The impact of centralization on SMEs’ new product performance
Abstract

Previous research mostly focuses on improving the NPD for large firms. However, SMEs are in particularly interesting, because there are way more of them than large firms. Therefore, this research focuses on SMEs and their NPP. This study specifically focuses on the role of centralization on the NPP efficiency and effectiveness. 111 SMEs were interviewed in the Netherlands. Although previous research indicates that centralization does influence NPP, this study could not prove this.

Keywords: centralization, new product performance, SMEs, new product performance efficiency, new product performance effectiveness
1. Introduction

Small- and medium sized enterprises (SMEs) are 99% of businesses in the EU (European Commission, 2014). SMEs employ around 87 million people (Gagliardi-Main et al., 2013). The large presence of SMEs plays an important role in national economies (Leithold, Woschke, Haase, & Kratzer, 2016; Muller, Devnani, Julius, Gagliardi, & Marzocchi, 2016). In order to be competitive, especially against larger firms, SMEs need to innovate (De Jong & Vermeulen, 2006; Deshpandé, Farley, & Webster Jr, 1993; Song, & Thieme, 2006). Trends such as globalization, fast product life cycles and product commoditization all add to this importance (Cardinal, 2001). Developing new products is not only important for longevity of the firm, but for society as well (De Jong & Vermeulen, 2006). Innovative firms generate economic growth and employment, thus greatly improve people’s lives (Ahlstrom, 2010).

One important aspect in the innovation process is how an organization is structured. There has been a long tradition of scholarship on the links between strategy, structure, and performance. In the last 20 years strategy scholars increasingly emphasized the importance of technological innovation for firm competitiveness (Eisenhardt & Santos, 2002; Kogut & Zander, 1992; Teece, 1996). Researchers have shown an interest by exploring the relationship between a firm’s organization of its research efforts and the generation and application of such knowledge (Argyres & Silverman, 2004). A critical problem in the innovation process is to create and work within organizational structures that effectively coordinate the new product development (NPD) process, facilitate information sharing and provide mechanisms for decision making and conflict resolution (Olson, Walker, & Ruekert, 1995).

A traditional bureaucratic management structure is centralization, which refers to the extent to which decision making power is concentrated at the top levels of the organization (Yang, Zhou, & Zhang, 2015). Researchers suggest that centralization may benefit innovation, through more efficient coordination and integration between functional units and reduced transaction costs in knowledge transfer within a firm. Managers and decision makers can use their power to control information flows and reduce information redundancy with centralization (Bunderson & Boumgarden, 2010; Bunderson & Reagans, 2011). The increase in information processing efficiency enables a faster time to market and cost reductions. (Argyres & Silverman, 2004; Cardinal, 2001; Olson et al., 1995; Zhou & Li, 2012). This has a positive effect on NPP by improving its efficiency.

Other researchers suggest that centralization has a negative effect on NPP by decreasing its effectiveness. Because of centralization, information flow from bottom to top management may actually be constrained through a filter-like hierarchy structure, restraining freedom of information flow, resulting in information loss (Cardinal, 2001; Jansen, Van Den Bosch, Frans AJ, & Volberda, 2006). Another argument is that centralized organizations have less inter-department communication. Inter-department communication is seen as a source of information generation.
Restraining information flow and sources of information generation reduces the quantity and quality of new ideas and knowledge (Jansen et al., 2006; Yang, Zhou, & Zhang, 2015). Increased regulation of behavioral control through centralization could negatively impact the motivation for pursuing radical innovation, because of the higher probability of failure of radical innovations. R&D might avoid the risk of making mistakes and therefore focus on small improvements (Cardinal, 2001).

Yang et al. (2015) found that human capital, charismatic leadership and entrepreneurial orientation (EO) positively moderate the relationship between centralization and NPP. Thus centralization can have a positive effect on NPP if:

- human capital compensates for the information loss mentioned by Cardinal (2001) and Jansen et al. (2006)
- charismatic leadership compensates for the undermined motivation mentioned by Cardinal (2001) can be adjusted
- EO compensates for both information loss and undermined motivation.

An explanation for these contradicting results may be that the studies mentioned above use different samples and different measurements for the concept performance. Therefore they find positive or negative effects on different forms of performance, specifically efficiency and effectiveness. Yang et al. (2015) measure innovation performance based on Song, Dyer, & Thieme (2006) and Lichtentaler (2009). Yang et al. (2015) assess the quantity, speed and success of NPD compared to its main competitors. Cardinal (2001) measures performance by the likelihood of the innovation of new drugs or drug enhancements. (Argyres & Silverman, 2004) measure performance by the level of innovative impact. The samples of these studies were across large (e.g. fortune 500 companies) and/or specifically pharmaceutical firms (Argyres & Silverman, 2004; Cardinal, 2001; Olson et al., 1995). Studies that focus on SMEs are scarce. Considering that 99% of all firms in the EU are SMEs, means that only a small part of firms is studied (European Commission, 2014).

Innovation often differs between SMEs and large firms (Nootenboom, 1994; Tether, 1998). SMEs have limited capital, less employee capacity and limited time for new product development (Garengo, Biazzo, & Bititci, 2005; Laforet & Tann, 2006; Leithold, Woschke, Haase, & Kratzer, 2016). To summarize, it is still inconclusive if centralization improves NPP or not, specifically in SMEs. The goal of this study is to find more insights in the relationship between centralization and the different measures NPP. The expectation is that centralization influences NPP efficiency positively, but NPP effectiveness negatively.

2. Literature review

SMEs and centralization

Researchers use quantitative and qualitative definitions to define SMEs. E.g. quantitative definitions could based on turnover, number of employees and turnover. Qualitative definitions could be based on scale, personality and independence (European commission, 2016). Nootenboom (1994) uses a qualitative definition based on small scale, personality and independence. Researchers also use different definitions within these two. This research uses
a quantitative definition, where an SME is defined as a firm that has between 20-150 employees. Nooteboom (1994) mentions that SMEs have informal communication and shorter decision-making channels. The shorter decision-making channels could be explained by the size of SMEs. The lack of functional departments, due to the small size of SMEs could also explain why SMEs are less centralized. There are simply not enough employees for a centralized organization.

**Centralization and new product performance**

Centralization describes the extent to which decision making power is exercised at the upper levels of the organizational hierarchy. E.g. excessive centralization restricts the autonomy of an employee to make their own decisions or to take actions (without permission). The opposite of centralization is decentralization, it describes to what extent there is more autonomy in decision making power. When a firm is decentralized Organizational structure can fall anywhere between centralization and decentralization (Jimenez, 2017; Yang et al., 2015).

New product performance can be defined as the performance of a new product development process and its launch (Hsiao, Chen, Guo, & Hu, 2017). There are many different measures of NPP namely, product quality, NPD speed and costs, cost-efficiency, technical performance with respect to specifications, performance in terms of customer satisfaction, market share and overall profitability (Ahmad, Mallick, & Schroeder, 2013; Schleimer & Faems, 2016).

Researchers associate centralization with efficiency in information processing, but also argue that centralization leads to a more conservative approach to pursue and achieve more innovative solutions (Atuahene-Gima, 2003). The relationship between centralization and NPP can be vague and the mixed arguments don’t make it much clearer. In order to make this clearer, table 1 summarizes arguments of studies that try to explain the relationship between centralization and NPP.

**Table 1  Summary of studies on centralization and NPP**

<table>
<thead>
<tr>
<th>Author</th>
<th>Argument</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olson et al. (1995)</td>
<td>Participative mechanisms (decentralization) are inefficient and time consuming in coordinating activities and resolving functional disagreements</td>
<td>Centralization has a positive influence on NPP</td>
</tr>
<tr>
<td>Olson et al. (1995)</td>
<td>Decentralization leads to increased participative decision making which increases the odds of developing products that address market desires better</td>
<td>Centralization has a negative influence on NPP</td>
</tr>
<tr>
<td>Cardinal (2001)</td>
<td>Centralization improves</td>
<td>Centralization has a</td>
</tr>
</tbody>
</table>
One of the main arguments for a positive relationship between centralization and NPP is an increase in information processing efficiency. Centralization increases the freedom of decision makers and the power of upper-level managers. This results in an increase in their managing discretion and scope. In addition, there will be a reduction in information redundancy, because managers can focus on goal relevant information instead of goal-irrelevant information. Managers can effectively integrate and coordinate resources and knowledge across departments to reduce costs associated with communication and coordination in information transfer. This improves information processing efficiency by having easier and more efficient coordination with information flow and integration between departments (Argyres & Silverman, 2004; Cardinal, 2001; Olson et al., 1995). Knowledge sharing, transfer and management are made more efficient with centralization. The increase in information processing efficiency results in less transaction costs of knowledge transfer (Yang et al., 2015). Decentralization may also be inefficient and time consuming in coordinating activities and resolving functional disagreements (Olson et al., 1995). Table 2 shows a brief summary of the arguments and which performance dimensions are related.

Table 2: Centralization arguments and its positive influence on performance dimensions

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Argument</th>
<th>Related performance dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardinal (2001) and Olson et al. (1995)</td>
<td>Centralization increases information processing efficiency</td>
<td>Time to market of newly developed products will decrease</td>
</tr>
<tr>
<td>Argyres &amp; Silverman (2004)</td>
<td>Centralization reduces transaction costs in knowledge exchange</td>
<td>Product development costs of newly developed products will decrease</td>
</tr>
</tbody>
</table>
It is expected that a reduction in time to market and NPD costs leads to more efficiency. Therefore the following hypothesis will be tested:

“**H1: Centralization positively influences new product performance of SMEs in terms of efficiency**”

Jansen et al. (2006) argues that centralization stifles creativity. In a decentralized structure, rules and procedures are less formalized and individual units tend to develop their own methods and tend to have more autonomy in decision making.

Increased autonomy, lower centralization and fewer rules and regulations lead to increased participative decision making and interdepartmental information sharing on a frequent and informal basis. These processes can help to reduce barriers between individuals and departments. In an atmosphere where innovative ideas are shared, critiqued and refined across multiple functions, the odds increase of producing products that successfully address market desires (Olson et al., 1995). On the contrary, centralization means more layers of information transfer, more information filtering, and narrower communication channels (Cardinal, 2001; Jansen et al., 2006). There is less inter-departmental communication in centralized organizations than in decentralized organizations (Hage & Aiken, 1967). This lack of communication among functions and layers leads to more information gaps. In this way, centralization restrains the sources of information generation and the freedom of information flow from bottom towards upper management, thus reducing the quantity and quality of new ideas and knowledge for problem-solving and initiative activities (Jansen et al., 2006). The reduction in new ideas and knowledge will lead to lower innovation performance, since advanced knowledge is needed to reach high technical product performance (Pierce & Delbecq, 1977). Decentralization also fosters R&D’s psychological ownership and empowerment, which leads to better commitment and intrinsic motivation for creativity or future challenges (Yang et al., 2015). This, in turn, will increase the product quality, because the psychological ownership will motivate employees to produce higher quality products. Product quality is the degree to which the product satisfies customer quality and performance requirements (Atuahene-Gima, 2003). Decentralization also increases the probability of producing successful products in terms of market desires as well as technical
and operational requirements (Olson et al., 1995). Table 3 shows a brief summary of the arguments and which performance dimensions are related.

Table 3:  Centralization and its negative influence on performance dimensions

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Argument</th>
<th>Related performance dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jansen et al. (2006)</td>
<td>Centralization stifles creativity</td>
<td>Product quality will decrease</td>
</tr>
<tr>
<td>Olson et al. (1995)</td>
<td>Centralization leads to a decrease in interdepartmental information sharing, which reduces the quality and quantity of new ideas and knowledge</td>
<td>Technical performance will decrease</td>
</tr>
<tr>
<td>Cardinal (2001) and Yang et al. (2015)</td>
<td>Centralization lowers commitment and intrinsic motivation to pursue more radical innovation</td>
<td>Product quality will decrease</td>
</tr>
</tbody>
</table>

It is expected that less creativity, commitment, motivation and a reduction in the quality and quantity of new ideas and knowledge decrease new product performance effectiveness. Therefore the following hypothesis will be tested:

“H2: Centralization negatively influences new product performance of SMEs in terms of effectiveness”

Figure 1: Conceptual model
Therefore, the research question of this paper is as follows:

“*How does centralization influence the efficiency and effectiveness of new product performance within SMEs?*”

3. Method section

Sample
The data for this study is collected by students from the University of Groningen. Each student interviews two employees, a project manager and a project member in two or more SMEs. Two respondents per firm are interviewed in person or by phone in order to reduce bias. A different (predefined) questionnaire is used for the supervisor and project member. Some questions overlap and some questions are specific to the supervisor or project member. The total sample size is 111. The SMEs have 20 to 250 employees. The SMEs are active in new product development and are located in The Netherlands. All SMEs have completed a NPD project prior to the interviews. This means SMEs providing service(s) are excluded in the sample. The database of Orbis is used to select the firms.

Measures
All the used questionnaire items can be found in appendix 1. The five question items for the independent variable centralization are measured by 7-point Likert scales (1 = strongly disagree, 7 = strongly agree) based on (Jansen et al., 2006). Questions related to decision making authority and autonomy were used. E.g. “little action could be taken until a supervisor approves the decision”. The respondent ticks 6 if he or she agrees. Researchers assume that a Likert scale is interval data (Jamieson, 2004). The used dependent variables of new product performance based on Schleimer & Faems (2016) and Ahmad et al. (2013) are also measured with a 7 point Likert scale (1 = significantly worse than initial expectations, 7 = significantly better). The two dependent variables are NPP efficiency and NPP effectiveness. Where NPP efficiency consists of two question items related to time to market and product development costs. Performance is efficient when compared to the standard less resources are used, which relates to time and costs. Performance efficiency consists of two question items related to product quality and technical performance with respect to specifications. Performance is effective when a desired outcome is realised, which relates to quality and technical performance.

Method
In order to test the hypotheses a regression analysis should be performed to assess the impact of centralization on the performance dimensions. A factor analysis is done for centralization and the results show that item 2 of centralization (P_central2) is below the absolute value of
0.5, therefore it is deleted, because it doesn’t reflect the variable centralization. This multi-item centralization measure is tested for internal reliability by means of the Cronbach's alpha and surpassed the reliability threshold of 0.7 with 0.885. The four remaining centralization indicators are combined into one variable (MEAN_P_central) by taking the mean. The multi-item centralization will be used as the independent variable and is measured against the two dependent variables.

Time to market of newly developed products and product development costs of newly developed products are combined into one variable efficiency. The mean for items 1 and 4 of new product performance is used of both the project members (P_perf1, P_perf4) and managers (M_perf1, M_perf4) and are combined into one variable (MEAN_efficiency). Product quality and technical performance are combined into one variable effectiveness. The mean for items 2 and 3 of new product performance is used of both project members (P_perf2, P_perf3) and managers (M_perf2, M_perf3) and are combined into one variable (MEAN_efficiency). A regression analysis is conducted with two control variables: firm age and size.

Results

There is a significant (weak) positive relationship between NPP efficiency and NPP effectiveness, \( r = .267 \) at \( p < 0.1 \). There is a significant (weak) positive relationship between the number of employees and NPP effectiveness, \( r = .202 \) at \( p < 0.05 \). There is a significant (weak) negative relationship between the number of employees and NPP efficiency, \( r = -.254 \) at \( p < 0.1 \). There is a significant (weak) positive relationship between the number of employees and firm age, \( r = .237 \) at \( p < 0.05 \). There is insufficient evidence to conclude there is a significant linear relationship between NPP efficiency and \( y \) because the correlation coefficient is not significantly different from zero. The control variables are shown without a natural logarithm, in the linear regression the natural logarithms are used. No other correlations were found.
### Linear regression analysis

The expectation is that the independent variable centralization has a positive effect on the dependent variable NPP efficiency (H1) and a negative effect on NPP effectiveness (H2).

Firstly a regression analysis is done for H1 without control variables. The ANOVA table shows that $F(1,109) = 0.801, p = 0.373$. With control variables, the ANOVA table shows that $F(3,106) = 1.593, p = 0.195$. The regression model is not significant, centralization does not predict the outcome variable efficiency.

A regression analysis for H2 is done without control variables. The ANOVA table shows that $F(1,109) = 0.507, p = 0.478$. Including the control variables shows the following results in the ANOVA table $F(3,106) = 1.143, p = 0.934$. Therefore this regression model is not significant either, centralization does not predict the outcome variable effectiveness. Therefore, H1 and H2 are both rejected.

### Discussion

The intended goal of this study is to find more insights in the relationship between centralization and NPP efficiency and NPP effectiveness. As stated in H1, a positive relationship between centralization and NPP efficiency was expected. On the other hand, as stated in H2, a negative relationship between centralization and NPP effectiveness was expected. In order to test the hypotheses, a regression analysis was performed for both H1 and H2. The result of the regression analysis is that centralization can’t significantly predict NPP efficiency nor NPP effectiveness. Therefore, both hypotheses are rejected. Including the control variables firm age and size did not make the model significant.

The insignificant results might be due to that there is a difference in the type of innovation. The complexity or routiness of innovation projects requires different information processing. Cardinal (2001) mentions that in radical innovation projects were more successful when all team members communicated outside of their team.
Whereas incremental innovation projects were more successful when a single gatekeeper was responsible for external communication. Radical innovation projects benefit from cross-functional teams, whereas cross-functionality creates information overload in incremental innovation projects (Cardinal, 2001). In this study the distinction between radical and incremental innovation is not made. A possible explanation for the reason that centralization can’t predict the outcome variables is because this study does not distinct between radical and incremental innovation.

**Limitations**

The sample size (N=111) was relatively small. A larger sample size could make the research more reliable. Another limitation could be that only Dutch SMEs were interviewed. Next to that, the interviews were mainly conducted by students, some may have underdeveloped interview skills. Which may lower the quality of the data.

**Appendices**

Appendix 1: Items of questionnaire

<table>
<thead>
<tr>
<th>Variable</th>
<th>Items</th>
<th>Scale</th>
</tr>
</thead>
</table>
| **Project performance (related to expectations)** | 1. Product development costs  
2. Product Quality (same anchor as question 1)  
3. Technical performance with respect to specifications (same anchor)  
4. Time to market (same anchor)  
5. Market share (same anchor)  
6. Overall profitability of the product? (same anchor)  
7. Overall commercial success of the product (same anchor) | 1=significantly worse than initial expectations  
2=worse  
3=somewhat worse  
4=about the same  
5=somewhat better  
6=better  
7=significantly better | |
| **Centralization** | * there could be taken little action in the project until a supervisor approved the decision | 1=completely disagree  
2=disagree  
3=somewhat disagree  
4=neutral  
5=somewhat agree |
* a person wanting to make his own decision during the project would have been quickly discouraged
* even small matters had to be referred to someone higher up for a final decision
* project members needed to ask their supervisor before they did almost everything
* most decisions project members made had to have their supervisor’s approval

(adapted from Jansen et al., 2006)

6=agree
7=fully agree.

<table>
<thead>
<tr>
<th>Control Variables</th>
<th>Items</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firm size</td>
<td>What is your firm size (number of people working in the firms (&gt;= 30))?</td>
<td>Number</td>
</tr>
<tr>
<td>Firm age</td>
<td>What is the age of your firm?</td>
<td>Years</td>
</tr>
</tbody>
</table>

References


“bureaucratic” teams can be better learners. *Organization Science, 21*(3), 609-624.


