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INTRODUCTION

Obtaining customer information during the new product development (NPD) process is considered to help firms improve business performance (Martin and Horne, 1993; Prahalad and Ramaswamy, 2000). Consequently, a considerable amount of research has focused on customer co-creation methods for acquiring customer information (e.g., von Hippel, 1988; Neale and Corkindale, 1998; Alam, 2002; and Svendsen et al., 2011). However, there is actually limited empirical evidence regarding the actual benefits of obtaining customer information in the NPD process, especially for services (Carbonell et al., 2009; Johne and Storey, 1998). In fact, Weterings and Boschma's (2009) even found that co-operation with customers does not help firms to generate higher turnover from new goods or services and they even suggested that the relevance of customer co-creation in the NPD process should not be exaggerated.

Access to customer information should enable a firm to develop goods and services that provide a superior value proposition (Svendsen et al., 2011), but the effect of obtaining customer information in the NPD process might differ from one phase to another (Gruner and Homburg, 2000). Gustafsson and Johnson (2003) noted that the NPD process for goods has many proven tools and methods, whereas the NPD process for services tends to be relatively arbitrary and unstructured. Gottfridsson (2010) even claimed that NPD for services cannot be considered to be a structured process; in reality it is a part of a daily problem solving process in which unique problems for different customers are solved. Finally, Carbonell et al. (2009) found that although it can be beneficial to obtain customer information, there are no differences across the various phases of the NPD process for service firms.

The present study revisits the research by Gruner and Homburg (2000) and Carbonell et al. (2009) and argues that the phase in the NPD process for obtaining customer information should matter for both manufacturing firms and service firms. Specifically, this study addresses two important questions regarding the role of obtaining customer information in the NPD process. Firstly, does the amount of customer information obtained during NPD have a different effect on profits from new offerings for manufacturing firms than it does for service firms? Secondly, is the role of obtaining customer information in a specific phase of the NPD process different for NPD for manufacturing firms than it is for service firms? The study is based on a survey of 244 manufacturing and service firms, combined with financial data from an external database. We developed and tested a conceptual model in order to show how customer information obtained at different phases in the NPD process influences profits from new offerings. The results show that access to customer information does have an effect on profitability. Furthermore, the results show that the effect size varies across different phases of the NPD process and that they do differ depending on if it is a goods or service that is developed. In addition, our results provide managers with insights into how goods and services differ during the development process and as a consequence how customer information should be obtained.

THE ROLE OF OBTAINING CUSTOMER INFORMATION IN NPD

Customer information is a key success factor for NPD (von Hippel, 1988; Svendsen et al., 2011). Theoretical models and concepts describe how to involve customers (Prahalad and Ramaswamy, 2000; Witell et al., 2011) or how to use the customer as a resource (Rothwell, 1976; von Hippel, 1988) in order to obtain customer information. Carbonell et al. (2009) suggested that having customer information can provide a more accurate and complete assessment of customers' needs and can contribute to the development of a differentiated and superior service (see also Alam, 2002). The present study contributes to this important

literature stream by focusing on the effect that customer information has on profits from new

offerings during each phase of the NPD process. Some studies have examined the

relationship between access to customer information and the output of the NPD process; in

these cases, however, the output is development time (e.g., Tessarolo, 2007), market newness

(Callahan and Lasry, 2004), or managers' perceptions of performance (Gruner and Homburg,

2000; Carbonell et al., 2009). Previous research have acknowledged this limitation, and

specifically suggested that future studies should extend previous research by using other

performance measures such as profitability (Carbonell et al., 2009), which is what is done in

this research.

A conceptual model

The conceptual model presented here includes four focal constructs: supporting factors,

inhibiting factors, obtain customer information, and profits from new offerings (see Figure 1).

If a firm is to obtain customer information in the NPD process, it must have the cultural

norms (supporting and inhibiting factors) that allow it to implement these work practices. The

theoretical rationale for including these constructs is that cultural norms and values can

predispose a firm to actively obtain customer information in the NPD process (Homburg and

Pflesser, 2000). The extent to which a firm acquires customer information influences profits

from new offerings. In the design of the new offering, customer information can be used and

implemented in the different phases of the NPD process, which encompass; strategy, idea

generation, concept development, design, and test and launch. The present study is

specifically interested in identifying the best phases for obtaining customer information.

Since profitability is a difficult measure to compare across industries a number of control

variables have been included as covariates to account for the differences in profits from new

offerings that arise from factors outside the NPD process.

- Insert Figure 1 here -

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HYPOTHESES

Based on the conceptual model depicted in Figure 1, this section develops a number of hypotheses concerning the role of customer information in the NPD process.

The role of cultural norms and values

A firm's decision to obtain customer information in the NPD process is based on its cultural norms and values concerning potential benefits and risks. Access to customer information offers several potential benefits, referred to as supporting factors. While there are supporting factors for engaging customers, a number of inhibiting factors may also hinder a firm from collecting customer information. For example, a firm can choose not to obtain customer information because it is reluctant to change its way of working, even though such a change may help the firm improve its offerings (Olson and Bakke, 2001).

Von Hippel (1988) used case studies to show that lead users have been the origin of many offerings in various industries. Some studies have suggested that even ordinary customers, given the right opportunities, can be more innovative than R&D personnel (Magnusson et al., 2003; Kristensson et al., 2004). Consequently, acquiring customer information may lead to more innovative offerings that better suit customer needs. By bringing customers into the NPD process, firms can ensure that an offering satisfies customer needs, although this may result in longer development time. As a result, collecting customer information may result in a trade-off between speed and market fit. But, anticipating customer needs early in the NPD process can make the process move more swiftly (Iansiti and MacCormack, 1997). Finally, access to customer information may be a marketing opportunity (Alam, 2002), as it makes customers feel more important and may improve customer loyalty.

The most obvious inhibiting factors for collecting customer information may be the structure and culture of the firm. Olson and Bakke (2001) found examples of firms that stopped actively obtaining customer information because the R&D departments did not like the impact of the customer information and felt that the generated product concepts were too ambiguous and simplistic. Furthermore, the R&D departments of these firms did not want to change their way of working and prestige made it difficult to collect and accept the content of customer information. Obtaining customer information has also been found to be difficult, complicated and the cause of an increased work load, which demands more resources in terms of time and money (Gales and Mansour-Cole, 1995; Lilien et al., 2002). Inexperienced firms may thus find that obtaining customer information is a new but complicated way of working. Based on the conceptual model, the present study suggests that the firm's norms and values should influence the behavioural practise of the firm in the following way.

> **H1. a)** *Supporting factors [norms and values] increase the practice of obtaining customer information.*

> **H1. b)** *Inhibiting factors [norms and values] reduce the practice of obtaining customer information.*

Obtaining customer information and profits from new offerings

Obtaining customer information through continual, informal and in-depth contact with customers is important for project success (Maidique and Zirger, 1984; Carbonell et. al, 2009). Access to customer information should enable a firm to develop improved functional requirements, modify the design of the offering, and reduce production costs (Yli-Renko et al., 2001; Svendsen et al., 2011). Von Hippel (1994) explained that customer value is 'sticky information,' which means it is costly to transfer from one place to another because it is tacit (Luthje et al., 2005). Therefore, firms can find it difficult to identify, understand, and adopt

knowledge about the value-creational processes of customers. Similarly, Hunt and Morgan (1992) argued that demand and supply are heterogeneous and constantly changing (also see Alderson, 1957). Hunt and Morgan (1992) further emphasized that both customer information and firm information are imperfect and costly to attain. Consequently, it can be difficult and resource-intensive for firms to identify, understand, and adopt knowledge about the value-creational processes of customers. From a service-dominant logic, it follows that value-creational processes are subjective and must be understood in relation to the specific time and place in which each process occurs (Lusch et al., 2007). Customer knowledge about value in context (Vargo, 2011) should help a firm to develop a better value proposition and create customer satisfaction, loyalty and higher profit margins on new offerings.

The present study has identified three significant attempts to measure the empirical relationship between customer information obtained during different phases of the NPD process and business performance. The first was Martin and Horne's (1993) study of what separates successful projects from unsuccessful ones. Their results showed that a greater use of customer information in several phases of the development process was not associated with the success of the new service. In contrast, Carbonell et al.'s (2009) study on new service development found that customer involvement has a direct positive effect on technical quality and innovation speed, with positive indirect effects on competitive superiority and sales. Finally, Gruner and Homburg (2000) investigated the relationship between customer interaction and product success throughout the NPD process. Their study of the machine industry in Germany concluded that customer interaction is related to NPD success in some, but not all phases.

Based on Gruner and Homburg (2000) and Carbonell et al. (2009) it is proposed that obtaining customer information influences the success of the NPD of goods and services. The underlying logic is that customers have better access to their own context and usage than

firms do. Furthermore, customers may find it easier than employees to think outside the context of current solutions and offerings (Kristensson et al., 2002). Customers may also bring original ideas into the creativity process (Magnusson et al, 2003; Kristensson et al., 2004). Consequently, the present paper argues that obtaining customer information throughout the NPD process ensures that the goods or services design fits with customer needs. This results in higher profit margins as a result of larger sales volumes and better value propositions for customers.

> **H2:** *Obtaining customer information in the NPD process has an effect on profits from new offerings.*

Goods and services

In essence, goods are generally produced at a time and place of the supplier's choosing and not in the presence of customers. Services are usually produced in the customer's presence, at a time and place of the customer's choosing, with the customer's input. Customer presence during production and consumption has long been recognised as an integral feature of services (Parasuraman et al., 1985). Early research defined the concept of 'customer co-production' as customer participation within organisationally defined parameters (Lovelock and Young, 1979). More recently, Lusch and Vargo (2006, p. 284) differentiated co-production from co-creation, noting that co-creation 'involves the [customer's] participation in the creation of the core offering itself. It can occur through shared inventiveness, co-design, or shared production of related goods, and can occur with customers and any other partners in the value network.' The co-production and co-creation of services require in-role and extra-role behaviours, as well as information sharing, for which tacit knowledge is especially difficult to communicate (Bolton and Saxena-Iyer, 2009). Risch-Rodie and Kleine (2000) suggested four key reasons why customers participate in service production: efficiency in process, efficacy of the outcome, hedonic and emotional benefits, and increased

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perceived control. In other words, the outcome of any service depends on how well the elements function together in the service process to meet customer expectations (Edvardsson, 1997). Therefore, customers' expertise and level of activity in the process has a significant influence on the service process and outcome.

It has been argued that when customers and a firm's human resources participate in service production it leads to a higher frequency of 'things gone wrong' (Johnson et al., 2002; Johnson and Nilsson, 2003). In contrast to the production of goods, if something goes wrong in service production, it is often too late to institute quality controls before the service reaches the customer (Hoffman and Bateson, 1997). Co-production introduces inconsistencies that are inherent in human behaviour (on the part of both employees and customer) into the production process itself. Another key distinguishing feature of services is their intangibility; services cannot be touched or felt in the same way as goods (Grönroos, 1990; Hoffman and Bateson, 1997). Intangibility also makes it inherently more difficult to display or communicate differentiated service offerings to customers (Fornell and Johnson, 1993) making the role of the customer in NPD for services more important than for goods. Co-production and the use of customer expertise as a resource imply that customers have knowledge that can be used during all phases in NPD for services. Due to the benefits of co-production, in which the customer has greater knowledge about the service, the effect of obtaining customer information on business performance is greater for service firms than for manufacturing firms.

> **H3**: *Obtaining customer information has a greater effect on profits from new offerings for services than it does for goods.*

Should customer information be obtained in all phases of the NPD process?

The underlying assumption in this research is that obtaining customer information has a positive influence on profits from new offerings during all phases of the NPD process. This is based on Rust et al.'s (2002) research, which shows that customer focused firms are more successful than firms with a cost and operational focus. Based on previous research, the present paper argues that customers have the best opportunity to contribute in the early phases of the NPD process in manufacturing firms (Gruner and Homburg, 2000).

The customer experience of goods consumption is focused on the outcome of the process (Grönroos, 1990). Consequently, what goods do is more important than how they are produced. The opportunity for customer influence in NPD decreases with each subsequent phase of the NPD process as the firm makes more design choices (Krishnan and Ulrich, 2001). The customer has limited potential to contribute during the development phase, especially if the offering is technically complex. This is in line with Gruner and Homburg's (2000) argument that customers should be excluded from technical development because firms cannot expect them to provide technical solutions. Once the firm has constructed prototypes, customers can contribute with feedback (Johnson, 1998). We expected that obtaining customer information would have the highest impact during the early phases, before technical development, but that it would have a positive impact on profits from new offerings during all phases of the NPD process.

> **H4a:** *Obtaining customer information has a greater impact on profits from new offerings in the early phases of the NPD process for goods.*

A consequence of the distinction between goods and services is that customers evaluate offerings differently depending on attributes. The role of a services' attributes is different from those of goods (Nelson, 1970; Darby and Karni, 1973). Services have fewer search attributes than goods (Nelson, 1970) and are dominated by experience and credence attributes (Johnson et al., 1995). Search attributes are observable prior to purchase, while experience

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attributes can only be evaluated after purchase and consumption of goods. Darby and Karni (1973) identified a third category, called *credence attributes*, which are still not readily observable after some degree of purchase and consumption. For services, customers are part of the sort and transformation processes as co-creators of value (Alderson, 1965), which means that customers have and need more process knowledge. Consequently, the consumption process becomes more important for customers (Grönroos, 1990); this also explains why services tend to have more experience and credence attributes than goods.

The present research argues that customers' higher reliance on experience and credence attributes when evaluating services means they should have a different role in NPD for services than for goods. Customers must rely on their imagination or previous experience with other services early in the NPD process for services. Therefore, customers can only provide feedback regarding search attributes in the early phases of the NPD process. However, once the service concept has been formed, customers can provide feedback on experience attributes. Even later in the NPD process, the service experience can be test-driven (Edvardsson et al., 2005) and customers can provide feedback on credence attributes. Accordingly, the present research argues that obtaining customer information should have a greater influence on profit margin in the later phases of the NPD process for service firms.

H4b: Obtaining customer information has a greater impact on profits from new offerings in the later phases of the NPD process for services.

RESEARCH DESIGN

Sample

An email survey was sent to the R&D managers and marketing managers of 3478 Swedish firms selected from an external database (PAR Affärsregister AB). Because it was not possible to determine in advance which firms were active in NPD, managers were asked to

participate only if they were involved in the NPD process for goods or services. As an incentive to fill out and return the questionnaire, respondents were promised an executive summary of the study. Two reminders were mailed to non-respondents, one and two weeks after the initial mailing; this yielded an overall response rate of 10.5 percent (366 respondents). Telephone interviews were conducted with 100 non-respondent managers in order to determine how many firms conducted development projects. Of these 100 managers, 37 indicated that their firm did not conduct any development projects. A further six said that while their firm did perform development projects, they personally had no knowledge of the projects. In addition, there were no statistically significant differences between early and late respondents (Armstrong and Overton, 1977). Together, the non-response analysis and the analysis early and late respondents suggested that the survey provided an accurate view of how firms obtain customer information in NPD.

Sample characteristics

The sample included manufacturing firms in industries such as pulp and paper, chemicals, plastic goods, fabricated metal goods, machinery and equipment, and electrical and optical equipment. It also included service firms in industries such as hotels, transportation, renting and real estate, construction services, and business services (see Table 1 for descriptive statistics). The major industries represented in the study were construction services (20 percent), construction (11 percent), machinery and equipment (7 percent), fabricated metal goods (7 percent), and pulp and paper (6 percent). The firms in the sample ranged in size from only a few employees to several thousand. Approximately 76 percent of the firms worked predominantly in a business-to-business market, with the remainder operating in the consumer market. The average firm in the sample had 290 employees, a turnover of €54 million, and a profit margin of 3.36 percent.

- Insert Table 1 about here -

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Constructs and variables

The study included two constructs (supporting and inhibiting factors) associated with cultural norms and values related to obtaining customer information within a firm (e.g., Homburg and Pflesser, 2000). A pilot study collected data from 100 managers to identify the items for supporting and inhibiting factors. The first step in the pilot study was to conduct a number of interviews with R&D managers and marketing managers to determine how they worked with customers throughout the NPD process. These interviews revealed a number of issues that either supported or inhibited obtaining customer information. A large set of potential items was examined, following standard approaches to scale development (Bearden et al., 1993). We then used the items of inhibiting and supporting factors that worked well in the pilot study in the main study (see Appendix). For the main study, we included six items in the research instrument for inhibiting and supporting factors (two items were dropped for each construct due to low item-to-total correlation). Most items required a rating on a 10-point Likert scale that ranged from 'strongly disagree (1)' (or 0 percent of the projects) to 'strongly agree (10)' (or 100 percent of the projects). A factor analysis was performed using data from the entire sample, including firms for which financial data were unavailable (n = 366). All items included in the final survey loaded on the intended constructs, and the three factors explained 55 percent of the variance.

The amount of customer information obtained was measured using the percentage of projects in which customers participated during different phases of the NPD process, relative to the total number of projects. The NPD process consisted of five phases: strategy, idea generation, concept development, design, and test and launch. The adopted phases are similar to previous research on the use of customer information (Gruner and Homburg, 2000), except that a strategy phase was added.

We measured profits from new offerings based on a firm's profit margin from new offerings, rather than by the profits generated by an individual offering (good or service). Profit was selected because it took both the increased sales of new offerings and the costs associated with developing new offerings into account. We used the standard accounting measure of profit margin, which was calculated as net sales less the cost of goods and services sold and selling and administrative expenses (but before deducting depreciation) normalised by net sales. We argue that firms that obtained more customer information should have increased project success, which will result in the specific project contributing to the future profits. In order to identify the unique effects of obtaining customer information during NPD on firms' profit margins from new offerings, several other factors were measured and controlled for, including the industry, the firm's previous profit margins, type of business, firm size, and type of market.

The first of the control variables was industry, which was selected because the level of profit margin, supporting and inhibiting factors, and obtaining customer information varies across industries. Specifically, all firms were divided into groups based on the SIC industry codes, and the items that measured obtaining customer information and profit margin were mean-centred, see e.g. Moorman and Rust (1999). Secondly, firm size, type of business and type of market were controlled for. Firm size influences product development (Narver and Slater, 1990) and is an indicator of the level of firm resources (Rust et al., 2002). The number of employees for each firm was obtained from an external database. The level of profit margin was determined partly by the specific market characteristics, which is why type of industry (goods and service) and type of market (industrial and consumer) were included as controls.

A baseline analysis

A paired, industry-matched baseline analysis was conducted as an initial test of the effect of obtaining customer information on profit margin. Firms in the same industry (same two-digit SIC code) and of similar size were assumed to be subject to similar economic and competitive factors. The selected matching process was similar to that used in previous research (Hendricks and Singhal, 2001; Kaplan, 1989). Within each industry, firms of similar size and profit margin were matched for the year t-3. The primary difference between the firms was that one firm obtained more customer information.

The mean value of obtaining customer information over the five phases of the NPD process was used to differentiate between high and low degrees of obtaining customer information. In order to be certain that the mean value of obtaining customer information did in fact distinguish between the firms, a control was used that captured the methods used for obtaining customer information, such as the degree of usage of interviews, surveys, observations, and the lead user methodology. Firms were only matched if they were similar in size, displayed a higher mean value of obtaining customer information, and were more likely to use the explicit methods for obtaining customer information. In total, there were 58 matched pairs for manufacturing and 51 matched pairs for service firms. The average difference in obtaining customer information of the different phases of the NPD process was 2.2 (on a scale of 1 to 10) for manufacturing firms and 2.5 for service firms. T-statistics were used to test whether the mean values of the difference in profit margin were significantly different from zero. The significance of results was measured conservatively by reporting two-tailed t-tests.

Table 2 illustrates the differences in profit margin for the matched sample of firms with high and low degrees of obtaining customer information in NPD for goods and services, respectively. On average, the profit margins decreased from approximately 6 percent in t-3 to 3 percent in t. However, the difference between firms with high and low degrees of obtaining

customer information increased over the four years. At the beginning of the time period (t-3), the difference was 1.40 percent (ns) for manufacturing firms and 3.11 percent (ns) for service firms. This difference increased for manufacturing firms over the time period. In t, there was a statistically significant difference ($p < 0.05$) of 2.31 percent. For service firms, this statistically significant difference ($p<0.05$) appeared both in t-1 (5.57 percent) and t (4.60 percent). This baseline analysis provides empirical evidence that obtaining customer information influences the NPD process differently for goods and services, as shown by the differences in profits from new offerings. The appearance of statistically significant differences, one year earlier for services, suggests that obtaining customer information paid off earlier for service firms than it did for manufacturing firms.

- Insert Table 2 about here –

In order to isolate the recent effects of obtaining customer information on profits from new offerings, it is necessary to include a lagged measure of profit margin (Ordanini and Parasuraman, 2010). The baseline analysis supports the argument that profits from new offerings as a dependent variable in the structural model could include several items (Chin, 1998), such as results from both t-1 and t, while it is also necessary to control for previous profit margin coming from t-2 and t-3. The inclusion of previous profit margin makes the results robust against potential 'halo effects.' In addition, a firm that was profitable in the past was more likely to be profitable in the future, and the use of previous profit margin also acted as a control for industry-specific factors that influenced the profit margin of firms in different industries. The appendix to this article provides details on the items used in the models.

Analysis, reliability and validity of the measurement model

Partial Least Squares (PLS) was used to estimate the conceptual model of the relationship between cultural norms and values, obtaining customer information and profits from new

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offerings (Wold, 1982; Fornell and Cha, 1994; Hulland, 1999). PLS was selected ahead of other modelling approaches because the study's objective was to explain and predict profit margin (Fornell and Cha, 1994). In addition, H4a and H4b needed to be tested using the weights of the model at the indicator level. All of the constructs in the conceptual model were modelled as reflective constructs. PLS tends to homogenize the loadings and weights for a factor when the actual pattern is varied (Chin, 1995), which means that the differences between various phases and between various industries would be conservatively estimated. As PLS makes no distributional assumptions, we used the jack-knifing method to evaluate the significance of the paths in the measurement model (Chin, 1998). Because the sample of 244 firms was evenly distributed between manufacturing and service firms, we generated three models: one for all firms (n = 244), one for manufacturing firms (n = 124), and one for service firms (n = 120). To be able to test H4a and H4b, we took means and standard deviations from the jack-knifing output and performed a pooled t-test (Chin, 2012).

Before the hypotheses could be tested, the measurement model had to exhibit a satisfactory level of validity and reliability (Fornell and Larcker, 1981). The first step involved testing the reliability of each measured variable to ensure that the measurement variables loaded meaningfully to their constructs. All of the individual loadings in the measurement model reached the recommended level of 0.707 (Hulland, 1999).

In addition to studying the reliability of the individual items or measurement variables, it was necessary to study the composite reliability of the constructs. The rho coefficient can be calculated to investigate the internal consistency of a given block of indicators (Chin, 1998). In the present study, all rho values were higher than the proposed threshold of 0.70, which supported the ability of the measures used to operationalise the various latent constructs (see Appendix).

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The Average Variance Extracted (AVE) was used to check the validity of the model (Fornell and Larcker, 1981). The AVE measured the amount of variance captured by the constructs in relation to the amount of variance due to measurement error (Fornell and Cha, 1994). In order to ensure the discriminant validity of the constructs, the AVEs of the latent variables should be greater than the square of the correlations among them (Chin, 1998) and greater than 0.50 (Fornell and Larcker, 1981). In order to make this comparison we used the correlation matrix of the latent constructs, for which the diagonal elements were replaced by the square root of the AVEs, see Table 3. Higher values for the diagonal elements compared to the off-diagonal elements suggested good discriminant validity. The table shows that the measurement model used in the study had discriminant validity.

- Insert Table 3 about here -

Structural model results

All of the relationships in the overall measurement model (n = 244) were significant in the hypothesised directions, and the measurement model explained 12 percent of the variance in the objective profit margin. In the models for manufacturing (n = 124) and service firms (n = 120), four of the six paths displayed a significant relationship, while the measurement models explained 24 percent and 11 percent of the variance, respectively (see Table 4). Neither Table 4 nor the Appendix includes firm size, type of industry or type of market because these factors had no significant relationships with profits from new offerings.

- Insert Table 4 about here -

The first hypotheses (H1a and H1b) concerned the influence of inhibiting and supporting factors on obtain customer information. Firstly, inhibiting factors showed a negative relationship to obtain customer information ($\beta = -0.17$; $p < 0.01$) and supporting factors showed a positive relationship to obtain customer information ($\beta = 0.28$; $p < 0.01$), which

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supported hypotheses H1a and H1b. An investigation of the differences between the models for manufacturing and service firms revealed that the supporting and inhibiting factors showed a stronger relationship for service firms than for manufacturing firms.

H2 posited that obtaining customer information had a positive impact on profits from new offerings. This relationship was significant in the overall model, the model for manufacturing firms, and the model for service firms ($\beta = 0.15$; $p < 0.01$; $\beta = 0.11$; $p < 0.05$; $\beta = 0.14$; $p < 0.05$). To further examine the relationship between customer information and profit margin, the effect size was investigated in terms of its explanatory power. Mathieson et al. (2001) suggested that an effect size of f^2 could be estimated by multiplying f^2 with (n-k-1), and a pseudo-F test could be conducted to test the significance of f^2 with 1 and n-k degrees of freedom, where n is the sample size and k is the number of exogenous constructs (Mathieson et al., 2001). The results of this analysis revealed that the effect size of obtaining customer information was statistically significant ($F = 5.76$; $p<0.05$) for explaining profits from new offerings. These results supported H2. However, no statistical difference was found between the models for manufacturing and service firms concerning this relationship. Consequently, H3 was not supported.

The remaining hypotheses concerned the phases in the NPD process in which the acquired customer information was most financially rewarding. In general, the pattern of the phases in which firms have access to customer information is similar between goods and services with the largest share of firms obtaining customer information in the idea generation and concept development phases. With regard to the model for all firms, the measurement variable weights for all phases were positive and significant, which supported the finding that acquiring customer information in all phases of the NPD process contributed to profitability. In order to determine the phases in which the effects of obtaining customer information are

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the highest, the effect sizes were compared within each sector: goods (H4a) and services (H4b).

For the manufacturing firms, the first two phases of the NPD process (strategy and idea generation) had larger measurement variable weights than the later phases ($p < 0.05$). This provided support for H4a. The pattern of the measurement variable weights over the five phases of the NPD process for service firms was more complex. The impact of the first phase (strategy) was quite large, although it decreased during the idea generation phase and became larger again in the concept development and design phases. All of these differences were statistically significant ($p < 0.05$). These results did not support H4b because the strategy phase and the test and launch phase did not behave as expected.

As suggested by reviewers, we did a validity check where the same analysis with a formative specification of the construct obtain customer information was performed. The formative measurement variable weights displayed the following pattern for manufacturing firms; strategy = 0.55, idea generation = 0.50, concept development = 0.22, design = -0.05, and test and launch = 0.11. For service firms, the pattern was as follows; strategy = 0.50, idea generation = -0.06, concept development = 0.21, design = 0.33, and test and launch = 0.41. The pattern of the formative measurement variable weights is similar to the results using a reflective model specification and provides support for H4a, but not for H4b. The negative signs of two of the phases in the NPD process depend on the high correlation between the phases; that is, a firm that obtains customer information in one phase is more likely to obtain customer information in subsequent phases.

DISCUSSION AND CONCLUSIONS

The empirical investigation, which used two different types of analyses, established a relationship between obtaining customer information in the NPD process and profits from

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new offerings. An aggregate measure of access to customer information was used in the first analysis, while the second analysis used measures for obtaining customer information at each phase of the NPD process. Two separate analyses were used in order to strengthen the external validity of the findings.

Theoretical implications

One key result of this study is that firms that obtain customer information in the NPD process can expect higher profits from new offerings. By having access to customer information in different phases of the NPD process, a firm can tap into the heterogeneity in demand and create a better match in supply (Alderson, 1957; 1965). Previous research has shown that firms find it difficult to identify, understand and adopt knowledge about customers' value-creating processes, but that methods and approaches that build on capturing this type of information provide better results (Witell et. al., 2011). Through the use of customer information, firms get better knowledge of 'sticky information' and generate better matches in market offerings. The empirical research presented herein not only replicated the results of Carbonell et al. (2009) and Gruner and Homburg (2000) but extend it by relating obtaining customer information in the NPD process to an objective measure of profit margin from new offerings. Interestingly, the main effect does not reveal any difference between goods and services. Two differences were, however, identified: firstly, the cultural norms and values influenced services more than goods. Secondly, the effect of obtaining customer information influenced profits from new offerings faster for services than for goods.

The study has shown that, for goods, the effect of obtaining customer information on profits from new offerings is strongest in the early phases of the NPD process. Furthermore, firms appeared to rely more on their own skills during the later phases of technical development rather than on customer information. This finding is consistent with Gruner and Homburg (2000). Even if customer information was obtained in the test and launch phase, it

might only have a minor impact on the profitability of the new offerings. This was due to the lack of opportunities for customer information to influence the design of the goods late in the NPD process, by which time the design parameters have already been decided.

In contrast to Carbonell et al. (2009), our results for service firms showed that the financial benefits of acquiring customer information varied depending on the phase of the NPD process. With the exception of the strategy phase, the highest payoff for obtaining customer information seemed to occur in the later phases; during concept development and design. It is difficult for customers to provide valuable feedback to developers before the service concept had reached a certain degree of maturity. These findings were consistent with previous research, which stated that experience attributes are more important for services. It is also consisted with the active role of the customers for services. Consequently, NPD for services must move into the concept development and design phases before the customer can make a substantial contribution to the new service. The design parameters of a service can often be changed late in the NPD process without any significant costs, which makes it possible to allow late design changes.

Managerial implications

The results of this study have important implications for NPD managers developing goods and services. It is beneficial to obtain customer information throughout the phases of the NPD process. However, the payoffs to the firm (in terms of profit margins for new offerings) are larger for certain phases of the NPD process than for others.

Acquiring customer information as early as in the strategy phase of the NPD process is a key for improving the profitability of new offerings. Hence, project managers should build strong relationships with key customers early in the NPD process, preferably in the strategy phase. The importance of the strategy phase seems to hold for both manufacturing and

service firms (Griffin, 1997). Involving key customers in the strategy phase of the NPD process could be a way of extending the NPD process into sales and delivery (see, e.g., Kindström and Kowalkowski, 2009). Furthermore, by placing strategic customers in the development team from the start of the development project, the first product or service could be sold even before the offering is put on the market.

Obtaining customer information in the concept and design phases has a significant impact on profit margins for new services. Service customers know their own needs and participate in the co-production of the service. When there is an existing service concept, customers find it easier to imagine and think about redesigning and improving it. In Witell et al.'s (2011) study of the development of microwave ovens, customers were involved in the concept phase through co-creation methods to generate ideas on goods and service offerings. The originality of the service concepts was significantly higher than for the goods concepts. Consequently, managers should search for proactive methods to involve customers during the concept and design phases (Gustafsson and Johnson, 2003).

Limitations and future research

Although the use of objective profit margin as a measure of business performance is an improvement on previous research, accounting techniques may vary across industries. Future studies should include longitudinal data on both the use of customer information and financial performance. In addition, there was no way to screen which firms in the sample performed NPD and which ones were pure production units. This contributed to a low response rate. Future studies on NPD should include a screening phase to exclude production units from their sample. In addition, the iterations that occurred throughout the NPD process, moving forth and back between the phases, were not fully captured. This study used overall measures of obtaining customer information for each individual phase. An alternative would be to focus more on what happens in one particular phase and use several measures to capture

obtaining customer information in detail. One particular phase of interest for further research is the strategy phase, particularly its complexity and its role in NPD.

It is important to investigate how introducing more proactive methods of customer co-creation at different phases of the NPD process can influence the contribution of obtaining customer information. For example, it would be beneficial if service firms received a higher payoff from obtaining customer information earlier in the NPD process. This research argues that such change cannot be achieved without radically changing the NPD process. There is a need for further experimental research and empirical cross-sectional studies to investigate how to increase the pay-off from obtaining customer information and how the payoff varies for different kinds of innovation (Gustafsson et al., 2012).

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TABLE 1: Descriptive statistics of the sample.

Industry	No. of firms	Obtain customer information	No. of employees	Turnover [KSEK]	Profit margin [%]
Pulp and Paper	22	5.83	270	829,593	3.48
Chemicals	8	4.72	235	283,966	3.10
Plastic Products	9	4.9	16	78,509	4.45
Fabricated Metal Products	26	5.88	62	82,194	2.67
Machinery and Equipment	27	5.41	133	207,494	3.78
Electrical and Optical Equipment	16	4.95	108	209,977	2.55
Construction	16	5.27	330	419,287	1.70
Hotels	7	3.86	56	76,128	3.79
Transportation	15	4.99	975	2,405,996	1.16
Renting and Real Estate	15	4.52	224	893,939	7.67
Data	19	5.93	140	157,347	3.36
Construction	39	4.59	352	280,931	2.18
Business Services	17	5.07	977	495,545	3.75
Others	8	4.89	290	334,575	3.36

TABLE 2: A paired comparison of profit margins between firms with high and low degrees of obtaining customer information (* $p < 0.05$).

	Manufacturing firms		Service firms	
	Mean	Difference	Mean	Difference
t-3	6.30	1.40	6.01	3.11
t-2	4.31	0.61	2.62	1.58
t-1	2.98	1.01	3.36	5.57*
t	3.06	2.31*	3.33	4.60*

TABLE 3: Assessment of the validity of the research (n = 244).

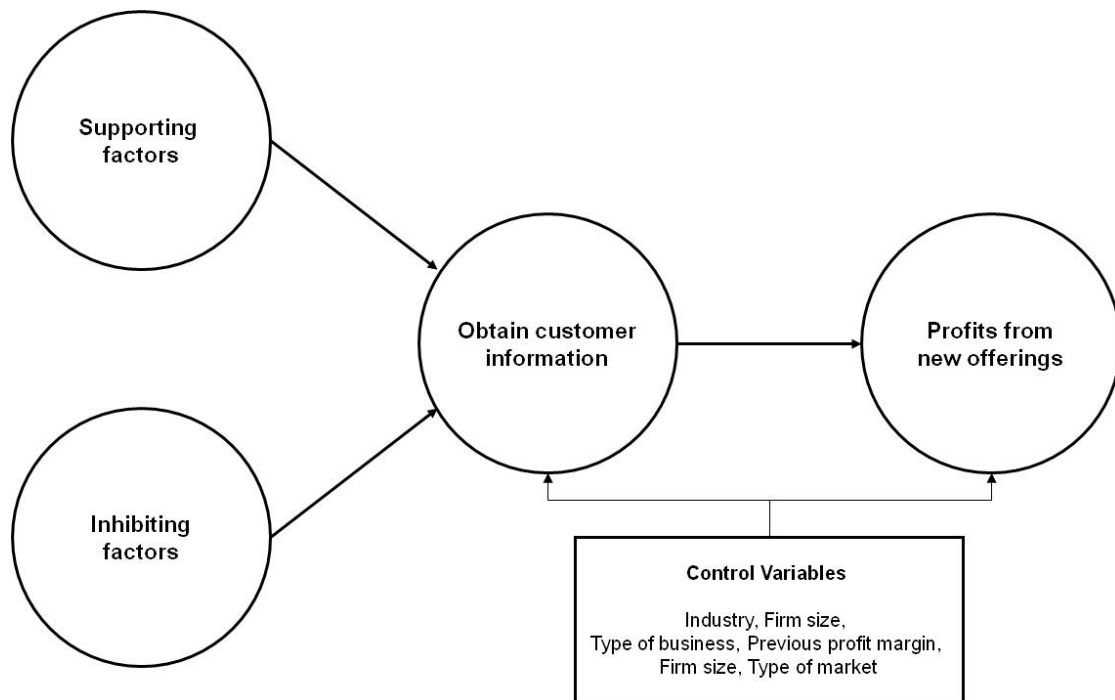|	Mean	Std. Dev.	Previous profit margin	Supporting factors	Inhibiting factors	Profit margin	Obtain customer information
Previous profit margin	1.25	11.03	**0.88**				
Supporting factors	6.09	1.77	-0.031	**0.73**			
Inhibiting factors	4.08	1.96	0.125	-0.176	**0.74**		
Profit margin	-0.45	6.27	0.312	0.009	0.013	**0.87**	
Obtain customer information	-0.82	1.82	0.029	0.309	-0.214	0.162	**0.73**

Note: The table contains correlations with the square root of the AVE on the diagonal.

TABLE 4: Path coefficients and measurement weights.

	Overall	Manufacturing firms	Service firms
The outer model paths	(n=244)	(n=124)	(n=120)
Supporting factors→ Obtain customer information	0.280^{**}	0.233^{ns}	0.32^{**}
	t = 3.38	t = 1.34	t = 3.40
Inhibiting factors→ Obtain customer information	-0.165^{**}	-0.093^{ns}	-0.224^{*}
	t = -2.84	t = 0.12	t = -2.22
Obtain customer information→ Profit margin	0.153^{**}	0.113^{*}	0.146^{*}
	t = -3.00	t = -1.67	t = -1.67
Previous profit margin → Profit margin	0.31^{*}	0.47^{**}	0.30^{ns}
	t = 2.0	t = 6.4	t = 0.97
R^2	0.12	0.24	0.11
The inner model weights			
Obtain customer information			
Strategy	0.30^{**}	0.36^{**}	0.31^{**}
	t = 7.09	t = 2.67	t = 3.83
Idea generation	0.28^{**}	0.35^{**}	0.23^{**}
	t = 6.76	t = 4.14	t = 3.37
Concept development	0.28^{**}	0.26^{**}	0.29^{**}
	t = 15.06	t = 3.44	t = 8.95
Design	0.27^{**}	0.24^{**}	0.30^{**}
	t = 9.69	t = 2.80	t = 4.26
Test and Launch	0.25^{**}	0.23^{**}	0.25^{**}
	t = 7.56	t = 1.98	t = 3.87

Note: ** = $p < 0.01$; * = $p < 0.05$; ns = $p > 0.05$ (ns); All t-tests are one-tailed.

FIGURE 1: A conceptual model.

Constructs	Items	All			Manufacturing firms			Service firms		
		Load-ings	AVE	rho	Load-ings	AVE	rho	Load-ings	AVE	rho
Supporting factors	Customers are more innovative and create better products.	0.68	0.53	0.81	0.65	0.52	0.83	0.70	0.55	0.82
	Customer involvement saves money.	0.80			0.76			0.82		
	Customer involvement reduces time-to-market.	0.85			0.83			0.86		
	Customer involvement provides a good marketing opportunity.	0.58			0.63			0.55		
Inhibiting factors	Our current organisation structure and culture hampers customer involvement.	0.77	0.55	0.82	0.85	0.54	0.84	0.71	0.56	0.83
	Customer involvement is difficult and complicated.	0.71			0.65			0.72		
	The lack of appropriate methods makes it difficult to involve customers in the innovation process.	0.87			0.86			0.85		
	Customer involvement increases the work load and demands more resources in terms of time and money.	0.60			0.53			0.69		
Obtain customer information	In what share of the development projects did you obtain customer information in this phase of the development process? [1=0%; 10=100%]		0.53	0.83		0.50	0.85		0.53	0.85
	The strategy phase	0.68			0.67			0.71		
	The idea generation phase	0.73			0.74			0.75		
	The concept development phase	0.79			0.73			0.83		
	The design phase	0.75			0.73			0.74		
	The test and launch phase	0.61			0.64			0.57		
Profit margin	Profit margin for the years t and t-1	0.81 0.93	0.76	0.66	0.87 0.89	0.77	0.87	0.75 0.96	0.74	0.85
Previous profit margin	Profit margin for the years t-2 and t-3	0.91 0.84	0.77	0.87	0.89 0.76	0.69	0.81	0.88 0.90	0.79	0.89

Note: Previous profit margin is the only control variable that is both a multi-item measure and has a significant relationship to profit margin.