# An Empirical Exploration of the Antecedents and Outcomes

## of NPD Portfolio Success

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### Abstract

The manuscript first combines theory and previous empirical findings to build a model of new product development portfolio success. Because relationships between product development portfolio decision-making effectiveness, portfolio success and firm-level success have not previously been investigated, we generate propositions that the relationships in general exist (rather than directional hypotheses) and then test those relationships with empirical data. Data from 378 paired dyads in 189 Dutch firms were used to test the initial general model, and then explored further to produce a final structural equation model of these relationships with good fit statistics.

Several unexpected findings arise, with important implications both for theory and practice. For example, portfolio balance, one recommended measure of portfolio success (Cooper et al. 2001) has no direct link to market performance, but operates strictly through the other two dimensions of portfolio success, strategic alignment and maximal value. In addition, we find that all three dimensions of portfolio decision-making effectiveness are associated with achieving portfolio success, which in turn influences market performance. No one dimension of decision-making effectiveness or portfolio success is sufficient to achieve market performance.

### Introduction

In order to successfully compete in the market place, firms can no longer afford to make new

product development (NPD) decisions on a project-by-project basis. Therefore, best practice

firms are increasingly moving from managing projects individually to making decisions for the

complete NPD portfolio (Cooper et al., 1999; Hauser et al., 2006; Chao and Kavadias, 2008).

The firm's NPD portfolio is the embodiment of their strategy (Eisenhardt and Zbaracki, 1992). To survive in the long run, firms may need to radically refocus their NPD portfolio resource allocations as technology capabilities and competitor offerings change. However, while effectively managing the NPD portfolio is critical for business success doing so is difficult and little is known about how successful NPD portfolio management can improve overall performance. Despite regular calls in the literature for more research (Cooper et al., 2001; Hauser et al., 2006), what successful NPD portfolio management means and how firms can achieve this remains unclear. Furthermore, while most of the portfolio management literature has focused on optimal portfolio configuration, research has not linked these insights to how firms actually make (effective) NPD portfolio decisions.

This research addresses this gap by empirically investigating the relationships between portfolio management and market performance. Specifically, we propose that NPD portfolio success is an outcome of a firm's effectiveness in NPD portfolio decision-making, and that NPD portfolio success positively contributes to market performance, and test these relationships emprically. In doing so, we provide two major contributions to the literature.

First, we develop, operationalize, and validate scales for NPD portfolio success as conceptually defined by Cooper et al. (1999; 2001), and for portfolio decision-making effectiveness as defined by Kester et al. (2011). Second, we develop and empirically test a model of NPD portfolio success that helps us understand how firms may improve market performance through effective NPD portfolio management.

#### Literature review and proposition development

NPD portfolio management is: "a dynamic decision process whereby a business' list of active

projects is constantly updated and revised. In this process, new projects are evaluated, selected and prioritized; existing projects may be accelerated, killed, or deprioritized; and resources are allocated and reallocated to active projects" (Cooper et al., 1999, p. 335). This section first reviews the extant literature on NPD portfolio configuration and success and develops propositions to relate NPD portfolio success to market performance. Next, we discuss three outcomes of portfolio decision-making processes (see Kester et al., 2011) and introduce propositions that relate these antecedents to NPD portfolio success.

#### **NPD** portfolio success

The most significant empirical research investigating new product portfolio management was conducted by Cooper and his colleagues (1999, 2000, 2001, and 2004). The main purpose of this descriptive research was to benchmark current practices for project selection and prioritization methods and develop an initial understanding of the results achieved with different NPD portfolio evaluation methods. Their most important findings were the conceptual identification of three characteristics of successful portfolios:

- *Strategic alignment:* the portfolio composition reflects the firm's strategic business priorities;
- Balance: the NPD portfolio is harmonious with respect to specific parameters, such as the different types of projects and their risk/ reward characteristics; and
- *Maximal portfolio value:* an optimal ratio between resource input and return.

Strategic alignment is the extent to which the NPD portfolio will deliver against the strategic aspirations of the firm (Cooper 2001). Each project in the portfolio should individually support the firm's articulated strategy. Additionally, a strategically aligned portfolio is one in which the breakdown in spending across all projects reflects the importance of each market or technology area in achieving the firm's strategic goals.

Cooper et al. (2001; 2004) used only single item measures for the first and the last dimension in analyzing strategic alignment in their survey. The self-rated best performing firms more often indicated that their projects were individually in line with the firm's strategy (best: 65.5% versus average: 57.2%, and worst: 46.2%), and that their overall resource allocations reflected their business strategy (best: 65.5%, versus average: 30.7%, and worst: 8.0%) (Cooper et al., 2001, 2004). Although these findings suggest a positive relationship between strategic alignment and NPD performance, no statistically significant evidence of such a relationship is provided, nor was a scale for the overall 'strategic alignment' construct developed or validated. Several studies in related domains also suggest that strategically aligned portfolios may lead to improved (new product or firm) performance (Chesbrough, 2002; Lin and Lee, 2011). Although these findings suggest that a strategically aligned NPD portfolio may contribute to achieving enhanced firm performance, no empirical evidence for such a relationship exists.

A balanced NPD portfolio is one with an optimal spread in individual NPD project risk, and has right number of projects for the available resources. NPD portfolio risk/reward most typically is evaluated based on product newness and the technical and/or market risks versus expected financial rewards for the individual project. Other portfolio balance indicators are: innovativeness (Jansen et al., 2006); market diversification (Cooper et al. 2001, Eggers, 2006; Lin and Lee, 2011); short- versus long-term project ratio (Cooper et al., 2001; Chesbrough, 2002), and project distribution across the various NPD stages (Cooper et al., 2001).

Several studies explicitly have investigated portfolio diversification, one aspect of NPD portfolio balance in various domains (Bordley, 2003; Grewal et al., 2008). Taken together, these exploratory studies suggest that the relationship between portfolio diversification and performance may be characterized by an inverted U-shape: too much diversification may lead to a lack of focus and too little diversification may increase portfolio risk. Although these findings suggest that some aspects of NPD portfolio balance may be related to firm performance, they do

not fully conceptually investigate how NPD portfolio balance may influence firm performance.

In essence, maximal NPD portfolio value refers to the ratio between resource input (efficiency) and value output (effectiveness), in relationship to a business objective of the firm such as return on investment (Cooper et al., 2001). The optimal portfolio composition in terms of value differs by firm and depends on its strategic objectives. A firm aiming for market leadership in a highly innovative market may need to allocate a large proportion of their resources to high impact, high risk projects. In contrast, a firm striving for low cost leadership in a mature market may achieve maximal value if their NPD portfolio reflects lean investment decisions in incremental product improvements with a higher cost/reward ratio. In general, maximal value is defined strictly in terms of monetary value (Cooper et al., 2001; Lin and Lee, 2011).

Unfortunately, the NPD literature provides little insight explaining maximal NPD portfolio value or how firms can achieve it. Several exploratory empirical studies do suggest that maximal NPD portfolio value may contribute to achieving new product or firm performance (Cooper et al., 2004; Voss et al., 2006. However, how best to measure maximal portfolio value and precisely how it influences a firm's performance is still unclear.

To conclude, research has posited, but not tested, that firms who achieve successful NPD portfolios as defined by Cooper et al. (1999; 2001; 2004) will have higher performance. However, a direct relationship between the dimensions of NPD portfolio success and firm performance has not been established. Nor has the extant literature proposed how each of the three success dimensions leads to firm performance. Therefore, we explore these potential relationships as propositions:

P1: Successful portfolios (Cooper et al., 2001) enhance market performance:

- a) A strategically aligned NPD portfolio positively effects market performance;
- b) A balanced NPD portfolio positively effects market performance;
- c) A NPD portfolio that has been developed to deliver maximal value positively effects

#### market performance.

### Portfolio decision-making effectiveness

Previous research posited that the NPD portfolio composition results from how a firm makes portfolio decisions (Hauser et al., 2006). Kester et al. (2011) found that firms strive to achieve three organizational objectives in making effective portfolio decisions: they make these decisions from a portfolio mindset; keep their short-term development efforts focused on those projects that achieve their long-term goals and are agile in how they make and implement decisions. Furthermore, they found that the most effective firms in NPD portfolio decision-making achieve all three dimensions simultaneously. They also suggest that portfolio decision-making effectiveness is an antecedent to achieving successful NPD portfolios as defined by Cooper et al. (1999; 2001). We thus propose that portfolio decision-making effectiveness is an antecedent to achieving NPD portfolio success:

**P2:** Portfolio decision-making effectiveness is positively associated with a firm's ability to develop successful NPD portfolios. Specifically, firms:

- a) Making decisions from a portfolio mindset develop more successful NPD portfolios;
- b) Focused in their decision-making develop more successful NPD portfolios; and
- c) Agile in making portfolio decisions develop more successful NPD portfolios.

Figure 1 presents the relationships proposed above.

Insert Figure 1

### Methodology

This research used a multiple informant survey to empirically explore and test the NPD portfolio

success model.

### Sample and data collection

Because NPD portfolio decisions are made at the Strategic Business Unit level (Cooper et al.,

2001), that is the unit of analysis. The sample was sourced from the REACH commercial

database in the Netherlands and included a broad range of manufacturing and service industries for which it was expected that firms regularly initiated innovation activities. SBUs appropriate to this research from the overall list were identified through visiting firms' websites to determine their NPD activity levels. This procedure resulted in a potential sample of N = 338 firms.

Common method bias can cause a divergence between observed and true relationships between constructs (Podsakoff et al., 2003). Using multiple informants with different perspectives enhances convergent validity of the measurement instrument (Van Bruggen et al., 2002). Data were thus collected from two informants in each firm:

- 1. Senior managers with NPD portfolio decision-making responsibility and authority;
- 2. Middle managers with no portfolio decision-making authority, but who provided inputs to senior managers for making the portfolio decisions.

The research used a carefully designed data collection strategy to identify and approach informants at each firm. Starting from the contacts in the REACH database, we used a snowball technique to identify appropriate informants in each firm. Phone conversations with each potential informant determined the person's knowledge about their firm's NPD portfolio management, and if they had either portfolio decision authority or provided inputs to portfolio decisions. Once one informant was identified in the firm, we used them to identify a second informant. We promised each informant a PowerPoint presentation and an invitation to a seminar at which we would present the results. Eventually,120 managers attended the seminar.

Of the 450 informants who agreed to participate in the research, 399 informants (87%) from 205 companies (76%) completed the questionnaire<sup>1</sup>. The final dyadic sample was composed of 378 informants from 189 firms. Table 1 provides sample demographics. Table 2 overviews the informants' characteristics.

<sup>&</sup>lt;sup>1</sup> This high response rate was achieved through the personally repeated contacts doggedly made by the lead author with each of the potential respondents identified.

Insert Tables 1 and 2

We assessed non-response bias by comparing early and late respondents. T-tests between early (response within seven days) and late (response after three weeks) respondents showed no significant differences on any of the model's variables. To assess informant bias, tests of significant differences were done between the answers provided by the portfolio decision authority managers and those providing inputs to portfolio decisions. Except for agility-speed (p< 0.5) there were no significant differences (p > .05). There were no potential informant biases related to the industries in which the firms operated (p > .05).

#### Measure development

Multi-item reflective scales were used to measure the constructs in the model. Existing scales from the literature were adapted to measure market performance. New scales were generated for the characteristics of NPD portfolio success as defined by Cooper et al. (1999; 2001; 2004) and for the dimensions of portfolio decision-making effectiveness as defined by Kester et al. (2011).

The survey was fielded in English, as we had screened for fluency. Following Narver and Slater (1990), the construct items were first pretested with 8 senior academics and 10 senior managers, all knowledgeable in NPD, to assess face and content validity. We used this feedback to revise the survey instrument and to ensure clarity and appropriateness of the items. We next conducted a pilot study with 67 members of the Product Development and Management Association's (PDMA) membership in the Netherlands to assess the underlying structure for the items of each scale. Exploratory Factor Analysis (EFA) extracted only one factor for each construct with an eigenvalue > 1.0. All scales showed acceptable reliability ( $\alpha$  > .70; Nunally (1978)) and the factor loadings were larger than .60 (Hair et al., 2005).

We used three scales from Vorhies and Morgan (2005) to measure different dimensions of market performance: customer satisfaction ( $\alpha = .82$ ); market effectiveness ( $\alpha = .82$ ); and profit ( $\alpha = .90$ ). As no measurement scales exist, we used the Cooper et al. (2001, 2004) definitions to define appropriate items for each dimension of NPD portfolio success. Strategic alignment ( $\alpha = .88$ ) and NPD portfolio balance ( $\alpha = .82$ ) were both measured using five items. The 4-item measurement scale for maximal portfolio value ( $\alpha = .78$ ) emphasized monetary value rather than strategic or brand value, also as suggested by Cooper et al. (2001).

Portfolio decision-making effectiveness was operationalized from the rich case study data from Kester et al. (2011). Portfolio mindset ( $\alpha = .79$ ) used five items that reflect the degree to which the firm has a complete overview of their NPD portfolio as well as in-depth knowledge about each individual project, and how these relate to the overall portfolio. Focused effort ( $\alpha =$ .80) used five items that assess the extent to which the firm's (long-term) objectives are reflected in their NPD portfolio priorities. Five items relating to a firm's ability to be fast and flexible in making and implementing NPD portfolio decisions examined a firm's agility ( $\alpha = .74$ ) in NPD portfolio decision-making. Final scales and their properties can be found in Appendix 1.

#### **Reliability and validity of measures**

Confirmatory factor analysis (CFA) with LISREL 8.72 was used to analyze scale reliability and validity. The measurement model showed an acceptable fit ( $\chi^2$  [d.f.] = 1182 [601], root mean square error of approximation (RMSEA) = .05 (90% confidence interval = .05 - .06), non-normed fit index (NNFI) = .97, comparative fit index (CFI) = .97, and goodness of fit index (GFI) = .86). The standardized factor loadings of each item on exceeded .50 (Hair et al., 2005), with the exception of agility. Two items loaded on agility at .46 and .49. Further investigation with EFA indicated that agility consists of two components: flexibility and speed. A CFA with

both components did not, however, significantly improve the model's fit indices. Thus, we treat agility as a second order construct.

Each construct exceeded the reliability threshold of .70 for Cronbach's α (Nunally, 1978) and .70 for composite reliability (Fornell and Larcker, 1981). The average variance extracted (AVE) estimates for each construct were larger than .50 (Fornell and Larcker, 1981). When we compared the squared correlation between each two scales with the AVE for each, AVE was systematically greater than the squared correlations, demonstrating discriminant validity (Fornell and Larcker, 1981). These tests satisfy the conditions for convergent and discriminant validity.

Insert Table 3 here

### Dealing with multi-informant data

Multi-informant data can be used to investigate potential effects of common method bias using additional statistical analyses (Podsakoff et al., 2003). They also may be used to create an aggregated data sample, in which the potential effects of common method bias are reduced (Van Bruggen et al., 2002). We used both approaches.

First, Harman's single factor test with EFA with an unrotated factor solution found that the variables loaded on nine factors with the first factor accounting for 25.8% of the variance. This suggests that – on a measurement level - common method bias may not be a serious problem (Podsakoff et al., 2003). Additionally, a one factor CFA model of all of the variables had a very poor fit, also indicating that common method bias may not have a major influence on the data.

Next, we compared two sets of measurement models: one in which the parameters for both groups were freely estimated; and one in which the parameters were set equal for both groups. Chi-square difference tests between the models were non-significant, except for portfolio decision-making effectiveness, p = .03, which suggests that there are no significant differences

in factor loadings, variance, and covariance. The observed means between the two groups are comparable. Further examination showed that the significant difference in chi-square was caused solely by a mean difference for agility-speed: managers who have portfolio decision-making authority scored their firm higher on portfolio decision agility-speed than managers who provide inputs to portfolio decisions.

Taken together, these results indicate that common method bias may not be a major problem in the data. However, scholars still recommend using responses from different informants for the dependent and independent variables (Van Bruggen, et al., 2002; Podsakoff et al., 2003). Therefore, created the final aggregated from multiple informant responses.

We used the response data from the senior managers to assess market performance. The aggregated sample for the portfolio variables (portfolio decision-making effectiveness, and portfolio success) followed Van Bruggen, et al. (2002) by creating weighted means. The responses of the senior and middle level managers were weighted based on their experience with portfolio decision-making (Table 2).

### Limitations

This study has several limitations that should be taken into account when interpreting the findings. First, the study used data from a sample of firms in the Netherlands, which may limit the generalizability of the findings. Second, although objective market performance measures would have been more desirable, we were not able to collect such information. Third, the study used cross-sectional data from a sample of firms representing several different industries. Although we tested for potential industry bias and found no significant differences, it still is possible that industry composition may have influenced the results.

### Results

We used LISREL 8.72 to test the proposed NPD portfolio success model. The direct effects model, where each of the effectiveness dimensions was related to each of the NPD portfolio success variables, and in which each of the NPD portfolio success variables was related to market performance had a poor fit ( $\chi^2$  [d.f.] = 93 [12], p < .001, RMSEA = .19, NNFI = .74, CFI = .91, and GFI = .90). Following Vorhies and Morgan (2005), we estimated market performance factors.

In analyses using multiple regression, including independent variables in the equation which ultimately do not exhibit statistical significance does not negatively impact the fit statistics for the final equation estimated. However, in structural equation modeling, fit statistics are negatively impacted both by including paths in the equation that are not significant as well as not including paths that would be significant. We thus next explored the path structure to determine which of the paths were and were not significant, and thus, which propositions are supported, as no one previously has empirically investigated the relationships we investigate.

Multiple regression analysis found that *NPD portfolio balance* has no association with any of the market performance variables and *strategic alignment* has no association with market effectiveness or profit. Further investigation of balance revealed significant associations with customer satisfaction ( $\beta = .29$ , p < .001) and market effectiveness ( $\beta = .17$ , p < .05), when strategic alignment and maximal portfolio value are not included in the regression. This suggests that balance's effect of on market performance may be fully mediated by these variables. Using Baron and Kenny's (1986) procedure, we indeed found that balance is an antecedent to strategic alignment ( $\beta = .56$ , p < .001) and maximal value ( $\beta = .53$ , p < .001), and that the effect of balance on customer satisfaction and market effectiveness is fully mediated by strategic

alignment and maximal value. This finding suggests that firms first need to assure that their portfolio is balanced before they can achieve strategic alignment and maximal value.

Finally, the regression analyses also showed that focused effort did not have a significant effect on developing an NPD portfolio that delivers maximal value.

We built the final SEM model (Figure 2) which included balance as an antecedent to strategic alignment and maximal value and deleted the paths from strategic alignment to market effectiveness and profit and from focus to maximal NPD portfolio value. This model had a good fit ( $\chi^2$  [d.f.] = 26.35 [15], p = .035, RMSEA = .06, NNFI = .97, CFI = .99, and GFI = .97).

Insert Figure 2

### Discussion

Previous research posited that NPD portfolio success leads to enhanced firm performance (Cooper et al., 1999, 2001; Chao and Kavadias, 2008). This study provides empirical support for this assumption, but also finds that the relationship between NPD portfolio success and market performance is more nuanced than previously assumed.

One major new finding is that achieving NPD portfolio balance may be a prerequisite for developing a portfolio that is in line with the firm's strategy and that delivers maximal value. This finding is important, as it implies that firms first may have to improve their NPD portfolio balance, before they may be able to improve market performance through NPD portfolio success. Thus, firms need to critically analyze the extent to which their NPD portfolio has the right number of projects for the available resources, is balanced in terms of radical and incremental projects, and has a balanced spread of projects across the markets that they intend to serve. Further, it is also important that a firm's NPD portfolio represents projects that are in various stages of development, and that the portfolio is balanced to mitigate risks across the projects in the portfolio. If a firm's NPD portfolio is not sufficiently balanced, they may have difficulty achieving strategic and financial portfolio objectives.

Our findings also show that the three characteristics of NPD portfolio success each play different roles in helping firms achieve better market performance. Therefore, firms may want to emphasize different aspects of their NPD portfolio, depending on the outcomes they want to achieve. For example, firms that want to improve overall customer satisfaction may want to critically evaluate the extent to which their NPD portfolio is in line with strategy. A disconnect between the firm's strategy ("what they say they do") and their NPD portfolio ("what they actually do") can lead to incoherent messages being conveyed to customers and thus lower overall satisfaction. On the other hand, firms that need to improve their performance in terms of profit or market effectiveness may want to focus on enhancing the overall value of their NPD portfolio by implementing high impact projects that provide a source of revenue in the short and long run and provide platform or spin-off opportunities.

However, we not only investigated if and how NPD portfolio success can help firms improve performance; we also investigated to what extent a firm's NPD portfolio configuration relates to decision-making process effectiveness. Our findings have several implications.

First, our findings indicate that focused effort in decision-making (i.e., being able to set clear development priorities) is essential to prevent portfolio overload and develop a balanced NPD portfolio. However, setting clear development priorities alone is not sufficient to prevent overload and assure a well-balanced spread of projects in the portfolio. Our results suggest that firms who are fast and flexible in making and implementing portfolio decisions may be more capable of quickly eliminating those projects that are no longer interesting in light of a changing

market environment. Hence, agility can help free up resources in the portfolio, which contributes to achieving NPD portfolio balance. Firms who also make portfolio decisions from a portfolio mindset have both an overview and in-depth knowledge of the individual projects, which helps them understand how to mitigate risks across the portfolio. Hence, our findings suggest that even though focused effort represents the most important antecedent to achieving portfolio balance, firms who are strong on all three dimensions of portfolio decision-making effectiveness are more likely to develop balanced NPD portfolios.

Second, firms who make decisions from a portfolio mindset combine detailed project knowledge with an overall portfolio perspective, which enables them to align the entire portfolio to their strategic goals. Not only do they understand how projects complement each other in achieving the strategic objectives, they also understand where the strategic gaps are in their portfolio. Firms who are then also strong in making portfolio decisions with focused effort are capable of assigning resources to those projects that will fill the gaps and contribute to achieve long-term strategic goals. Finally, agility helps to quickly respond to strategic opportunities in the market and incorporate projects in the portfolio that reflect those opportunities. Thus, all three dimensions of portfolio decision-making effectiveness need to be considered to achieve a strategically aligned NPD portfolio.

Finally, the combination of a portfolio mindset and agility helps firms to develop NPD portfolios that deliver maximal value. While agility helps to quickly anticipate market changes and incorporate projects reflecting emerging opportunities, a portfolio mindset helps firms understand how the portfolio should be configured to achieve maximal value for the firm. Having a continuous overview also means that the firm is able to detect potential high value projects in the portfolio that otherwise would be overlooked.

To conclude, this research empirically demonstrates the importance of effective portfolio decision-making processes for achieving NPD portfolio success and thus superior market performance. As such, our study both enhances the theoretical understanding of NPD portfolio management and helps improve managerial practice. The NPD portfolio success model shows managers how they can improve their market performance through NPD portfolio management and which actions may be taken to achieve more successful portfolios.

However, the results also open up several opportunities for future research. While previous portfolio management research has predominantly focused on specialized industries, such as pharmaceuticals, automotive, and theater, our findings are based on a more general population of firms specifically focused on NPD. Therefore, it could be interesting to investigate whether some aspects of portfolio decision-making effectiveness and NPD portfolio success may be more or less important in specific industries. Future research also may want to investigate whether our findings hold for other types of portfolios, such as new venture portfolios or alliance portfolios. More research is needed to confirm these findings in different settings, while extending the model by identifying additional antecedents to effective NPD portfolio decision-making and potential contingency variables.

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## **Tables and Figures**

### Table 1. Firm sample characteristics

Industry	Indu N	stry %	% sales from new products	% profit from new products	R&D spending (% of sales)
Construction & Installation products	80	21%	42%	41%	5.6%
Machinery & Electronics	64	17%	52%	55%	6.7%
Consumer packaged goods	44	11%	38%	39%	6.8%
Chemical products	37	10%	38%	39%	5.3%
Durables	30	8%	60%	64%	7.4%
Food ingredients & agriculture	27	8%	34%	38%	7.3%
Transport, storage, and communication products	24	6%	61%	57%	3.5%
Services (financial, IT and other)	23	6%	48%	44%	5.4%
Pharmaceutical & medical devices	36	10%	58%	57%	5.9%
Utilities	13	3%	35%	32%	5.8%
Average			47%	47%	6%
Total	378	100%			

### Table 2. Informant characteristics

	Senior managers	Middle managers	Average
Years of portfolio decision experience	$6.8 (\sigma = 5.3)$	$6.1 (\sigma = 5.0)$	$6.5 (\sigma = 5.2)$
Years of NPD experience	$10.7 (\sigma = 8.4)$	9.6 ( $\sigma = 8.4$ )	$10.1 (\sigma = 6.6)$
Years of work experience	19.0 ( $\sigma = 8.3$ )	18.1 ( $\sigma = 8.0$ )	$18.6 (\sigma = 8.2)$
Years with firm	11.3 ( $\sigma = 8.6$ )	$10.5 (\sigma = 8.4)$	$10.9 (\sigma = 8.5)$
Function:			
Marketing & sales	35%	42%	39%
R&D	32%	42%	37%
General management	33%	16%	25%

### Table 3. Correlation matrix and Cronbach's alpha (\*\* p < .01; \* p < .05)

		1	2	3	4	5	6	7	8	9
1.	Customer satisfaction	0.82								
2.	Market effectiveness	.56**	0.82							
3.	Profit	.29**	.56**	0.90						
4.	Strategic alignment	.37**	.25**	.14	0.88					
5.	Balance	.29**	.17*	.14	.56**	0.82				
6.	Maximal value	.40**	.33**	.23**	.56**	.53**	0.78			
7.	Portfolio mindset	.16*	.07	.01	.55**	.43**	.41**	0.80		
8.	Focus	.16*	.09	.09	.56**	.49**	.40**	.67**	0.80	
9.	Agility	.42**	.29**	.13	.33**	.32**	.36**	.22**	.23**	.74
MF	EAN	5.40	5.14	4.94	5.26	4.31	4.73	5.11	4.49	4.75
S.D	).	.89	1.00	1.13	.79	.82	.81	.83	.83	.73



Figure 1. The exploratory NPD portfolio success model



Model fit:  $\chi^2$  [d.f.] = 26.35 [15]; p = .04; RMSEA = .06; NNFI = .97; CFI = .99; GFI = .97

### Figure 2. The tested NPD portfolio success model (standardized $\beta$ )

Measures and sources	s Description St. f	actor loadings	t-value
MARKET PERFORM	ANCE		
Customer satisfaction	As compared to our competitors over the past three years we have:		
CR = .88  AVE = .66	Achieved high levels of customer satisfaction	.76	16.28
	Delivered value to our customers	.85	18.97
	Delivered what our customers want	.75	15.94
	Retained valued customers	.61	12.16
Market effectiveness	As compared to our competitors over the past three years we have:		
CR = .88 AVE = .65	Achieved market share growth	.75	16.27
	Achieved growth in sales revenue	.85	19.89
	Acquired new customers	.75	11.78
	Increased sales to existing customers	.61	15.02
Profit	As compared to our competitors over the past three years we have:		
CR = .94 AVE = .79	Increased business profitability	.89	21.62
	Increased return on investment (ROI)	.92	22.92
	Increased return on sales (ROS)	.90	22.38
	Reached our financial goals	.68	14.68
NPD PORTFOLIO SU	ICCESS		
Strategic Alignment	Our NPD portfolio is aligned with our business goals	.74	16.16
CR = .91 AVE = .68	Our NPD portfolio is aligned with our innovation strategy	.79	17.74
	The projects in our NPD portfolio collectively contribute to achieving our strategic goals	.81	18.38
	Our spending on projects for our NPD portfolio is consistent with our business strategy	.77	17.06
	The projects funded for development reflect the priorities of our business strategy	.76	16.62
Balance CR = .86 AVE = .51	Our NPD portfolio is balanced in terms of incremental (improvements) and radical (really new projects	.64	12.94
	Our NPD portfolio has the right number of projects for our available resources	.62	12.32
	The projects in our NPD portfolio are balanced across the various development stages (idea-la	unch) .66	13.28
	Our NPD resources are in balance with the resources needed to execute the projects in our port	folio .67	13.76
	Our NPD portfolio is balanced to mitigate risk across the different projects	.70	14.33
	Our NPD portfolio is balanced in terms of serving both growing and mature markets	.66	13.28
Maximal value	Our NPD portfolio contains several high impact projects in terms of revenues	.53	10.48
CR = .86 AVE = .61	Over the past three years we maximized the return on investment from our NPD portfolio	.58	11.59
CR = .86 AVE = .61 Over We b profi	We believe that the current composition of our NPD portfolio will maximize long term (>3 yeaprofitability	urs) .83	18.53
	We believe that the current composition of our NPD portfolio will maximize market share grow over the long term (> 3 years)	wth .84	18.61
PORTFOLIO DECISIO	ON-MAKING EFFECTIVENESS		
Portfolio mindset	At all times, we have an overview of all the projects in our NPD portfolio	.73	15.33
CR = .86 AVE = .56	We have in-depth knowledge about each project in our NPD portfolio	.74	15.60
	We understand how each project relates to other projects in our NPD portfolio	.63	12.65
	We know at all times how many projects are in which stage of development	.59	11.63
	We can readily anticipate where bottlenecks may occur in our development pipeline	.66	13.41
Focus	We focus our innovation resources to achieve our NPD portfolio priorities	.64	13.07
CR = .86 AVE = .56	It is clear which projects in our NPD portfolio have priority	.60	11.88
	Nothing distracts us from executing our NPD priorities	.71	14.84
	Our resource allocation in the short term reflects our long term NPD portfolio priorities	.64	12.85
	We work in a focused manner and do not easily get distracted from our priorities	.79	17.22
Agility	We readily change the composition of our NPD portfolio to respond to new strategic opportun	ities .69	10.34
$C\bar{R} = .82 \text{ AVE} = .50$	We proactively change the composition of our NPD portfolio to anticipate to market changes	.63	9.30
	We implement NPD portfolio decisions fast	.73	13.86
	Our NPD portfolio decision-making processes are speedy enough to assure that we can quickly upon new opportunities	v act .73	14.12
	We rapidly change our NPD portfolio priorities when we detect a new market opportunity	.67	12.85

# Appendix 1: Constructs and their psychometric properties