criticism is that the CIT/BEI highlights extremes. The focus is on the excellence of workers, rather than measuring the broad scale of competences that the entrepreneur possesses. The CIT/BEI only provides information about the top level of competence (Caird, 1992). Respondents also have the tendency to focus on success rather than on failure, which biases the outcomes.

A second method described by Caird is the job function analysis. The job function analysis is a well-known technique for curriculum development and involves the analysis of task functions related to a certain job or profession. Specific knowledge and skills for this job or function can be inferred from this profile. The job analysis method has some major disadvantages. Firstly, the method is very time consuming. Secondly, the techniques focus on the job description and therefore fail to discern between levels of competence. Thirdly, the result of the job function analysis is often an atomised description of skills, knowledge and attitude, with no guarantee that mastery of these sets will lead to competent performance. Finally, the job function analysis method is a rather conservative method, new competences are easily neglected.

A third method consists of the so-called behaviourally anchored rating scales (BARS). BARS are used to identify criteria for effective performance, using evaluation of job performance. The evaluation is conducted by a supervisor, and therefore relies to a large extent on the ability of the supervisor to observe behaviour. A pitfall of this technique is that the focus is merely on the outcome, which may neglect the underlying learning process.

The fourth method described by Caird can be labelled the action research method (Morgan, 1988 in Caird, 1992). Morgan’s action research method promotes self-reflective enquiry and team work by managers. The method focuses on the organisational needs and strategic concerns. It provides a picture of the competence needs for strategic development. A disadvantage of this technique is that it focuses on the needs rather than the actual competences present.

There are also many variations on these four broad strategies, ranging from observations to entrepreneurship games. For a complete overview see Bird (1995). Bird (ibid.) argues that when considering using a particular assessment method, it is important to find examples of this method in other published research, consider time and money aspects, and moreover to determine the reliability and validity of the method for appropriate analysis and conclusions. Luken (2004) mentions some additional aspects to take into consideration when measuring competences: (1) the definition of competence is not a homogeneous definition; (2) competences are not stable; (3) competence assessments are always subjective (4) competence assessments are based on individuals, whereas the definition of the competence concept tries to include the context as well; (5) the competence concept includes capacity, whereas it is also important to look at actual performance.

Although the above mentioned methods do have elements that should be taken into consideration, it can be concluded that none of them are completely suitable for assessing entrepreneurial competences in this context. Hence, based on the considerations outlined, six main design criteria were formulated:

- A focus on the integration of knowledge, understanding, attitudes and skills (visible and hidden elements);
- A focus not merely on behaviour outputs, but also on the ongoing training and education process;
- A focus in the first instance on the actual competences and not on competence needs;
• The measurement of competences is not a matter of measuring the facts, but also of discussing, interpreting and negotiation;

• It is important to rate competences in more than one way. One way of making a relatively valid and reliable assessment is to use different assessment methods;

• Although it is hard to explain the meaning of abstract constructs such as competence, people do have some kind of notion of what it entails (Stoof et al., 2002). As McClelland argues, 'people agree more readily on who is outstanding that on what makes them outstanding'.

Methodology

Based on the evaluation of the assessment methods and the theoretical considerations outlined above, a procedure was designed. The taxonomy of Man et al. (2002) and the underlying competences shaped the framework within which the assessment procedure was developed. To give a detailed picture of the actual competences and development issues in important competence clusters of the assessed entrepreneurs, a triangulation of assessments procedures was used. These were: (1) a self-assessment procedure, (2) a peer-assessment procedure and (3) an expert-assessment procedure. The self-assessment questionnaire consisted of three parts. In the first part of the self-assessment, the entrepreneurs had to answer several questions about themselves and their business (education, work experience, type of business, ultimate goal). In the second part the entrepreneurs had to rank the importance of the twenty-two selected entrepreneurial competences. In the third part the respondents had to rate statements that corresponded (positively or negatively) to these competences on a five-point Likert scale. A similar peer-assessment questionnaire was designed based on the self-assessment questionnaire. In the peer assessment, a peer ('professional colleague') selected by the entrepreneur had to rate their professional colleague based on the same statements that were used in the self-assessment. Finally an expert assessment was developed. The expert had to rate the entrepreneur for the twenty-two selected competences, on a five-point Likert scale. The self-assessment is given in appendix A (in Dutch).

Participants

Before conducting the assessments, the questionnaire was pre-tested by two entrepreneurs and two content experts on clearness, use of language and user friendliness. To test the assessment procedure, 16 entrepreneurs were selected, from three distinct agribusiness sub-sectors: vegetable production under glass (5), floriculture (flower production) (5), and dairy farming (6). Experts working in the different sub-sectors selected the entrepreneurs. The expert had to be knowledgeable in the agricultural sub-sector and had to have a professional understanding of the entrepreneur's activities. Entrepreneurs, peers, and experts were asked to fill in he questionnaire and send it back to the first two authors. After processing the results, the entrepreneurs and experts received feedback on the results.

Analysis

After entering them in a database, the scores of the individual questions on the different clusters were combined. An average score was calculated for each different competence area. These average scores were used in the further analysis. Simple statistical analysis (mean and standard deviation) was performed.

After completing the questionnaire the results of the self- and peer assessment were presented to the entrepreneurs. The scores were presented in a spider-plot format (see the examples in figure 1 & 2).
Figure 1 & 2 Self-assessment scores: case 1 and case 2

The content validity was assessed by comparing the scores of the self-assessment and the peer assessment ($S_A-P_A$), the scores of the self-assessment and the expert assessment ($S_A-E_A$) and the scores of the peer- and expert assessment ($P_A-E_A$) for all the competences measured. Both the average and the standard deviation were calculated for all these differences (the latter as a measurement of how tightly all the scores are clustered around the mean, and therefore an indicator of how much consensus there is about a competence cluster).

Reliability was defined as the consistency of the scores. There are two ways of looking at reliability: inter-item reliability (consistency between the different questions per item) and test-retest reliability (consistency in time) (Shrock, and Coscarelli, 1989). Since the sample was too small for a serious inter-item reliability test and the focus was on competence development rather than stability over time, reliability was primarily sought in the assessment techniques and questionnaires used by other researchers in the domain of agribusiness and entrepreneurship (Chandler and Jansen, 1992; McClelland, 1987; Lans et al., 2004; Bergevoet et al., 2004).

Usability in this study was defined as the level of practical use of the assessment procedure for competence development of entrepreneurs. A discussion of the results with the experts afterwards was introduced in order to improve usability of the assessment procedure in practice. Three questions structured this discussion: are the results of the three methods recognisable, are the results usable in practice and thirdly in what way can the results best be presented to the entrepreneurs themselves?

Results

Table 2. Scores on the different entrepreneurial competence areas: comparison of the entrepreneurs’ results with the assessment results of peers and experts.

<table>
<thead>
<tr>
<th></th>
<th>$S_A$</th>
<th>$P_A$</th>
<th>$E_A$</th>
<th>$S_A-P_A$</th>
<th>$S_A-E_A$</th>
<th>$P_A-E_A$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Avr SD</td>
<td>Avr SD</td>
<td>Avr SD</td>
<td>Avr SD</td>
<td>Avr SD</td>
<td>Avr SD</td>
</tr>
<tr>
<td>Opportunity</td>
<td>3.32 0.77</td>
<td>3.18 0.82</td>
<td>3.22 0.76</td>
<td>0.15 0.87</td>
<td>0.12 0.99</td>
<td>-0.15 1.13</td>
</tr>
<tr>
<td>Relationship</td>
<td>3.72 1.11</td>
<td>3.76 0.74</td>
<td>3.59 0.82</td>
<td>0.02 1.21</td>
<td>0.19 1.36</td>
<td>0.07 1.11</td>
</tr>
<tr>
<td>Conceptual</td>
<td>4.10 0.80</td>
<td>3.91 1.04</td>
<td>3.44 0.78</td>
<td>0.27 1.35</td>
<td>0.69 1.00</td>
<td>0.45 1.35</td>
</tr>
<tr>
<td>Organising</td>
<td>3.95 0.96</td>
<td>3.61 0.89</td>
<td>3.53 1.01</td>
<td>0.29 1.13</td>
<td>0.21 1.24</td>
<td>-0.19 1.47</td>
</tr>
<tr>
<td>Strategic</td>
<td>3.59 0.72</td>
<td>3.66 0.74</td>
<td>3.69 0.94</td>
<td>-0.05 0.95</td>
<td>-0.08 1.00</td>
<td>-0.11 1.18</td>
</tr>
<tr>
<td>Commitment</td>
<td>3.74 0.78</td>
<td>3.87 0.87</td>
<td>3.45 0.89</td>
<td>-0.13 0.97</td>
<td>0.34 1.10</td>
<td>0.43 1.43</td>
</tr>
</tbody>
</table>

Absolute average (rated on a five-point scale, 1=not at all...5=very much present) and the average and standard deviation of the differences of $S_A$, $P_A$ and $E_A$ (subtracting $P_A$ from $S_A$, $E_A$ from $S_A$ and $E_A$ from $P_A$). $S=$ self (entrepreneur), $P=$ peer and $E=$ expert. (n=16).
In general, the entrepreneurs gave themselves high scores on the competences areas, although the standard deviation is considerable. As can be seen from table 2, in three of the six clusters, the entrepreneurs rate themselves higher (in absolute numbers) than their peers and experts do. Comparing the average self-assessment scores with the peer-assessment scores \( (S_A-P_A) \), shows that the clusters strategic and relationship have the smallest differences. The largest differences are found in the clusters conceptual and organising. Comparing the average of the self-assessment scores with the expert-assessment scores \( (S_A-E_A) \), the smallest differences were found in the competence clusters opportunity, relationship and strategic. The largest differences were found in the clusters conceptual and organising. There are larger differences between the self- and expert assessment than between the self- and peer assessments (see the scores in the average and standard deviation columns). Comparing the data of the peer- and expert assessments \( (P_A-E_A) \) produces a slightly different picture. Most consensus is found in the relationship cluster, followed by the strategic and opportunity clusters. The largest differences are found in the conceptual and commitment clusters. What is important to note is that the standard deviation across all three differences of \( S_A, P_A \) and \( E_A \) is considerable (indicating less consensus about a competence cluster) but is lowest for all three in the cluster opportunity.

According to the experts, the results of the three assessment methods were recognisable. This can be best exemplified by the portrayal of two extreme cases. In one case in floriculture (see figure 1 in the methodology paragraph), there were serious issues concerning the planning and organisation, personnel management and leadership of the entrepreneur in question. These issues had been primarily raised by advisors from the bank, who had serious doubts about the way the entrepreneur organised his business. Some of the staff had recently been fired because of ‘mismanagement’ and according to the bank there was a lack of clarity about who was in charge of the business and what the future prospects (for instance potential new markets) were. These two issues are indeed reflected in figure 1, indicated by the (low) scores of the entrepreneur on the clusters organising and opportunities. On the other hand, the experts described this entrepreneur as very committed with regard to organic and environmental aspects. This manifested itself in his business in the use of biological control agents. These aspects were also reflected in the competence profile, where the entrepreneur scored high in the commitment cluster. In another case (from the sector ‘vegetables under glass’), the entrepreneur was well known for his energy-saving management. According to the experts, the entrepreneur could be characterised as a master in optimisation. He is eager to keep things under control and registers everything that is happening in his business. On the one hand he is focussed on maximising control of the biological processes in the greenhouse, on the other he is also focussed on optimising the external environment. In sum, this entrepreneur seems to be a rather all-round entrepreneur, with a lot of qualities. According to the experts, this entrepreneur could be characterised as a manager (optimising processes in his business). These aspects are also reflected in the competence profile (figure 2). This entrepreneur scored relatively high on all clusters, but especially high on the organising cluster.

With regard to the usability, several important aspects were mentioned by the experts. Firstly a clear distinction can be made between the one-man businesses and the ‘partnerships’ consisting of more than one business owner. In the latter case the entrepreneurial competences are ‘dispersed’ (ideally) over several individuals. According to the experts a distinction of competences based on roles can be made, especially the differentiation between the more entrepreneurial role and the more managerial role. Competences that seem to be related to the entrepreneurial role are networking, conceptual thinking, value clarification and international orientation. Competences that seem to be related to the managerial role are learning orientation, result orientation, teamwork, planning and organising. Moreover, the triangulation of methods also provides serious points for discussion in some cases, especially in the case where there is a fairly large difference between the self-perceived competences and the scores given by the peer or expert.

The relative ranking of the different competence clusters is shown in table 3. The entrepreneurs themselves rank the competence clusters relationship, organising and strategic as the most important clusters. Comparing the different sub-sectors indicates a difference in the importance for the six clusters. For vegetables under glass organising competences are considered most important, whereas
the most important for floriculture are relationship competences and for dairy it is strategic competences.

Table 3. Average ranking of the six competence clusters for the different sub-sectors.

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Average</th>
<th>Vegetables under glass (n=5)</th>
<th>Floriculture (n=5)</th>
<th>Dairy (n=6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opportunity</td>
<td>14</td>
<td>14</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td>Relationship</td>
<td>10</td>
<td>11</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Conceptual</td>
<td>13</td>
<td>10</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>Organising</td>
<td>10</td>
<td>9</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>Strategic</td>
<td>10</td>
<td>10</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td>Commitment</td>
<td>13</td>
<td>13</td>
<td>11</td>
<td>13</td>
</tr>
</tbody>
</table>

The numbers indicate the rank scores from 22 (1=highest importance...22=lowest importance), based on the average (absolute) scores of the different underlying competences rated by the respondents (n=16).

The self assessment scores of the entrepreneurs in the different sub-sectors are given in table 4. The entrepreneurs in the sub-sector vegetables under glass score the highest in the cluster conceptual and the lowest in the cluster relationship. The entrepreneurs in floriculture scored also highest in the cluster conceptual and lowest in the cluster relationship, whereas the dairy farming entrepreneurs scored the highest in the organising cluster and the lowest on opportunity competences.

Table 4. Average scores of the self-assessment on the six competence clusters for the different sub-sectors.

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Average</th>
<th>Vegetables under glass (n=5)</th>
<th>Floriculture (n=5)</th>
<th>Dairy (n=6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opportunity</td>
<td>3.32</td>
<td>3.63</td>
<td>3.67</td>
<td>3.28</td>
</tr>
<tr>
<td>Relationship</td>
<td>3.72</td>
<td>3.47</td>
<td>3.41</td>
<td>3.94</td>
</tr>
<tr>
<td>Conceptual</td>
<td>4.10</td>
<td>4.33</td>
<td>4.31</td>
<td>3.61</td>
</tr>
<tr>
<td>Organising</td>
<td>3.95</td>
<td>4.26</td>
<td>3.82</td>
<td>4.33</td>
</tr>
<tr>
<td>Strategic</td>
<td>3.59</td>
<td>3.75</td>
<td>3.70</td>
<td>3.56</td>
</tr>
<tr>
<td>Commitment</td>
<td>3.74</td>
<td>3.80</td>
<td>3.69</td>
<td>3.63</td>
</tr>
</tbody>
</table>

Rated on a five-point scale (1=not at all...5=very much present), based on the average (absolute) scores of the different underlying competences rated by the respondents (n=16).

To investigate the relation between the relative importance of a competence cluster and the actual scores, table 3 and 4 were compared. Vegetables under glass had the highest self-assessment scores in what they considered the most important clusters. For floriculture the opposite was true: the cluster relationship was considered most important but received the lowest score. The dairy group had a somewhat intermediate position.

Discussion and conclusions

This study attempts to gain an understanding of the competence concept in the conceptual domain of entrepreneurship. It seems to be possible to identify and measure the most important entrepreneurial competences using an assessment procedure and a triangulation of assessments. The triangulation of assessments by entrepreneur, peer and expert revealed that there is more agreement among the different assessors in the competence clusters related to the more entrepreneurial competences (opportunity and strategic). In the other clusters there is less consensus about the level of competence.

The entrepreneurs recognise the results that are derived from the questionnaire as representing their competence level. Differences between the self/peer assessments and the expert-assessments may mean several things. First of all, is the expert really an expert on all the competence clusters? How well do you have to know the company (do you have to visit it every week, also taking into consideration the process of competence development, or is it better not to know the business too well,
in order to prevent socially desirable answers being given?). Considering experts as 'golden standards' is frequently mentioned in the self-assessment literature as one of the factors explaining why people are poor or moderate judges of one's own competences (for an overview see Ward et al., 2002). In order to find out whether the expert really is a golden standard, the reliability of the experts should be assessed in a complementary study. An alternative way of overcoming problems with the golden standard is to work with multiple experts (Ward et al., 2002). On the other hand it could be that some of the differences between the self-assessment and the peer assessment are simply the result of the entrepreneur giving socially desired answers, or self underestimation or overestimation. In that case, the expert assessment is an essential element of the triangulation. A questionnaire does say something about the (intended) behaviour and motives of the entrepreneurs, whereas the expert assesses actual behaviour (performance). This is especially noticeable in the clusters that are most related to concrete human behaviour (in particular the clusters organisating and relationship). Both extremes have been noticed. On the one hand certain competences in these clusters are underestimated (for instance no confidence in own negotiation competence, whereas peers and experts rate the level of confidence as moderate to even high). The converse is also noticeable, for instance self-assessment of the ability to communicate may differ greatly from the peer and expert assessments. Lastly, the differences between the self/peer scores and the experts scores could also be explained by the fact that the experts had to rate the competences as a whole. If the expert has a slightly different picture of the competence in question, he might make a different assessment from what was meant in the self and peer assessment. In conclusion the assessment procedure seems to be more feasible for some competence clusters than for others. In the area of opportunity and strategic competences the measurements seem to be the most valid. An alternative to asking the expert to independently assess the competences of the entrepreneur would be to involve the expert in the process of assessing the self and peer scores, and use the expert as a final validation of the assessment. To improve the experts' ratings in practice it would be advisable to develop assessment training for the experts involved, in order to focus on exactly the same aspects of competence.

The learning and development part is also an interesting feature of the assessment procedure. The results seem to provide a good way to confront entrepreneurs with their own qualities and with areas for improvement and discussion. Since it is a learning and development tool, and not a 'test', it should also be communicated that way, not in terms of deficits, but in terms of areas for further improvement. Therefore it is important to know which competences the entrepreneurs themselves consider important for entrepreneurship in their own context. In general the entrepreneurs rate the different clusters as almost equally important. It was noticeable however that opportunity competences were rated as the least important, whereas many authors argue that the discovery and exploitation of entrepreneurial opportunities is the heart of entrepreneurship (Shane and Venkataraman, 2000). Competences such as general awareness and market orientation can be regarded as essential for the development of opportunities. At the same time the self-assessment results revealed that the entrepreneurs score the lowest on this cluster. Hence, it is important to discuss the scores with the peer and expert extensively as a follow-up. Why do entrepreneurs in this sector perceive these competences as relatively unimportant, and, more importantly, what factors contribute to the development of these competences? In a recent review on entrepreneurship research Busenitz et al. (2003) conclude that research in the area where a number of field meet, including individuals, opportunities, modes of organising and the environment are likely to represent important areas for entrepreneurship research. Others argue that the domain of discovering and pursuing opportunities in particular is one of the most promising candidates for a new framework of entrepreneurial competences. Moreover, most research on entrepreneurship investigates entrepreneurial progress after opportunities have been discovered, and do not include the learning process that underlies this progress (Shane, 2000). After this discussion the entrepreneur can decide for him or herself which competence clusters should receive priority for development. Based on this decision the next step will be to think about concrete learning activities (informal or formal) that might contribute to the development of this competence. After a given period, the entrepreneur can decide again to consult his peer and expert to assess whether progress has been made in the development of the selected competences. In this respect, the assessment method can
be developed further as a career development tool, building for instance on the work of Defillippi and Arthur (1994) (the competence-based concept of the boundaryless career).

Two other important aspects of the research were whether the procedure could be applied to different sub-sectors in agri-business, and whether the results could be generalised. There are some interesting differences in scores between the three sub-sectors. The horticultural sectors (vegetable & flowers), scored higher on the typically entrepreneurial clusters (opportunity and strategic) than the dairy farming sector. This difference could be explained by the fact that floriculture in particular is a sector that is historically characterised by entrepreneurship. Floriculture is one of the most successful export sectors in the Dutch economy, and is responsible for about 65% of world exports of cut flowers (Porter and Van der Linde, 1995). Generalisation of the results has consequences especially for the external validity and the reliability of the data. The small sample used in this research has two serious drawbacks here. Although the internal validity is high due to the methods used, the sample is too small and biased to be valid for all enterprises in the sub-sectors that were studied. Secondly, there is the issue of reliability. Due to the small sample, there is no data on how the items in the questionnaire relate to each other. In order to improve the external validity and inter-item reliability, the assessment procedure would need to be applied in further research to a larger sample of entrepreneurs. Nevertheless, it is a matter of doubt as to whether the classical psychometric standards problems, concerning external validity and reliability can be solved (in competence assessments). As argued by Luken (2004), it is very unlikely that competences are homogeneous constructs that can be measured, or that they are stable in time. For instance, a test-retest (testing over time) design will only be useful when the focus is on measuring competence development, rather than using it as a reliability measure. Luken (2004) suggests an alternative standard, the consequential validity. This concept involves not only the assessment scores, but also the interpretation and use of assessment scores as a basis for action (Messick, 1995). It would therefore be interesting in the future to look for follow-up activities after completing the assessment in a larger sample of entrepreneurs.

With regard to future research, the opportunity cluster in particular might provide some interesting starting points. Researching the issue of competence and competence development in the process of discovery and exploitation of entrepreneurial opportunities might provide important insights into how entrepreneurs learn, what they learn most from, whether the competences are shaped by the situation or whether it was the situation that ‘activated’ these competences, and how entrepreneurs’ learning can be stimulated and optimised in order to respond adequately to the changing environment.

Acknowledgements

We thank Dr. Harm J.A. Biemans and Dr. Jos A.A.M. Verstegen for their advice, assistance and helpful comments on the manuscript.

References


## APPENDIX A. SELF-ASSESSMENT QUESTIONNAIRE

<table>
<thead>
<tr>
<th>1</th>
<th>Als het op zaken aankomt ben ik niet bang risico's te nemen</th>
<th>1 2 3 4 5</th>
<th>Als het op zaken doen aankomt dan speel ik graag op safe.</th>
<th>NVT</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Belangrijke beslissingen neem ik altijd zelf</td>
<td>1 2 3 4 5</td>
<td>Belangrijke beslissingen neem ik altijd samen met partner(s) en/of maatschappleden</td>
<td>NVT</td>
</tr>
<tr>
<td>3</td>
<td>De doelen die ik met mijn bedrijf heb kan ik niet direct benoemen</td>
<td>1 2 3 4 5</td>
<td>De doelen, die ik met mijn bedrijf wil behalen, kan ik direct benoemen</td>
<td>NVT</td>
</tr>
<tr>
<td>4</td>
<td>De ontwikkeling van nieuwe technologieën ervaar ik als een ernstige bedreiging</td>
<td>1 2 3 4 5</td>
<td>De ontwikkeling van nieuwe technologieën ervaar ik als een grote kans</td>
<td>NVT</td>
</tr>
<tr>
<td>5</td>
<td>Een goede planning is in mijn ogen niet belangrijk voor het succes van mijn bedrijf</td>
<td>1 2 3 4 5</td>
<td>Een goede planning is essentieel voor het succes van mijn bedrijf</td>
<td>NVT</td>
</tr>
<tr>
<td>6</td>
<td>Het bedrijf up-to-date houden is voor mij niet zo belangrijk.</td>
<td>1 2 3 4 5</td>
<td>Het bedrijf up-to-date houden is voor mij erg belangrijk.</td>
<td>NVT</td>
</tr>
<tr>
<td>7</td>
<td>Het imago van de agrarische producten zie ik als ernstige bedreiging</td>
<td>1 2 3 4 5</td>
<td>Het imago van agrarische producten zie ik als een grote kans</td>
<td>NVT</td>
</tr>
<tr>
<td>8</td>
<td>Het is mij niet duidelijk waar mijn bedrijf over 5 jaar staat</td>
<td>1 2 3 4 5</td>
<td>Het is mij duidelijk waar mijn bedrijf over 5 jaar moet staan</td>
<td>NVT</td>
</tr>
<tr>
<td>9</td>
<td>Het ruimtelijke ordeningsbeleid ervaar ik als een ernstige bedreiging</td>
<td>1 2 3 4 5</td>
<td>Het ruimtelijke ordeningsbeleid ervaar ik als een als een grote kans</td>
<td>NVT</td>
</tr>
<tr>
<td>10</td>
<td>Het subsidiebeleid van de (internationale) overheid ervaar ik als een ernstige bedreiging</td>
<td>1 2 3 4 5</td>
<td>Het subsidiebeleid van de (internationale) overheid ervaar ik als een grote kans</td>
<td>NVT</td>
</tr>
<tr>
<td>11</td>
<td>Het wegvallen Europese binnengrenzen ervaar ik als een ernstige bedreiging</td>
<td>1 2 3 4 5</td>
<td>Het wegvallen Europese binnengrenzen ervaar ik als een grote kans</td>
<td>NVT</td>
</tr>
<tr>
<td>12</td>
<td>Het werken in teams op mijn bedrijf vind ik niet belangrijk</td>
<td>1 2 3 4 5</td>
<td>Het werken in teams binnen mijn bedrijf vind ik belangrijk</td>
<td>NVT</td>
</tr>
<tr>
<td>13</td>
<td>Ik ben afwachtend in het vragen aan anderen (adviseurs/collega's) wat zij van mijn aanpak vinden</td>
<td>1 2 3 4 5</td>
<td>Ik vraag regelmatige aan andere (adviseur, collega) hoe zij tegen mijn aanpak aankijken</td>
<td>NVT</td>
</tr>
<tr>
<td>14</td>
<td>Ik ben gemakkelijk van mijn gestelde doelen af te brengen</td>
<td>1 2 3 4 5</td>
<td>Ik ben niet makkelijk van de doelen die ik me gesteld heb af te brengen.</td>
<td>NVT</td>
</tr>
<tr>
<td>15</td>
<td>Ik ben niet betrokken bij activiteiten die bijdragen aan een positief imago voor mijn beroepsgroep</td>
<td>1 2 3 4 5</td>
<td>Ik ben betrokken bij activiteiten die bijdragen aan een positief imago voor mijn beroepsgroep.</td>
<td>NVT</td>
</tr>
<tr>
<td>16</td>
<td>Ik draag als bedrijf weinig bij aan het uitdragen van een goed en gezond product</td>
<td>1 2 3 4 5</td>
<td>Ik probeer als bedrijf het produceren van een goed en gezond product duidelijk naar de consument uit te dragen</td>
<td>NVT</td>
</tr>
<tr>
<td>17</td>
<td>Ik evalueren mijn eigen acties niet</td>
<td>1 2 3 4 5</td>
<td>Ik probeer zoveel mogelijk mijn eigen acties te evalueren</td>
<td>NVT</td>
</tr>
<tr>
<td>18</td>
<td>Ik ga alleen zoeken naar informatie als ik een belangrijke beslissing moet nemen</td>
<td>1 2 3 4 5</td>
<td>Ik ben voortdurend op zoek naar nieuwe informatie</td>
<td>NVT</td>
</tr>
<tr>
<td>19</td>
<td>Ik geef nauwelijks feedback op het gedrag van mijn personeel</td>
<td>1 2 3 4 5</td>
<td>Ik geef gericht feedback op het gedrag van het personeel</td>
<td>NVT</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>20</td>
<td>Ik heb geen idee hoe mijn bedrijf het doet ten aanzien van andere bedrijven in de sector</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>22</td>
<td>Ik heb moeite met het aangeven van mijn sterke en zwakke punten</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>23</td>
<td>Ik heb moeite met kritiek van anderen (collega’s, medewerkers, etc.)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>24</td>
<td>Ik heb nauwelijks contacten buiten de agrarische sector</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>25</td>
<td>Ik heb nauwelijks contacten met andere partijen in de keten</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>26</td>
<td>Ik heb op mijn bedrijf geen communicatieplan</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>27</td>
<td>Ik heb op mijn bedrijf niet of nauwelijks contact met burgers</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>28</td>
<td>Ik houd geen rekening met feedback van burgers op mijn product in de bedrijfsvoering</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>29</td>
<td>Ik kan moeilijk hoofd- en bijzaken scheiden en blijf snel in details hangen</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>30</td>
<td>Ik neem beslissingen voornamelijk op gevoel</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>31</td>
<td>Ik neem meestal geen initiatief in het bijeenbrengen van mensen uit mijn netwerk</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>32</td>
<td>Ik neem minder vaak uitdagingen aan dan collega’s in het vak</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>33</td>
<td>Ik onderhandel zelden met leveranciers of afnemers over prijzen waaronder we zaken doen</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>34</td>
<td>Ik probeer dingen pas uit als ze in de praktijk zich bewezen hebben</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>35</td>
<td>Ik vind het moeilijk feiten van meningen te scheiden</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>36</td>
<td>Ik vind het moeilijk om aan te geven welke nieuwe ontwikkelingen voor mijn bedrijf belangrijk zijn</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>37</td>
<td>Ik vind het moeilijk om in onderhandelingen met collega’s of leveranciers tot de kern van de zaak te komen</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>38</td>
<td>Ik vind het moeilijk om problemen op de werkvloer te herkennen</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>39</td>
<td>Ik vind het moeilijk om problemen vanuit meerdere invalshoeken te zien</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>40</td>
<td>Ik vind het moeilijk om relevante informatie te vinden</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Nummer</td>
<td>Omschrijving</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>--------</td>
<td>-----------------------------------------------------------------------------------------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>41</td>
<td>Ik vind het moeilijk de problemen op mijn bedrijf duidelijk in kaart te brengen</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>42</td>
<td>Ik vind het niet belangrijk om bij de hoogst producerende bedrijven te horen</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>43</td>
<td>Ik zie voor mijzelf geen rol in het bijdragen aan ontwikkeling en/of instandhouding van natuur- en landschapswaarden.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>44</td>
<td>Ik zoek alleen naar nieuwe mogelijkheden als er een concrete vraag of probleem is (brandblussen)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>45</td>
<td>Meer aandacht voor dierenwelzijn bij consument ervaar ik als een ernstige bedreiging</td>
<td>1</td>
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<td>3</td>
</tr>
<tr>
<td>46</td>
<td>Ontwikkelingen in de international markt ervaar ik als een ernstige bedreiging</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>47</td>
<td>Samenwerking tussen ondernemers onderling vind ik niet belangrijk</td>
<td>1</td>
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</tr>
<tr>
<td>48</td>
<td>Tijdens presentaties kan ik niet duidelijk maken aan mijn publiek wat mijn ideeën zijn</td>
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<tr>
<td>49</td>
<td>Toekomstige wet en regelgeving ervaar ik als een ernstige bedreiging</td>
<td>1</td>
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<tr>
<td>50</td>
<td>Wat betreft internationale ontwikkelingen wacht ik meestal af tot anderen vertellen wat ik moet doen</td>
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<tr>
<td>51</td>
<td>In mijn bedrijf heb ik (nog) geen functionering/ontwikkel gesprekken</td>
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<tr>
<td>52</td>
<td>Ik werk (nog) niet met scholingsplannen</td>
<td>1</td>
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<td>3</td>
</tr>
<tr>
<td>53</td>
<td>Het personeel kan heeft nauwelijks mogelijkheden om tijdens werkuren cursussen of training te volgen</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>54</td>
<td>Het verloop van personeel in het eerste jaar is groot</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>55</td>
<td>Ik vind het moeilijk om capaciteiten en mogelijkheden van medewerkers en anderen goed in te schatten</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>56</td>
<td>Ik vind het niet belangrijk dat werknemers hun eigen ontwikkel mogelijkheden zien</td>
<td>1</td>
<td>2</td>
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</tr>
<tr>
<td>57</td>
<td>Ik ben niet bewust een rolmodel</td>
<td>1</td>
<td>2</td>
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</tr>
<tr>
<td>58</td>
<td>Bij de planning van het werk houd ik geen rekening met de leerwensen van mijn personeel</td>
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</table>
NOBEM DISSERTATION OF THE YEAR PRIZE 2003

Pieter Terlouw, University of Twente, p.terlouw@utwente.nl

The NOBEM (Netherlands Organisation for research in Business Economics and Management) aims to stimulate scientific research in both Management and Business Economics in a broad sense. Members of the NOBEM are faculties, schools and/or departments of ten Dutch universities that conduct research in these fields. Each year, every member has the opportunity to nominate one of its dissertations (defended in the year before nomination) in the fields of business economics and/or management for the NOBEM dissertation of the year prize.

This is the third year in which the prize is awarded. Previous winners of the NOBEM dissertation of the year prize are:
2001: Dr. Erica van Herpen, Perceptions and Evaluations of Assortment Variety, Tilburg University, promotor: prof.dr. F.G.M. Pieters.
2002: Dr. Silvia Rosetto, Optimal Strategic timing of Financial Decisions, University of Amsterdam, promotor: prof.dr. E. Perotti.

A jury awards the prize based on the following criteria: i. Contribution to theory, ii. Contribution to practice, iii. Methodological quality, and iv. Contribution to the fields of Business economics and/or management.

For the year 2003 the jury for the dissertation of the year prize consists of the following persons:

- Prof.dr. P. Bagchus (Eindhoven University of Technology)
- Prof.dr. J. Bilderbeek (University of Twente)
- Prof.dr.ir. J.J. Krabbendam (University of Twente)
- Prof.dr.ir. A.C.J. de Leeuw (University of Groningen)
- Prof.dr. S.W.F. Omta (Wageningen University, chair)
- Dr.ir. P. Terlouw (NOBEM, secretary)

And the nominated theses defended in 2003 are:

- Sjoerd Beugelsdijk, Culture and Economic Development in Europe, Tilburg University.
- Annick van den Beukel, Task Flexibility in Team-Based Work: A multilevel investigation into outcomes and practices, University of Groningen.
- Dennis Fok, Advances Econometric Marketing Models, Erasmus University Rotterdam.
- Ad de Jong, One for All, All for the Customer, studies on self-managing teams in services, University of Maastricht.
- Heleen van Mierlo, Self-Managing Teamwork and Psychological Well-Being, Eindhoven University of Technology.
- Arjen Siegman, Optimal Financial Decesion Making under Loss Averse Preferences, Free University Amsterdam.
- Nicole Torka, Flexibel maar toch betrokken – De samenhang tussen contractrelatie en werknemersbetrokkenheid, University of Twente.
- Erik de Vries, ICT Enabled Distribution of Services: Service positioning strategy, front office information and multi-channeling, University of Amsterdam.
- Josephine Woltman Eelpers, Consumers’ Moment to Moment Processing of Television Commercials, University of Groningen.
In three rounds (decision about the procedure, first selection and final selection) the jury decided on the prize winner. The usual sentences expressed in these types of contests really hold here: All nominated dissertations were of high quality, therefore the jury had a hard time to reach a final conclusion. Several dissertations were reread and the help of other experts was called in.

Finally, an extraordinary decision was reached, and the jury decided on a tie. Therefore, there are two prize winners of the NOBEM dissertation of the year prize 2003:

Ad de Jong and Nicole Torka

At the PREBEM conference of 2005, both winners received a certificate and € 500 (to be spent freely).

The dissertation of Ad de Jong is a perfect example of how good rigorous scientific research should be done, whereas the dissertation of Nicole Torka is a perfect example of thought provoking results both for science and practice. It easily can be seen that it is hard to weigh those two types of perfection.

Of course, the jury hopes that in future, the combination of both worlds will appear in all dissertations. But it must also be noted that this rigor vs. relevance discussion in a natural way (due to the nominated dissertations) played an important role in the discussion the jury had.

Summaries of both dissertations (written by the authors themselves) constitute the next paragraphs of this chapter.
Executive Summary Doctoral Thesis

ONE FOR ALL, ALL FOR THE CUSTOMER: STUDIES ON SELF-MANAGING TEAMS IN SERVICES

Ad de Jong, Eindhoven University of Technology, a.d.jong@tm.tue.nl

The research perspective taken in this dissertation was motivated by the importance of self-managing teams (SMTs) as an effective strategy to increase marketing effectiveness of service companies. The essential hallmark of SMTs concerns the delegation of managerial responsibilities toward team members, which distinguishes them from work teams in general. A SMT consists of employees who are jointly responsible for managing and performing complete tasks that result in a product or service being delivered (Hackman 1990; Hackman and Oldham 1980; Yeatts and Hyten 1998). In service marketing literature there is growing evidence of the positive impact of innovative service management approaches, like empowering front-line employees and the use of teamwork on marketing parameters, as are quality of employee work life, customer satisfaction with the provided service quality, and company profitability (e.g., Berry et al. 1994; Emery and Fredenhall 2002; Hartline and Ferrell 1996; Helfert and Vit 1999; Spreitzer et al. 1999; Van Looy et al. 1998).

Although the number of academic studies on teamwork and empowerment in services is growing and the implementation of SMTs in service companies has become commonplace, little is known about the nature of service practice within SMTs. Therefore, it was imperative to investigate what social dynamics and technical task aspects drive service quality practice in service teams that self-manage their daily task activities.

In the service marketing literature it has been widely recognized that the presence of an organizational climate for service is a crucial determinant of external marketing outcomes, such customer satisfaction and loyalty in service companies (e.g., Johnson 1996; Schneider 1990; Schneider et al. 1992). So far, however, little is known about group processes and organizational conditions that determine service climate at work group level in business-to-business and business-to-consumer service settings. Therefore, the focus in this dissertation was on service climate as a holistic aspect of work group practice in SMTs. In a group context service climate refers to “perceptions of the manifestation of SMT attitudes and practices aimed at effective performance in service delivery to customers” (cf. Schneider and Bowen 1993). The concept of service climate comprises a wide range of behaviors that are collectively undertaken by the team members, as are proactive corrective actions, service improvement initiatives, and being flexible and open-minded toward customers (e.g., Jacobucci 1998; Pulakos et al. 2000). Frequently, service activities and problems are idiosyncratic, ill-defined, and complex in nature, which implies that extra-role behaviors are critical components of effective SMT service performance. Therefore, we have investigated adaptive and proactive behavior as well as the level of IT adoption, which are concrete service performance behaviors and as such involve relevant components of service climate in SMTs. Next, with the rapid technological advancements, service operations in SMTs are increasingly sustained by information technology to increase efficiency and effectiveness. The implication is that the use of IT systems has become inherently part of the SMT’s technical task responsibilities and influences the way team members interact with each other.

All in all, there exists broad consensus about the issue that the delegation of managerial responsibilities to work teams of employees is critical to service company effectiveness in terms of quality of work (life), customer satisfaction and customer loyalty, and productivity. However, the relevance of service SMTs to marketing parameters was not substantiated clearly by the empirical evidence and a lack of theoretical development exists regarding SMTs in services. Therefore, the overall aim of the dissertation was: to determine the impact of SMTs on marketing effectiveness in service companies. Specifically, we investigated SMTs that offered varied types of services (i.e., core...
service and after-sales) across different industries (i.e., business-to-business and business to consumer) to acquire a comprehensive and multi-faceted understanding of SMT effectiveness in services operations. By means of mediator models we examined the antecedents and consequences of SMT service performance from different point-of-views. These different perspectives share a number of common features. We discuss these issues and the consequences this might have on the design, management, and research of SMTs in service companies.

In the introduction we discussed the social technical systems theory as one of the fundamentals of the SMT approach (Pasmore 1988). The findings of this dissertation confirm the importance of both social issues and technical task issues as determinants of SMT service effectiveness. To begin with, throughout the dissertation tolerance-of-self-management is found to be a crucial determinant of SMT service performance. In the various service settings that have been investigated higher levels of self-management appear to be a necessary prerequisite for work teams to deliver excellent customer services. Generally, our findings show that particularly team members' cognitions and individual interpretation of the self-management process is related to SMT service performance (e.g., Spreitzer 1995), while shared perceptions of self-management do not significantly explain additional variance beyond individual employees' subjective perceptions. This signifies that the service performance in self-managing service teams particularly involves a matter of individual management skills. Therefore, the implementation of self-management can be best directed at individual team members and aimed at individual member skills such as managing customer expectations, goal setting, planning, and evaluating individual performance to improve self-directed customer service.

Consequently, it is found that formalization and inter-team network have a positive impact on SMT service performance. This implies that the self-management process in work groups needs to be guided by written rules and formalized procedures imposed by management as well as by formalized social structures. Work teams that have too much managerial freedom may develop service performance goals that do not correspond to the general objectives set by the organization. The availability of a few general procedural guidelines and feedback from the organization, combined with the presence of integrative networks, is indispensable to appropriately coordinate the self-management process in highly empowered service teams and to align team goals with general organizational goals to achieve higher performance rates (e.g., Polley and Van Dyne 1994).

The findings in this dissertation also emphasize the importance of supporting group processes within and between teams to the establishment of a SMT service climate as well as to adaptive and proactive recovery behavior. Mutual social support among team members within and between teams forms an invaluable ingredient to establish a high service quality climate. Customer employees who are appropriately treated by their co-workers are inclined to use this attitude in their personal encounters with external customers as well. The importance of pro-social interpersonal relationships among employees to SMT service performance confirms the incremental value of teamwork in service operations. Furthermore, the research suggests that a collective understanding of each other's technical tasks and a shared sense of how the team members should work together in providing high quality customer service is particularly relevant in the commonly more extended and complex non-routine service operations. To effectively coach teams in non-routine services managers should pursue a mutual understanding of each other's tasks and roles within the SMT.

In addition to cooperation among team members, interpersonal interactions between the team and other teams within the organization appear crucial to SMT service performance. SMTs do not operate in isolation, but are strongly dependent on the surrounding organizational context. Service companies involve organizational systems in which work teams act as interdependent units that possess complementary skills and expertise and that are interrelated through the social dynamics of employees working together. Therefore, the quality of interpersonal processes between teams within organizations forms a crucial leverage point to SMT service performance. Hence, to effectively manage SMTs in services it appears of importance to take inter-team relationships into account and to pay attention to the organizational infrastructure in order to facilitate, coordination, cooperation, and the sharing of information across functional boundaries within the organization. This dissertation clearly demonstrates that SMT service performance is not exclusively a matter of social issues, but also involves technical task-related performance behaviors and attitudes. Individual
team member attitudes towards and perceptions of IT appear to have a crucial impact on the usage-rates of service supporting IT applications. Team member’s IT task-related performance behavior is, however, not exclusively a matter of individual factors, but is also influenced by normative social processes within teams. It is found that a shared sense of risk aversion or shared perceptions of usefulness among team members may either inhibit or facilitate IT-usage behavior. This implies that task-related issues in SMTs in services are significantly related and influenced by social processes. When changing existing task responsibilities and conditions of service employees or implementing task-related innovations it is of paramount interest not only to consider individual team member opinions, but also the leading social norms within SMTs.

In general, our findings in relation to the antecedent-service performance relationships demonstrate that the performance of empowered service teams is the result of a combination of inter-personal processes and technical task-related issues. It appears that the effects of antecedents may be moderated by service type and/or are differential across the distinctive service performance behaviors investigated. Therefore, to acquire a sophisticated understanding of empowered work teams in services it is of major relevance to develop a contingency perspective and relate both social and task antecedents to distinctive behaviors of service team performance.

An important theme throughout this dissertation involves the distinction between individual and shared employee perceptions. By means of hierarchical linear modeling techniques we have determined to what extent SMT service performance is based on individual team member’s subjective experience, as well as on shared team member perceptions. We have compared the effects of individual-level and group-level assessments for work contextual characteristics, group properties, and individual characteristics in relation to different service performance indicators.

In sum, the findings in this dissertation clearly indicate that SMT service performance assessments are a composite of individual employee perceptions and shared team member perceptions. The results of this research further suggest that whether individual team member experiences or shared team member experiences of antecedents are relevant depends on the particular type of service performance that has been investigated. For instance, it appears that individual employee perceptions of usefulness have a crucial impact on the adoption-level of customized IT, while shared perceptions of usefulness among team members are significantly related to employees’ adoption-level of standardized IT. As such, the conclusion can be drawn that a distinction between individual team member experiences and shared experiences yields significant incremental insight into the differential role of individual and shared team member perceptions when investigating antecedent-service performance relationships in SMTs.

The results in this dissertation demonstrate that all investigated SMT performance indicators are significantly related to external company outcomes including customer perceptions, actual customer behavior, and quantifiable productivity criteria. In the first place, the relationship between SMT service performance and customer-based attitudinal and behavioral parameters has been examined. The results show positive (lagged) effects of SMT service climate, as well as adaptive and proactive recovery behavior on customer evaluations about the service quality delivered and on actual customer purchase behavior (i.e., share of customer). Although customer-contact employees and customers evaluate the service delivery process from a different perspective, their appraisals are significantly related. As such, these findings demonstrate the importance of a multi-faceted perspective taking both employee perceptions and customer perceptions into account as a way to determine and validate the marketing impact of service delivery practice in work groups.

The occurrence of delayed effects of SMT service climate suggests the causal nature of the relationship between employee perceptual measures and customer attitudinal and behavioral measures. It is important to realize that internal organizational practice may have a delayed effect on customer parameters. Due to implementation problems the impact of service practice in SMTs can be better determined after a period of time (Cohen and Bailey 1997). Furthermore, it has been demonstrated that customers’ assessments of service quality are unlikely to change much over time (Bolton and Drew 1991). Therefore, service managers as well as linkage researchers should consider varying time frames
and develop long-term perspectives to appropriately determine the influence of internal service practice on customer outcomes.

In addition, it appears that distinctive service performance behaviors affect differential customer measures. While excellent listening skills and being open-minded to customers lead to more positive customer evaluations, changes in actual customer purchase behavior are more the result of employee behavioral initiative and improvement actions to resolve problems timely and effectively, or to utilize extra resources to deliver additional services. Therefore, it is important to realize that certain service performance aspects are more appropriate to influence customer attitudes, whereas other performance aspects are more relevant to create changes in actual customer purchase behavior. To acquire a comprehensive understanding of the linkage between internal service performance and external customer outcomes, it is of importance to simultaneously consider distinctive aspects of internal performance.

Furthermore, it can be concluded that the linkage between SMT service climate and customer quality evaluations is contingent on service type. It appears that SMT service climate is significantly stronger related to customer perceived service quality in non-routine services when compared to routine services. This implicates that the specific type of service offered moderates linkages between internal performance measures and external customer-based parameters. Hence, the intensiveness of personal encounters between customer-contact employees and their customers may significantly vary across types of services. Therefore, it is recommendable to adopt a contingency approach when investigating internal-external performance linkages in different services settings.

In general, the positive impact of service-oriented performance measures (i.e., SMT service climate, adaptive and proactive behavior) on customer parameters clearly diverge with the absence of positive relationships with traditional company-based productivity measures. Too much emphasis on service-quality might result in sub-goal optimization leading to reduced team productivity. It is therefore relevant to pursue an appropriate balance between customer- and productivity issues by taking a dual-goal approach, setting explicit customer-oriented goals and productivity-oriented goals. Particularly with respect to non-routine customer services it remains a challenge to align quality goals with productivity aims. The implication is that priority setting should be the leading rationale when formulating goals for SMTs in services.

Additionally, it is found that the effects of SMT service climate also diverge in relation to the different productivity criteria investigated. For example, it is found that SMT service climate positively affect the service productivity measured as first-time-fixed rate, but leads to decreases in productivity indicated as the average number of services sold per team member. This discrepancy in results may be attributed to the differential nature of these productivity criteria. The first-time-fixed rate criterion involves an example of an objective performance measure that typically reflect a dual perspective taking both the customer and management component into account, since the logic behind these measures concerns maximization of the relationship with each individual customer. Actually, this measure refers to timely and the effective problem solving of individual customer requests by employees. The extra time required to solve problems appropriately may go at the expense of servicing other customers within the required time leading to lower service productivity rates per employee. Conversely, conventional (financial) service productivity measures do not take such a customer relationship perspective, focusing primarily on the efficiency of working methods and input-output convergence.

In contrast to the other service performance measures investigated, SMT's adoption-level of customized IT is both related to customer satisfaction and traditional productivity measures. This research suggest that the use of additional IT is the appropriate response to the increase both customer parameter scores and productivity rates. The implementation of additional specialized IT systems better integrates the frequently conflicting efficiency and effectiveness demands in comparison to other service performance indicators such as SMT service climate and adaptive and proactive service behavior that mainly reflect the social dynamics associated with SMT service performance.

In conclusion, the differential findings should stimulate the ongoing debate between academicians about the compatibility of customer-oriented parameters and financial metrics for services companies thereby distinguishing between types of services. Since relatively higher usage-rates of additional
customized IT systems are both related to higher customer satisfaction and productivity, the implementation of additional IT systems may be an appropriate strategy to reduce the existing gap between customer-oriented and traditional productivity measures. To create a competitive edge service companies should aim at the implementation IT systems that optimally fit with team members’ task requirements.

References


Executive Summary Doctoral Thesis

FLEXIBLE BUT COMMITTED. THE RELATIONSHIP BETWEEN EMPLOYMENT RELATIONSHIP AND COMMITMENT

Nicole Torka, University of Twente, n.torka@utwente.nl

Introduction: why research on the employment relationship/commitment link?
Employee commitment lies at the heart of Human Resource Management. It is assumed to lead to the innovative and qualitative capacity of people (e.g. Becker et al., 1996; Meyer et al., 1989), and therefore helps meeting market demands effectively. Flexibility is another competitive weapon for increasing organisational effectiveness: the ability of management to accommodate fluctuations and changes in the levels and patterns of demand (Blyton & Morris, 1992). Offering atypical employment relationships is an effective way to vary the use of the costly factor labour: temporary contracts, freelance contracts, and temping relationships. The last category refers to contractual triangles - a ‘ménage à trois between one employee and two employers – such as temporary work through agencies (TWA), personnel on loan, and labour pools. Statistical evidence supports the importance of so-called flexible work. In the European Union, 42 million people (27 per cent of the total working population) work under such ‘contract conditions’. In the Netherlands - the country in which the current research was completed - more than 31 per cent of the working population have such employment relationships (Randstad, 2004).

Many, including myself, believe that employers would like all workers to be fully committed to their company to obtain commitment-associated behaviours since they are vital for organisational success. Therefore, one of the most important questions for HRM practitioners and scholars should be how can they simultaneously maintain flexible working practices and commitment. Many scholars are convinced that these practices cannot be advantageous for commitment towards the (hiring) company at all, as the common belief in HRM assumes that ‘good commitment’ supposes a stable, long-term employment relationship based on mutual investment (see, for example, Atkinson, 1984; Baruch, 1998; Beer et al., 1984; Rousseau, 1995). In other words: a permanent contract offers security in exchange for commitment. Furthermore, besides the looser contract, there is some evidence that atypical employees work under more less favourable conditions than ‘traditional’ permanent workers do: atypical workers perform more often boring tasks (European Foundation, 2001) and earn in average 20 per cent less than permanent workers (Kleinknecht et al., 1997). Considering the disadvantages of atypical work, it is logical that demanding flexibility on the one hand and commitment on the other is seen as contradictory (Legge, 1989), but is this assumption also true? Since research on the contract/commitment link is scarce (e.g. Gallagher & McLean Parks, 2001; Purcell, 1996), and especially knowledge about the large group of blue collar atypical workers, these clear judgements seem to be based on expectations and common sense and not on empirical results. Therefore, it seemed appropriate to address the following research question to blue collar workers:

Does the contract relationship influence employee commitment?

Research method
It was decided to do mixed method research, using qualitative and quantitative techniques, in a case study design. I choose the Dutch metal industry, and more specific metalworkers, as my research domain. This industry uses quite a number of atypical workers: more than 20 per cent of employees have atypical contracts.

For several reasons, the first step was an extensive pilot study (lasting several months) to elicit workers’ perceptions of HRM policies and commitment: (1) relatively little is known about the contract-commitment relationship in general, (2) the voices of employees in flexible labour (Kessler et
al., 1999: 6) and commitment research (Reichers, 1985) is still largely missing, (3) it is not clear if commitment theory is transferable to atypical workers (Gallagher & McLean Parks, 2001), and, finally (4), our knowledge on blue collar workers perceptions in general is very limited (Geary, 1992). Concerning commitment, the understanding of this concept seems always to evolve from reviews of the literature and hybridizations of previous definitions; in general, commitment research instruments are hardly ever a subject of serious scrutiny (Reichers, 1985: 469). Therefore, we didn’t know if recent definitions and operationalisations of commitment matched those of the metalworkers.

Companies were chosen strategically, so that a large enough population of both typical and atypical workers would be present and both groups would perform essentially the same tasks under the same circumstances.

In two companies, big Q [ualitative] employee research was carried out (Kidder & Fine, 1997) using participant observation, informal conversations, and we performed 54 semi-structured interviews with metalworkers (32 of 54 had an atypical employment relationship). The interview protocol had questions about commitment as well as personal work-related and non-work-related issues, including all perceived HR practices such as work systems, employee influence, rewards, and human resource flow (Beer et al., 1984). During my stay in the different companies I walked on and talked to the floor and all things seen and heard from all levels of employees, thus also managers and supervisors, were incorporated into a final framework for empirical, statistical research. Naturally, a restriction of qualitative research is the limited number of observations that can be done. Therefore, in the second stage of the research, also questionnaire research was employed in four medium-sized metal companies (between 137 and 650 employees), including the companies were the extensive qualitative research was done. In companies 3 and 4, employees only took part in questionnaire research. 276 of 582 (response rate: 47%) metalworkers returned the questionnaire on personal factors, HR policies, and commitment. 101 of the 276 (37%) were atypical workers. In all four companies, also interviews were conducted with HR managers, production managers, work council members, and direct supervisors. From these interviews, it was possible to map the HR policy from the managements’ point of view.

Research findings and discussion
The metalworkers challenged many of the wide spread assumptions on the employment relationship/commitment link and therefore indirectly of HRM theory. In general, typical and atypical workers have much in common: I found no significant differences in affective, normative, and calculative commitment towards work, colleagues, department, and the (hiring) company. So, how do the companies manage to have flexible working practices and create commitment simultaneously? Unintentionally, ‘excellent companies’ participated in the research. According to the workers and their managers, the companies have equal treatment policies for all HR aspects and adopted long-term perspectives and strong ‘relational’ embeddedness for successful atypical workers. Thus, contrary to what Rousseau (1995) claims, atypical workers need not be ‘short-term outsiders’ (with low commitment). Long-term relationships are not exclusively connected to offering permanent contracts but rather refers to the company’s intention to hire the workers permanently or at least for as long as there is work available, and workers are perfectly able to understand this logic and are willing enough to accept this fact of life, as long as they are treated with respect, appreciated for their efforts and with honesty, so that no promises are made and later on reversed. In terms of staffing policies, educational facilities, and rewards, these companies without exception influenced the TWA’s policies. When they are satisfied with a particular worker they not only insisted that the agencies offer a better contract, but also stipulate on salary and educational matters. My research thereby gave many new insights into the commitment of atypical employment relations and ample opportunities for managers to actually enhance the commitment of atypical employees, that now represent a large part of the Dutch workforce, without which much of the highly appreciated current flexibility in both production and labour market, would be unthinkable.
Finally, this research shows that one should assess the specific needs of an investigation before deciding upon a statistical investigation. The metalworkers supported Allen and Meyers' (1990) three-dimensional model of commitment, but challenged the operationalisations of much of the abstract and tightly 'academically' formulated questionnaire statements such as "My attachment to this organisation is primarily based on the similarity of my values and those represented by the organisation" (Caldwell et al., 1990). Therefore, based on the employee interviews, we had to develop commitment scales with more mundane questions such as "if something goes wrong at ... (name of the company), I take it personally". Without the qualitative exertion, I couldn't find such exciting results.

References


APPENDICES

I. CONFERENCE PROGRAM

II. POSTER PRESENTATIONS
I. CONFERENCE PROGRAM

8th PhD Conference on Business Economics, Management and Organization Science

Wednesday, January 26th, 2005
Conference center De Observant, Amersfoort

Program:

08.30 – 09.00 h. Registration

09.00 – 09.15 h. Opening

09.15 – 10.00 h. Keynote speech by Dr. Paul Iske: “The entrepreneurial spirit: me and you”
Dr. Paul Iske is Senior Vice President Intellectual Capital Development at ABN AMRO Corporate Finance

10.00 – 10.10 h. Presentation of the NOBEM-dissertation-of-the-year-award

10.10 – 10.40 h. Coffee break

10.40 – 12.00 h. Workshops:

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<th>Financing your research</th>
<th>Surviving the academic debate</th>
<th>Collaborating with companies</th>
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<tr>
<td>Dr.ir. A.J.R. Zweegers,</td>
<td>Mw. dr. S. van Hoek-</td>
<td>Prof.dr.ir. J.C. Wortmann</td>
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<tr>
<td>Ir. R.J. van den Berg</td>
<td>Gerritsen</td>
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<td>Leicester zaal</td>
<td>Henrick van den</td>
<td>Mathilde van</td>
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<td>Broeck kamer</td>
<td>Denemarken lokaal</td>
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12.00 – 12.20 h. Poster presentations (Leicester zaal)

12.20 – 13.00 h. Lunch

13.00 – 14.30 h. Paper presentations (see overleaf)

14.30 – 15.00 h. Coffee break

15.00 – 16.30 h. Paper presentations (see overleaf)

16.30 – 17.00 h. Closing address

17.00 – 18.00 h. Drinks at the bar

18.00 – 20.00 h. Dinner (optional)
# Overview of paper presentations

## Session I: 13.00 - 14.30 h.

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<th>Time</th>
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<td>Decision &amp; Information Science</td>
<td>Innovation &amp; Organization</td>
<td>Business Networks &amp; Strategic Alliances</td>
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<td></td>
<td>Dr. A.B.J.M. (Fons) Wijnhoven</td>
<td>Dr. Wim P.M. VanHaverbeke</td>
<td>Dr. Charmianne E.A.V. Lemmens</td>
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<td>13.30-14.00</td>
<td>Jeffrey Gortmaker (TUD) Towards a reference architecture for process orchestrators in e-government</td>
<td>Frances Fortuin (WUR) Measuring customer value in corporate R&amp;D</td>
<td>Sandra Philippen (EUR) Dynamics of networks and innovation in biotechnology</td>
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<td>14.00-14.30</td>
<td>Chintan Amrit (EUR) The problem of coordination in software development: task allocation among teams</td>
<td>Henri Burgers (EUR) Exploring the differences between product, technology, and market innovation</td>
<td>Jurriaan Nijholt (RU) Self-managed teams – an enduring management fashion?</td>
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## Coffee/tea break: 14.30 - 15.00 h.

## Session II: 15.00 - 16.30 h.

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<th>Time</th>
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<th>Session 1</th>
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<td>Innovation &amp; Intermediaries</td>
<td>Business Economics &amp; International Business</td>
<td>Human Resource Management</td>
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<td></td>
<td>Prof.dr. S.W.F. (Onno) Omta</td>
<td>Prof.dr. Marno J.C.M. Verbeek</td>
<td>Prof.dr. Jaap Paauwe</td>
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<td>15.00-15.30</td>
<td>Jeroen Kraaijenbrink (UT) Designing web-informmediaries: bridging gaps between the supply and demand of knowledge for new product development</td>
<td>Oxana Kobzar (WUR) Analysing the efficiency of farm diversification</td>
<td>Luc Dorenbosch (UvT) All for one or one for all? Two distinct concepts of internal consistency among human resource management practices</td>
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<td>15.30-16.00</td>
<td>Ferdinand Jaspers (EUR) Organizational forms for new product development in systemic industries</td>
<td>Fabienne Fortanier (UvA) The impact of foreign direct investment on development: the role of FDI characteristics</td>
<td>Thomas Lans (WUR) Identification and measurement of competences of entrepreneurs in agribusiness</td>
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<td>16.00-16.30</td>
<td>Erwin Fliet (Telematica Instituut) Design factors contributing to the acceptance of electronic intermediaries</td>
<td>Gerrit Sarens (Ghent University) Contemporary internal auditing practices: (new) roles and influencing variables. Evidence from extended case studies</td>
<td>Astrid Boogers (RUG) Twelve foundations for the power position of consultants</td>
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II. POSTER PRESENTATIONS

EMOTIONAL SATISFACTION OF CUSTOMER CONTACTS AND ITS EFFECTS ON CUSTOMER LOYALTY
Hüs Güngör (UvA)

BARRIERS TO IMPROVING ENVIRONMENTAL MANAGEMENT IN THE DUTCH AGRI-FOOD INDUSTRY
Derk-Jan Haverkamp (WUR)

NEW LEADERSHIP PERSPECTIVES: TOWARDS INTEGRAL ORGANIZATIONAL LEADERSHIP
Edwin Holwerda (UvA)

OUTSOURCING OF LOGISTICS SERVICES IN FOOD SUPPLY CHAINS
Hsin-I Hsiao (WUR)

QUEST FOR QUESTIONNAIRE: MAPPING A MANAGEMENT CONTROL SYSTEM
Anne-Marie Kruis (EUR)

THE ROLE OF GOVERNANCE STRUCTURES IN DESIGNING EFFICIENT FRESH VEGETABLE SUPPLY CHAINS
Hualiang Lu (WUR)

THE ROLE OF BUSINESS LEADERS IN CORPORATE SOCIAL RESPONSIBILITY: HOW CHIEF EXECUTIVE OFFICERS INFLUENCE COMPANIES’ CSR STRATEGY AND PERFORMANCE
Cynthia Piqué (EUR)

ORGANIZATIONS NEED TEAMS, BUT TEAMS ALSO NEED ORGANIZATIONS
Chantal Savelbergh (OU)

AREX: A KNOWLEDGE-BASED SYTEM FOR THE AUDITOR’S REPORT
Mohamed Wahdan (MSM)