Operational effectiveness and strategic flexibility: scales for performance assessment of new product development systems

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Abstract: Many firms attribute a central role to their New Product Development (NPD) function, in speeding up time to market, improving product quality, increasing manufacturing efficiency, building core competence and increasing innovative ability, often all within one and the same NPD system. This balancing of short-term operational effectiveness and longer-term strategic flexibility requires accurate insight in NPD performance on both dimensions. This paper reports on the operationalisation of these constructs based on NPD success literature, using a subdivision in product concept effectiveness and NPD process effectiveness. A validation test of the subjective scales shows good reliability results. Preliminary analysis of test results (n = 29) seems to point at firms trying to both exploit and explore by adapting the NPD process, and the building of dynamic capabilities.

Keywords: new product development; operational effectiveness; strategic flexibility; performance assessment.

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1 Introduction

Competing in today's business environment requires companies to continuously create new products, services and processes. For many organisations, creating new products is central in order to adapt to changing environments. Organising and managing New Product Development (NPD) pro-actively requires the continuous balancing of both short- and long-term objectives. NPD systems striving for sustained innovation and longer-term competitive advantage are in the organisation of their innovation efforts confronted with the tensions between today's work and tomorrow's innovation. In this paper, we use the term operational effectiveness to refer to the effectiveness of today's work: the degree to which NPD processes contribute to realising the innovation goals set by the organisation. We use the term strategic flexibility to refer to the readiness to adapt to, anticipate or create future NPD performance requirements (de Weerd-Nederhof, 1998). Operational Effectiveness (OE) and Strategic Flexibility (SF) can thus be seen as two dimensions of NPD performance, reflecting a short-term and a longer-term view, respectively. Given the importance of balancing these two dimensions for sustained innovation, and the complexity of this balancing, which is related to the tensions that result from the contradictory demands on the NPD system, it is very important to be able to assess OE and SF performance adequately. This is necessary for both further theory development as well as for individual cases in practice, where it can be used for a self-assessment, giving input for (re)designing the NPD organisation.

The complexity of organising innovation efforts is directly related to the paradoxical nature of innovation itself. The need to address both exploitation and exploration in order to achieve sustained innovation often creates contradictory demands, imposing upon organisations the challenge of reconciling conflicting requirements (Dougherty, 1996). Capabilities that speed exploitation and efficiency may allow organisations to survive in the short run, but 'they simultaneously dampen the exploration required for longer-term adaptation' (Benner and Tushman, 2003, p.252). Organisational solutions proposed in literature point at the employment of ambidextrous organisational forms and semi- or quasi structures (Brown and Eisenhardt, 1995; O'Reilly and Tushman, 2004;

Schoonhoven and Jellinek, 1990; Van Looy et al., 2005). Dynamic capabilities (Leonard-Barton, 1992; after Teece et al., 1997) are advocated to reflect an organisation's ability to achieve new and innovative forms of competitive advantage. Although these studies make quite strong claims about the benefits of ambidextrous organisational forms and dynamic capabilities, they hardly suggest measures to actually assess the contribution to both short- and long-term innovation performance. In order to be able to value these organisational forms, and to make a comparison with the innovation performance of other forms possible, an adequate quantitative measuring instrument is required.

Within the body of NPD management literature, the assessment of NPD performance is a recurring topic. Lewis (2001) for example, explicitly points at the problems with the measurement and analysis of the success of NPD outcomes. Lewis states that internal measures tend to be efficiency (cost) and effectiveness (speed and resource utilisation) orientated (sometimes with little or no regard to overall financial performance), whereas external measures are commonly derived from whole enterprise performance (Lewis, 2001). Lewis also highlights that the single project 'unit of analysis' dominates most NPD research. Blindenbach-Driessen et al. (2005) in their critical assessment of performance measurement of NPD projects address the vast variety of objective (financial and market performance, project parameters (Cooper and Kleinschmidt 1987; Griffin, 1997; Langerak et al., 2004)) and subjective measures (which leave it up to respondents themselves to define project success). Objective measures are often preferred for their reliability, but they are always accompanied by a time-lag (Kerssens-van Drongelen, 1999), meaning that the performance of NPD in output or financial benefits (e.g. higher sales and profits (Cooper and Kleindschmidt, 1995, Griffin, 1997)) can only be assessed in hindsight. Besides, these measures only capture an overall NPD performance, and do not reveal the possible tensions and trade-offs between partial performance indicators. Song and Parry discuss correlations of subjective scales with objective measures of performance (Song and Parry, 1997b; citing Calantone et al., 1995), and prefer the use of subjective scales because they permit comparisons across firms, on the basis of firms' individual assessment given their particular industries, time horizons, economic conditions and goals. They capture longer-term NPD success in two subjective measures regarding windows of opportunity in terms of new product categories and new market opportunities, thereby partially reflecting strategic flexibility (Song and Parry, 1997a,b). In order to capture the complexities of NPD performance, reflecting the full extent of tensions and trade-offs between partial performance indicators, however, more sophisticated measures are needed.

The research question, which we specifically deal with in this paper is *how to quantitatively assess NPD's operational effectiveness and strategic flexibility*. Through a review of relevant literature, we present our operationalisation of these two NPD performance dimensions, leading to the proposed subjective scales for quantitative measurement of NPD performance, as well as the results of a test of the scales among 29 Dutch NPD managers. The remainder of the paper is organised as follows. We address the theoretical background of our approach to the assessment of NPD performance in terms of operational effectiveness and strategic flexibility in Section 2. Section 3 systematically discusses literature for the purpose of detailed operationalisation, resulting in the scales presented in Appendix A and B. Section 4 reports methodological issues as well as the results of the test in terms of validity and reliability. To conclude, implications for practice and further research will be given.

2 NPD performance measurement

The peculiarities of NPD success and performance assessment is a recurring theme in NPD literature. Most often, NPD performance is measured for product development projects. Blindenbach-Driessen et al. (2005) critically assess performance measurement of NPD projects, which are also valid for our scale construction on the level of the NPD system.

The issue of unreliability of subjective data, mentioned as a concern for example Montoya-Weiss and Calantone (1994) and Brown and Eisenhardt (1995), is addressed in more detail by Blindenbach-Driessen et al. (2005). They first of all stress that informant bias possibly accounts for 30% of the total explained variance (Ernst, 2002) with subjective scales. Research has shown that the type of respondent influences the reliability of the results. Project managers, for example, are better informed about project success, but rarely stick with a project from its start to the market introduction (Ernst, 2002). R&D managers have less insight in project details, but their bird's view enables them to evaluate a project in its context (Hoegl and Gemunden, 2001). The assessment of the OE and SF dimensions of NPD performance should be done on the level of the NPD system, which would indicate that R&D managers should be the preferred type of respondents for our study.

Although the NPD performance literature lacks standard definitions of constructs (Blindenbach-Driessen et al., 2005), many authors make use of the constructs proposed by Brown and Eisenhardt (1995) in their meta review. Brown and Eisenhardt distinguish between 'product concept effectiveness' and 'process performance'. Product concept effectiveness is further subdivided into 'fit with market needs' and 'fit with firm competencies', and process performance in 'leadtime' (speed) and 'productivity'. These constructs do justice to tensions occurring in new product development, such as between the quality or novelty of a product and the speed/throughput time of the process. Pursuing both simultaneously poses conflicting demands upon the organisational structure and (inter)actions for innovation in which NPD projects are being embedded (Van Looy et al., 2002). Within the construct of product concept effectiveness, the combining of fit with market demands and fit with firm competencies reflects the satisfying of often conflicting demands of internal and external 'stakeholders' such as marketing and manufacturing, customers and suppliers (Hart and Baker, 1994). According to de Weerd-Nederhof (1998), process performance comprises not only speed and productivity, but also process flexibility, which refers to the ability to gather and rapidly respond to new knowledge about technical and market information *as a project evolves*, including different combinations of, and balancing between feed-forward and feedback planning, which, as Verganti (1997) claims, may be effectively adopted to integrate the product development process.

In the introduction OE and SF were defined as two 'time' dimensions of NPD performance, in such a way that strategic flexibility is a *prerequisite* for future operational effectiveness (reflecting the short/long-term tension). Therefore, the first step towards operationalisation and constructing the scales is to consider the constructs product concept effectiveness and process performance on both dimensions (see the first two columns of Table 1 below). This means that for the SF scales, the basis is future product concept effectiveness (anticipating market demands and building firm competencies) and future NPD process effectiveness (anticipating time-and productivity constraints, and future needs for process flexibility). In the following section we systematically further develop our subjective scales.

Table 1 Literature used for the operationalisation

		Operational Effectiveness
Product concept effectiveness	Fit with market demands	Customer satisfaction, Timeliness, Product price, Quality (Chiesa et al., 1996)
		Sales and profit impact (de Brentani and Kleinschmidt, 2004)
	Fit with firm competencies	R&D/Manufacturing Integration (Swink, 1999; Yam et al., 2004)
		R&D/Marketing Integration (Leenders and Wierenga, 2002)
Development process effectiveness	Speed	Speed relative to schedule (Kessler and Bierly, 2002)
		Development Time (DT), Concept to Customer Time (CTC), Total Time (TT) (Griffin, 1997)
		The speed and commitment of the NPD decision-making process (Griffin and Page, 1993)
	Productivity/cost	Possibility for lower development budget (Iansiti, 1993)
		Cost relative to budget, competitors (Kessler and Bierly, 2002)
		Engineering hours, cost of materials, cost of tooling (Clark and Wheelwright, 1993)
	NPD process flexibility	Average time and cost of redesign, enhancement (Chiesa et al., 1996; Thonke, 1997)
		The ability to change specs late (Thomke, 1997)
Strategic flexibility		
Future Product concept effectiveness	Anticipating market demands	Product-market options (Johnson et al., 2003)
		Windows of opportunity (de Brentani and Kleinschmidt, 2004)
		Proactive market orientation (Narver et al., 2004)
	Building competencies	Acquisition of resources (Kessler et al., 2000)
		Deployment of resources (integrate, apply knowledge) (Yam et al., 2004)
Future development process effectiveness	Anticipating time constraints	Anticipating Total Time (TT) (Griffin, 1997)
		Anticipating the speed and commitment of the NPD decision-making process (Griffin and Page,1993)
	Anticipating productivity constraints	Anticipating cost relative to budget, competitors (Kessler and Bierly, 2002)
		Anticipating engineering hours, cost of materials, cost of tooling (Clark and Wheelwright, 1993)
	Anticipating on the need for NPD process flexibility	Anticipating average time and cost of redesign (Thomke, 1997)
		Anticipating on changes in specs (Thomke, 1997)

3 Operationalisation of operational effectiveness and strategic flexibility as performance dimensions for NPD

This section describes the operationalisation of OE and SF and the constructs identified in the Section 2. The literature used as the basis for the operationalisation is summarised in Table 1, the resulting scales are included in Appendix A and B.

3.1 Operational effectiveness

3.1.1 Product concept effectiveness

Measuring product concept effectiveness as part of operational effectiveness implies determining the current external and internal alignment of NPD (Brown and Eisenhardt, 1995). According to the review of factors affecting NPD success by Brown and Eisenhard, performance is strongly influenced by four characteristics of a product: unique benefits, quality, cost and a clear product concept. They summarise these variables in the term 'fit with market demands', capturing the more short term fit with extra-organisational context (Brown and Eisenhardt, 1995).

In general, high performance of the NPD function on the short-term – as a consequence of a fit with market demands – should be reflected in higher sales and profits (Cooper and Kleinschmidt, 1995; Griffin, 1997). De Brentani and Kleinschmidt (2004) developed a high reliability scale to measure short term financial performance with NPD managers as respondents. In order to fully capture the unique benefits, quality. cost and product concept factors identified by Brown and Eisenhardt, we added to these measures scales on customer satisfaction, product process, timeliness and quality based on the innovation scorecards developed by Chiesa et al. (1996) as part of their technical innovation audit.

'Fit with firm competencies' is the factor related to intra-organisational fit of the product concept. The need for internal fit is most obvious in the alignment with the marketing and manufacturing functions, the traditional predecessor and successor of the NPD function. We adopted scales for measuring the marketing-NPD interface from Leenders and Wierenga (2002) who used them in their study into the effectiveness of different mechanisms for integrating the marketing and R&D function. For the NPD-manufacturing interface we adopted scales developed by Swink (1999) and Yam et al. (2004). Swink (1999) studied the relationship between manufacturability and integration processes. In Yam et al. (2004) in their research address manufacturing capability, comprising the ability to transform NPD results into products which can be manufactured (which should ultimately lead to cost advantages).

3.1.2 NPD process effectiveness

The *speed* of the NPD process refers to the lead time (Brown and Eisenhardt, 1995), which is related to time to market. Griffin and Page (1993) regard the speed of decision making, and the commitment to these decisions, as measure for the speed of the development process. Kessler and Bierly (2002) define speed as the time elapsed between initial development efforts and the ultimate commercialisation of the product. For the measurement of speed, Griffin split up the NPD process in 5 stages and subsequently defines three forms of cycle time: development time, concept to customer

time and total time. We built the scale for speed by adopting the items about the decision making process and the different levels of speed from Griffin and adopting the item about speed relative to schedule from Kessler and Bierly.

Productivity refers to the use and costs of resources in the NPD process (de Weerd-Nederhof, 1998). According to Clark and Wheelwright (1993), three kinds of costs occur in the NPD process: engineering hours, material costs and costs of tooling. Kessler and Bierly (2002) focus on total cost of the process but they relate it to budget and competitors. Iansiti identifies the possibility to execute the current projects with a lower development budget as measure for productivity. For the purpose of our performance assessment, we split productivity into the cost categories proposed by Clark and Wheelwright and relate these to budget. Furthermore, we relate total cost relative to schedule and competitors based on Kessler and Bierly (2002). Finally, we incorporated an item about the possibility to develop the product with a lower budget than assigned based on Iansiti (1993).

Thomke (1997) operationalises *flexibility* as the incremental cost and time of modifying a design. If cost and time of modifying a design are low, flexibility is high and visa versa. We built the scale for NPD process flexibility at the operational effectiveness dimension by refining the term redesign used by Thomke. Based on the Technological Innovation Audit from Chiesa et al. we distinguish as well product redesign as product enhancement (Chiesa et al., 1996).

3.2 Strategic flexibility

3.2.1 Future product concept effectiveness

Johnson et al. define market focused strategic flexibility as the firm's intent and capabilities to generate firm-specific real options for the configuration and reconfiguration of appreciably superior customer value proposition (Johnson et al., 2003). To become strategically flexible, a firm needs to develop capabilities in

1 the identification of resources

2 the acquisition of resources

3 the deployment of resources

4 the identification of options.

Our construct of *anticipating market demands* then incorporates the identification of options and resources. The essence of strategic flexibility according to Johnson et al. is the creation of a pool of defined opportunities in the environment. The systematic discovery of these opportunities is fostered by the adoption of a proactive market orientation (Narver et al., 2004). In a proactive marketing orientation, businesses anticipate on latent customer needs. The concept of proactive market orientation is operationalised by Narver et al. (2004). In their study towards the impact of corporate culture and commitment on the success of international NPD, Cooper and De Brentani (2004) defined a measurement scale for the success of international NPD programs. One of the dimensions within this scale is 'windows of opportunity'. This again reflects an operationalisation of opportunities in the environment. In sum, we can state that anticipating market needs can be operationalised by the extent to which an organisation adopts a proactive market orientation. As a result of this market orientation, new product

market options should be the result and management should be expected to develop a preference for these projects. Because of the normative character of the scales we found in the above described literature, we could not adopt them as such. We built the scale by formulating statements about these items.

Building competencies is the second construct within future product concept effectiveness to be operationalised. Teece et al. (1997) define the ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments as dynamic capabilities. The dynamic capabilities reflect the organisations ability to achieve new forms of competitive advantage. These new forms of competitive advantage are exactly what a strategically flexible NPD system would aim at: making competitive advantage sustainable through innovation. The dynamic capabilities, as prerequisite for market focused strategic flexibility, reflect for the marketing function in the identification, acquisition and deployment of resources (Johnson et al., 2003). We can translate these marketing capabilities to the NPD function. The identification of resources is necessary to build a portfolio of resources with competitive advantage generation potential and therefore belongs to anticipating on market demands. The acquisition of resources is similar to enhancing the knowledge base of the organisation (Johnson et al., 2003). For NPD, this is about new ideas and new technologies and the link between the two (Kessler et al., 2000). When new resources are acquired they have to be deployed. This is similar to the integration and application of knowledge (Johnson et al., 2003). In sum, building NPD competencies for sustained competitive advantage incorporates the development of dynamic capabilities. These capabilities should be developed in acquiring new technologies and ideas and in passing this knowledge through the organisation. For the assessment of the acquisition of resources, we use Kessler and Bierly's (2002) operationalisation. For our operationalisation of the deployment of resources, we focus on learning capabilities distinguished by Yam et al. (2004).

3.2.2 Future NPD process effectiveness

To measure future NPD process effectiveness, we continue the translation along the time dimension, which means that the organisation should anticipate on the future requirements of time, productivity and flexibility constraints. The anticipation on the constraints is not simply a matter of increasing speed, decreasing cost or increasing flexibility, for this could lead to suboptimalisation. Taken together, the three types of constraints have to meet future requirements and a decrease in speed accompanied by an increase in flexibility can result in better anticipation than increase in speed solely. Because of this, two capabilities are deemed to be important for future NPD process effectiveness. In the first place, management has to be able to estimate the future requirements on the NPD process. Secondly, the organisation must posses the ability to adjust to these requirements (anticipation). In the operationalisation of the constructs we focus on these two aspects.

For the development of the scales, we used largely the same literature base as we used for the measurement of NPD process effectiveness. The items in the scales were translated also along the time dimension. The focus for the operationalisation of *anticipating on time constraints* in this part should be on the future requirements and not on a too detailed level within the process. Therefore, we decided to focus on Total Time in the strategic flexibility dimension. However, the future Total Time of the NPD Process

is still embedded in the decision-making process as described in the section on operational effectiveness (Griffin, 1997). We built the scale by recognising that the measurement of the anticipation on future time constraints is a matter of assessing the awareness about future total time constraints and assessing the speed and commitment of the NPD decision-making process. To operationalise *future productivity requirements,* we regard the costs of the development process relative to the organisation itself as well as to competitors. In our scale, we formulate statements about the ability to estimate these costs relative to the organisation and the competitors and the ability to adjust the process to these requirements. The operationalisation of this ability to adjust is split into the three types of costs identified by Clark and Wheelwright (1993). For the operationalisation of *anticipating on the need for NPD process flexibility,* we formulate statements about the ability to forecast the requirements on as well the time and cost of redesign as the ability to change specs. Secondly we develop items for the assessment of the extent to which the organisation is able to adjust the process to these requirements.

4 Methodological issues and preliminary test results

All scales for the assessment of an NPD system's operational effectiveness and strategic flexibility are built as ordinal scales for which seven-point Likert scales were applied. We chose to label 1 as 'disagree' and 7 as 'agree' instead of 'disagree strongly' and 'agree strongly' to motivate respondents to choose the extremes in the scales. For the purpose of validity and reliability, we also added 'not applicable' options in the scales. This is advised when the possibility exists that the respondent cannot answer the question due to a lack of knowledge or information (Korzilius, 2000). Several items were reverse coded to foster reliability of the scales. We set out to test the scales by asking 29 Dutch NPD managers from a variety of companies from different industries to fill in the questions through a web-based survey design.

In terms of industries, the test sample composition was as follows:

- Manufacture of textiles 27%
- Manufacture of electrical machinery and apparatus 26%
- Manufacture of food products and beverages 9%
- Manufacture of radio, television and communication equipment 9%
- Manufacture of motor vehicles, trailers and semi-trailers 9%
- Manufacture of furniture 5%
- Manufacture of chemicals and chemical products 5%
- Manufacture of medical, precision, and optical instruments, watches and clocks 5%
- Manufacture of other transport equipment 5%

In Table 2, the results of the reliability test on construct level are presented, which indeed look promising. All Cronbach's alpha's are above 0.70 (if 1 item of the 'fit with firm competencies scale is deleted), except 'building competencies', which is 0.66 if one item

is deleted. The overview in Table 3 of results on construct level shows a consistent picture, again all alpha's above 0.70, except 'future product concept effectiveness (which includes 'building competencies').

Table 2 Validity of concepts

Construct	*Cronbach's alpha*	*Number of items*	*Remarks*
Fit with market demands	0.75	7	
Fit with firm competencies	0.64	6	0.72 if item 6 deleted
Speed	0.79	6	
Productivity	0.77	7	
Flexibility	0.71	6	
Anticipating market demands	0.78	6	
Building competencies	0.63	9	0.66 if item 3 deleted
Anticipating time constraints	0.70	6	
Anticipating cost constraints	0.80	7	
Anticipating on the need for NPD process flexibility	0.84	6	

Table 3 Validity of overall constructs

Construct	*Cronbach's alpha*	*Number of items*
Operational NPD effectiveness	0.83	5
Strategic NPD flexibility	0.73	5
Product concept effectiveness	0.73	2
NPD process effectiveness	0.79	3
Future product concept effectiveness	0.60	2
Future NPD process effectiveness	0.77	3

5 Discussion and implications for further research

The sample size of the survey was quite small and we cannot draw any hard conclusions from this data, but nevertheless, it is worthwhile to have a further look at the test results, to discuss what NPD performance assessment with these scales might imply.

To start with, we took a closer look at differences in means and correlations for the different concepts, constructs and dimensions. On the OE dimension, the mean of the product concept effectiveness scores (4.74) was significantly higher than the mean for NPD process effectiveness (3.93). A correlation was found between product concept effectiveness and NPD process effectiveness of 0.570 (0.01 significant 2-tailed). On the SF dimension however, no significant differences between the means of product concept and NPD process effectiveness were found, nor were there any significant correlations. There was no significant difference between the mean scores of the overall OE and SF

dimensions, and the correlation between them was –0.572 (0.002 significant 2-tailed). We did not find a correlation between product concept effectiveness and future product concept effectiveness, but between NPD process effectiveness and future NPD process effectiveness, the correlation was –0.655 (0.000 significant 2-tailed), which might point at the correlation between OE and SF being predominantly caused by NPD process effectiveness.

These results might be interpreted as follows. NPD systems perform well on operational effectiveness because they exploit current firm capabilities by creating distinctive processes (Teece et al., 1997). Also, high OE scores might be seen to correspond with high SF scores because these firms consistently translate the percieved need to improve current NPD process performance to future process performance. It would be interesting to explore whether these firms indeed work on creating (continuous) innovation routines, which suit very well for incremental innovation activities as advocated in continuous improvement literature (Bessant and Francis, 1997). The NPD systems managed by the respondents seem to work predominantly towards building dynamic capabilities (Teece et al., 1997) by adapting the NPD *process*. For more radical innovation strategies, the NPD systems would be expected to have higher scores on anticipating market demands *as well as* building firm competencies. Because of the small number of respondents, these considerations should be seen as examples of the usefulness of the results with these detailed scales, and potentially as hypotheses for further research.

While in terms of reliability of the scales, the test results look promising, we are still aware of the limitations of the use of subjective scales, specifically for use in a large scale multifirm and cross country survey design. Song and Parry (1997) partly dealt with this drawback by collecting objective financial data for a subsample of their data (sales growth rate, average sales growth rate, market share, return on investment and gross margin), which in their case revealed high correlations with their subjective performance items (consistent with Calantone et al., 1995). We aim to follow their example for our own datagathering. Additionally, in our final survey design, we have included a limited number of objective overall company and NPD measures, (a.o. percentages of total annual sales originating from radical and incrementally new products that have been introduced over the last 3 years). Thus we hope to be able to link the scores in terms of both OE and SF to innovation output in financial terms, thus strengthening the reliability of the scales.

The proposed scales for measuring NPD performance in terms of operational effectiveness and strategic flexibility form a basis for the study of effective NPD systems. Further research should make it possible to link strategic and structural choices to performance on several dimensions, thus identifying heuristics for the design of effective NPD configurations, both in general as within specific national and industrial contexts. This will provide practitioners, who often have to rely upon speculation, anecdotic evidence, and idiosyncratic experience, with an empirical foundation for the construction of an innovative organisation.

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Appendix A

Current performance

This section will determine the short-term performance of your NPD function.

Fit with market demands

To what extent do you agree with the next statements, please circle the right answer (1 = disagree, 7 = agree, n/a = not applicable).

	Disagree						*Agree*	
1. Our new products perform the functions the customer requires	1	2	3	4	5	6	7	n/a
2. Relative to our goals, our new products enter the market on time	1	2	3	4	5	6	7	n/a
3. The price of our new products is satisfactory for the customer	1	2	3	4	5	6	7	n/a
4. The customer considers the quality of our products as good	1	2	3	4	5	6	7	n/a
5. Relative to our goals, we have a high percentage of product returns and customer complaints	1	2	3	4	5	6	7	n/a
6. The impact of our NPD program on our organisation's sales level is positive	1	2	3	4	5	6	7	n/a
7. We get good returns from our NPD program relative to our spending on it	1	2	3	4	5	6	7	n/a

Fit with firm competencies

To what extent do you agree with the next statements, please circle the right answer (1 = disagree, 7 = agree, n/a = not applicable).

	Disagree						*Agree*	
1. The degree of manufacturing cost advantage that NPD provides is satisfactory	1	2	3	4	5	6	7	n/a
2. Few manufacturing problems occur during production start-up phases	1	2	3	4	5	6	7	n/a
3. Many product design changes are needed to solve problems in production	1	2	3	4	5	6	7	n/a
4. Marketing and NPD often fail to share information with each other	1	2	3	4	5	6	7	n/a
5. Marketing and NPD are blaming each other for failures	1	2	3	4	5	6	7	n/a
6. Conflicts between marketing and NPD are of a constructive kind	1	2	3	4	5	6	7	n/a

Speed of your NPD process

First take a look at this picture and try to understand the concepts of Development Time, Concept To Customer time and Total Time.

Stage	*0*	*1*	*2*	*3*	*4*
Name	Concept generation	Project evaluation	Development	Manufacturing development	Commercialisation
Starting activity	Surfacing of idea	Developing of specs	Spending on physical development	Documentation of process development	Production trials (End: manufacturing for sales)
			Development Time		
		Concept To Customer time			
			Total Time		

Now please indicate to what extent you agree with the next statements, please circle the right answer (1 = disagree, 7 = agree, n/a = not applicable).

	Disagree						*Agree*	
1. Our new products are launched on schedule	1	2	3	4	5	6	7	n/a
2. The scheduled time is shorter than necessary	1	2	3	4	5	6	7	n/a
3. Our Development Time (DT) is satisfactory	1	2	3	4	5	6	7	n/a
4. Our Concept to Customer Time (CTC) is satisfactory	1	2	3	4	5	6	7	n/a
5. Our Total Time (TT) is satisfactory	1	2	3	4	5	6	7	n/a
6. The speed of the NPD decision making process is satisfactory	1	2	3	4	5	6	7	n/a

Productivity

To what extent do you agree with the next statements, please circle the right answer (1 = disagree, 7 = agree, n/a = not applicable).

	Disagree						*Agree*	
1. We are able to develop the same products with a lower budget than assigned	1	2	3	4	5	6	7	n/a
2. The development costs of our products exceed budgets often	1	2	3	4	5	6	7	n/a
3. The beyond-budget products exceed budgets with a large amount	1	2	3	4	5	6	7	n/a
4. Our development costs are lower than competitors' development costs	1	2	3	4	5	6	7	n/a
5. Realised development hours often exceed budgeted hours	1	2	3	4	5	6	7	n/a
6. Realised material cost often exceed budgeted material costs	1	2	3	4	5	6	7	n/a
7. Realised tooling costs often exceed budgeted tooling costs	1	2	3	4	5	6	7	n/a

Flexibility

To what extent do you agree with the next statements, please circle the right answer (1 = disagree, 7 = agree, n/a = not applicable).

	Disagree					*Agree*		
1. The average time of product enhancement is satisfactory	1	2	3	4	5	6	7	n/a
2. The average time of product redesign is satisfactory	1	2	3	4	5	6	7	n/a
3. Our ability to change the design fast, after being confronted with new specs, is badly developed	1	2	3	4	5	6	7	n/a
4. The average cost of redesign is satisfactory	1	2	3	4	5	6	7	n/a
5. We can only process a change of specs with a lot of extra financial resources	1	2	3	4	5	6	7	n/a
6. Our ability to change specs late is satisfactory	1	2	3	4	5	6	7	n/a

Appendix B

Future performance

This section determines your long-term NPD performance.

Anticipating market demands

To what extent do you agree with the next statements, please circle the right answer (1 = disagree, 7 = agree, n/a = not applicable).

	Disagree					*Agree*		
1. Our current development projects include new product-market options	1	2	3	4	5	6	7	n/a
2. We prefer projects that generate options for future product development	1	2	3	4	5	6	7	n/a
3. Our NPD function is successful in opening new markets to our organisation	1	2	3	4	5	6	7	n/a
4. Our NPD function is successful in leading our organisation into new product areas	1	2	3	4	5	6	7	n/a
5. Our NPD activities open new technologies to our organisation	1	2	3	4	5	6	7	n/a
6. We incorporate solutions to unarticulated customer needs in our new products	1	2	3	4	5	6	7	n/a

Building competencies

To what extent do you agree with the next statements, please circle the right answer (1 = disagree, 7 = agree, n/a = not applicable).

	Disagree						*Agree*	
1. Our competence to develop new ideas from inside the organisation is developed weakly	1	2	3	4	5	6	7	n/a
2. We are able to enhance our creative competences with ideas from external sources	1	2	3	4	5	6	7	n/a
3. Our competence to explore new technological developments from inside the organisation is developed strongly	1	2	3	4	5	6	7	n/a
4. We are not able to enhance our technological competences with technological developments from external sources	1	2	3	4	5	6	7	n/a
5. We are able to learn from previous experiences	1	2	3	4	5	6	7	n/a
6. Our NPD function has the capability to pass the lessons learnt across organisational boundaries	1	2	3	4	5	6	7	n/a
7. Our NPD function has the capability to pass the lessons learnt across time	1	2	3	4	5	6	7	n/a
8. We are not investing enough on the learning readiness of the NPD function	1	2	3	4	5	6	7	n/a
9. We are able to make tacit knowledge explicit	1	2	3	4	5	6	7	n/a

Anticipating time constraints

To what extent do you agree with the next statements, please circle the right answer (1 = disagree, 7 = agree, n/a = not applicable).

	Disagree						*Agree*	
1. We can estimate the future requirements on our total development time	1	2	3	4	5	6	7	n/a
2. We are able to adjust our development process to the future time requirements	1	2	3	4	5	6	7	n/a
3. We cannot estimate the future requirements on the speed of our NPD decision-making process	1	2	3	4	5	6	7	n/a
4. We aren't able to adjust our NPD decision making process to the future requirements	1	2	3	4	5	6	7	n/a
5. We are able to forecast the future requirements on the commitment to translating our NPD decisions into actions	1	2	3	4	5	6	7	n/a
6. We are able to adjust the commitment to translating NPD decisions into actions to the requirements	1	2	3	4	5	6	7	n/a

Anticipating cost constraints

To what extent do you agree with the next statements, please circle the right answer (1 = disagree, 7 = agree, n/a = not applicable).

	Disagree					*Agree*		
1. We cannot estimate the future internal requirements on the total costs of our development process	1	2	3	4	5	6	7	n/a
2. We are not able to adjust our development process to the future cost requirements	1	2	3	4	5	6	7	n/a
3. Our ability to predict future development costs relative to competitors is well developed	1	2	3	4	5	6	7	n/a
4. We are more capable to adjust the development costs than competitors	1	2	3	4	5	6	7	n/a
5. We are able to adjust the number of development hours to future requirements	1	2	3	4	5	6	7	n/a
6. We are not able to adjust tooling costs to future requirements	1	2	3	4	5	6	7	n/a
7. We are not able to adjust material costs to future requirements	1	2	3	4	5	6	7	n/a

Anticipating the need for future NPD process flexibility

To what extent do you agree with the next statements, please circle the right answer (1 = disagree, 7 = agree, n/a = not applicable).

	Disagree					*Agree*		
1. We are able to forecast the requirements on the time of redesign	1	2	3	4	5	6	7	n/a
2. We are able to adjust the average time of product redesign to future requirements	1	2	3	4	5	6	7	n/a
3. We are capable in forecasting the future requirements on the cost of product redesign	1	2	3	4	5	6	7	n/a
4. We are capable to adjust the average cost of product redesign to future requirements	1	2	3	4	5	6	7	n/a
5. We are able to predict changes in specifications	1	2	3	4	5	6	7	n/a
6. We are able to anticipate on changes in specifications	1	2	3	4	5	6	7	n/a