

# Patterns in NPD: searching for consistent configurations. A pilot of Dutch, Finnish and Portuguese cases.

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Companies pursuing sustained competitive advantage through continuous innovation are confronted with the tension between today's work and tomorrow's innovation. Based on the assumption that a holistic understanding of the relationships between strategy, processes, structure, and culture of New Product Development (NPD) imbedded in their overall context will contribute to the identification of consistent NPD configurations with sustained innovation performance, this paper reports on the search for so-called 'Patterns in NPD'. In order to investigate whether different types of consistent NPD configurations might be identified through a quantitative research design, a so-called quick scan using a structured questionnaire was carried out in Dutch, Portuguese and Finnish firms (n=82).

The results of this quick scan, which was seen as a pilot study for larger scale data collection, did highlight some practices in NPD configurations that can be related to Key Success Factors identified in best practice studies, such as: a dedicated project organization, an organisational culture fostering personal engagement and encouraging individuality and creativity, and a strategic NPD programme with a long-term thrust. Results also indicated possible pattern variety among the different countries (esp. Portugal vs Finland and the Netherlands) and a first indication of possible relationships between NPD strategy, structure and culture based on a bi-variate correlation analysis.

## 1. Introduction

Managing sustained innovation (and change) is vital for the company of the future. For many organizations, creating *new products* is central to adapt and sometimes even to transform themselves in changing environments. The 'Patterns in NPD' project is aimed at *developing knowledge on organizing New Product Development (NPD) to optimize its contribution to sustained innovation*. The project largely builds on a common descriptive database to be developed to contain holistic descriptions of a large number and variety (in terms of industry sectors and countries) of NPD configurations within European firms. The rationale of the research is that companies striving for sustained innovation are confronted with:

- tensions between today's work and tomorrow's

innovation (exploitation vs. exploration; incremental vs. radical innovation),

- tensions between firm competencies and market demands (cost/price versus flexibility/variety),
- dynamics and characteristics of their specific industry and national context;

and that consistent configurations (so-called 'patterns') of NPD organisations can be identified that contribute optimally to sustained innovation through a fit with the overall intra- and extra organizational context (Weerd-Nederhof, 2005). The collaborative project interconnects various individual efforts in Europe, ultimately aiming for multiple joint publications and, based on benchmarking from the common database, a Decision Support System for self-assessment and redesign of NPD organisations. The current paper reports on a quick scan, serving as a pilot study for the project at large, among in total 82

Dutch, Finnish and Portuguese companies.

Rooted in contingency theory, the main assumption for the Patterns in NPD research project is that contributing to sustained competitive advantage requires a *fit* within the NPD system and between the NPD system and its context (de Weerd-Nederhof, 1998). 'Fit' refers to alignment and compatibility between the elements of the systems (sometimes also referred to as congruence). *A consistent configuration would fulfil the fit requirements.* The contingency approach incorporated in the model is one of *functional equivalence* (Gresov & Drazin, 1997; Gomes & de Weerd-Nederhof, 2002), meaning that contingencies such as competitive or technological environment or a company's business strategy will determine the functions NPD must perform, but not its specific structure. This would indicate that instead of trying to find the one best way to organise for NPD, various best ways, or in other words: 'Patterns in NPD' might be identifiable, reflecting adjustment between the design of the innovation process and its context. This is in line with authors such as Calantone et al (1995) and Hobday (1998) who have suggested that successful NPD and R&D projects are more dependent on an adjustment between the design of the innovation process and its environment than on key success factors such as the matrix structure alone. Also the work of authors like Kumpe and Bolwijn (1994), Rothwell (1992) and Rogers (1996) suggest that various NPD patterns may be effective, as long as they match their respective environments. *If this is true, rather than an emerging best practice, empirical holistic research of the type we intend to undertake would show considerable variety in NPD configurations, even those who are subject to comparable internal and external organisational context.*

In the first stage of the research, which is reported in this paper, a pilot study in the form of a quick scan was carried out with the objective to investigate whether different types of consistent NPD configurations might indeed be identified through a quantitative research design. This would contribute to the first objective formulated for the overall Patterns in NPD project: *Identify, and develop a typology of, internally and externally consistent NPD configurations.* The envisaged impact of this first step of the project is to generate contextualised knowledge on the design and functioning of successful NPD configurations, including in-depth insight into relationships between NPD strategy, processes, structure and culture, and sustained innovation performance. As such, and by taking the already mentioned process view of innovation, the project aims to contribute to the equifinality discussions in contingency theory, and the strategic choice versus determinism debate in the organisation design field (a.o. Child, 1972, Drazin & Van de Ven, 1985, Donaldson, 1996; Gresov and Drazin, 1997).

The remainder of this paper is structured as follows. First we describe and explain our conceptualisation and operationalisation of NPD configurations for the purpose of the quick scan research. Next, results are presented discussing NPD strategy, structure and culture characteristics for the data set. Our discussion and conclusion focuses on indications for pattern

identification as well as on methodological implications, leading to requirements for the development of an extensive descriptive questionnaire to be used for the data gathering for the Patterns in NPD Descriptive Database.

## 2. NPD configurations –conceptual framework and operationalisation

The NPD process is a complex firm activity, which in many cases interacts with several intra- and extra-organisational factors. This statement is supported by the major reviews of the NPD process (e.g. Brown and Eisenhardt, 1995; Calantone et al., 1993; Cooper and Kleinschmidt, 1995; Ernst, 2002), which indicate a wide variety of factors related to the NPD process. In order to get a thorough holistic understanding of the process, it is necessary to look at all these different factors. The basis for the research is a process-based contingency model of organisation (Boer and Krabbendam (1991), tailored to NPD by de Weerd-Nederhof (1998), by combining systems theory, process models of organisation and innovation and contingency theory with the NPD literature on success factors in NPD, performance measurement and generic solutions in NPD (Tushman and Nadler, 1986; Miller and Rice, 1967; Perrow, 1967; De Leeuw, 1982; Loch et al, 1996; Mintzberg, 1979; Griffin and Page, 1996; Cooper, 1986; Cooper and Kleinschmidt, 1995; Chiesa et al 1996; Clark and Wheelwright, 1993; Kahn and McDonough, 1997). The description of the NPD configuration within this framework in short involves addressing goals, primary, management and support processes, people and means (tools & techniques), organisational arrangements (at individual, group and organisational level) and internal and external NPD context, and was operationalised in qualitative mapping tools (see Weerd-Nederhof, 1998, Weerd-Nederhof and Visscher, 2002 and Weerd-Nederhof and Gomes, 2002).

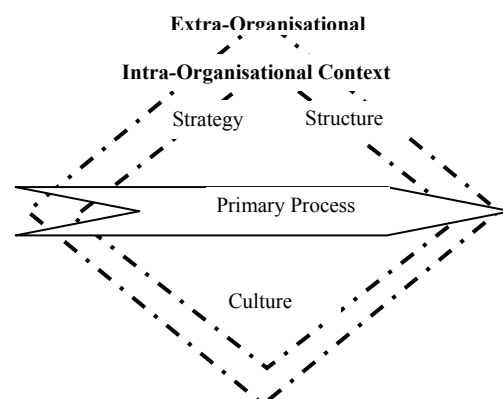


Figure 1, NPD system and its intra- and extra-organisational context

Figure 1 shows the visualisation of our definition of an NPD configuration for the purpose of the quick scan: a combination of strategy, structure and culture of NPD.

Because the focus of the quick scan was to explore whether indeed a variety of consistent NPD

configurations might be identified through quantitative research, we chose to use or slightly adapt existing scales for (NPD) strategy, culture and structure rather than develop new ones, and to focus on analysing emerging consistent combinations. The primary process was for the purpose of the quick scan characterised in terms of the customer order decoupling point (Draaijer, 1993): an indication of engineer to order, manufacture to order, assemble to order or produce for stock. Company context was indicated by identifying the industrial sector and legal status: business unit, wholly owned subsidiary, holding/parent company. Table 1 gives an overview of constructs, scales and references used. Below we discuss in more detail the operationalisation of Strategy, Structure and Culture for the purpose of our quick scan investigation (see also appendix A).

### Strategy

The typology of Miles and Snow (1978) was used to identify the main strategy followed by the case companies. Miles and Snow (1978) propose three strategic types, defender, prospector and analyser, and a fourth type, which embodies an absence of strategy, which they called reactor. This typology has been used in questionnaire-based research in one of two modes (1) Respondents are provided with four descriptions of their organisation and must choose the one which fits best the organisation; (2) The descriptions are broken down into a number of sentences and then respondents are asked to rate the extent to which each describes the organisation. This option assumes that there are no clear strategies rather all organisations may pursue a mix of strategies.

are used in this section were taken from Song, X.M. and Dyer, B. (1995).

### Structure

Four dimensions of organisational structure were measured: centralisation, formalisation, complexity and integration. The first three dimensions were also pinpointed by major reviews of the topic, such as the one by Van de Ven (1976) and the fourth dimension of structure was introduced by the works of Lawrence and Lorsch (1967), Galbraith (1973), and Mintzberg (1979). Next to this, six figures with descriptions of possible organisational configurations (functional, functional matrix, balanced matrix, project matrix, project-led matrix and project based) were presented to the respondents, which had to choose the most appropriate one. These figures aim to operationalise Larson and Gobeli's (1987; 1988), Galbraith's (1971; 1973), Turner et al. (1998), and Daft's (1997) structural types. The figures are inspired by Hobday (2000, p. 877).

### Culture

The work by Hofstede et al. (1990) was used to assess organisational NPD culture. Hofstede applied ecological factor analysis to 61 practices items across 20 units from 1295 individual responses, and found six culture factors, represented by 18 items. The 18 items were mixed in the current questionnaire.

This survey has used mode 2, and the 11 sentences that

<b>Constructs</b>	<b>Scale info</b>	<b>Literature used</b>
<b>Strategy</b>	<i>4 Strategy types, based on Miles and Snow (1978)</i>	
Defender, Reactor, Analyser and Prospector	This section uses 3 sentences per strategy type in order to identify the level of strategy a specific strategy is followed by the Organisation or Business Unit.	Miles and Snow (1978); Song, X.M. and Dyer, B. (1995).
<b>Structure</b>	<i>Structure of the organisation was defined by the following 4 factors, and the structural typology of Larson and Gobeli (1987; 1988)</i>	
Complexity	All factors were measured using 3 items per factor, 5 point likert scale	Blau (1970), Hage and Aiken (1967), Parthasarthy and Sethi (1993)
Centralisation		Van de Ven (1976), Vickery et al. (1999); Collins et al.(1988)
Formalisation		Roth et al. (1991), Parthasarthy and Sethi (1993), and Collins et al. (1988)
Integration		Lawrence and Lorsch (1967), Galbraith (1973), Mintzberg (1979)
Structural Type	Six Figures and Descriptions	Larson and Gobeli's (1987; 1988), Galbraith's (1971; 1973), Turner et al. (1998), Daft (1997), Hobday (2000)

<b>Culture</b>	<i>Organisational culture was defined using the 6 factors found by Hofstede et al. (1990)</i>	
Process-oriented vs. results-oriented	All factors were measured using 3 items per factor, 5 point likert scale	For all factors: Hofstede et al.(1990), Cabrera et al. (2001)
Employee-oriented vs. job-oriented		
Parochial vs. professional		
Open systems vs. closed systems		
Loose control vs. tight control		
Normative vs. pragmatic		
<b>Company info / Context</b>	<i>Generic background information regarding the company</i>	
Company profile, Various items like: - Sector or industry - Main activity - Legal status - Customer order decoupling point	Combination of open ended questions, and closed question with a nominal scale	Draaijer (1993), Cordis (xxxx)
<b>Company Size and Product Innovation Vital Statistics</b>		
- Number of employees - Financial size - Innovation activity	Combination of open ended questions (asking for figures), and closed question with a ordinal scale	EU Commission, Recommendation 06/05/2003,

Table 1 Constructs, scales and literature base.

### 3. Method and Sample

In the period of June 2004 till April 2005 the quick scan pilot survey was conducted. The questionnaire was developed as described above and subsequently as a means of Delphi method put before the various researchers now participating in the Patterns in NPD project as experts in the field.

A small pre-test of 5 Finnish companies led to some refinement of the questionnaire in the first half of 2004. Students from Finland, Portugal and the Netherlands visited in total 82 companies (24 Dutch, 25 Finnish and 33 Portuguese) where they conducted the survey by interviewing the NPD manager.

<b>Country company is located</b>	<b>Industry sector</b>		<b>Process</b>
Netherlands (24) Finland (25) Portugal (33)	Mfg food products and beverages (13%) Mfg chemical and chemical products (18%) Mfg rubber and plastic products (31%) Mfg basic metals (4%) Mfg machinery and equipment (4%) Mfg electrical/optical machinery/apparatus Mfg transport equipment (4%) Other (8%)		Engineer to order (29%) Manufacture to order (23%) Assemble to order (23%) Produce for stock (25%)
<b>Organisation</b>	<b>Number of NPD employees</b>	<b>R&amp;D Intensity (%)</b>	<b>Turnover</b>
Business Unit (51%) Wholly owned subsidiary (32%) Holding/Parent (17%)	<=10 (13%) 10-20 (13%) 20-50 (13%) 50-100 (22%) 100-250 (22%) >250 (17%)	<=2.5 (33%) 2.5 – 5 (21%) 5 - 10 (26%) 10 – 20 (18%) >20 (3%)	< 2 Million Euro (6%) 2 – 10 Million Euro (11%) 10 – 50 Million Euro (16%) > 50 Million Euro (67%)

Table 2, Pilot survey sample group summary

The 82 companies together form a convenience sample, in that they were the respondents from companies that were contacted mainly via university and personal contacts. Companies selected from these contacts were

manufacturing firms, with at least 6 people (fte) involved in NPD. The overall response rate was 30%. The facilitated approach, where the questionnaire was filled in through an interview with the NPD manager, was chosen instead of a more conventional self-administered approach

because it would make it possible to observe the respondent and assess the ease of answering the questions and determine which questions require revising. The companies represent a variety of different industries per country. Table 2 summarizes the key characteristics of the sample group.

#### 4. Results

In this section we will first under the heading of ‘practices’ interpret questionnaire results descriptively. This is followed by a section titled ‘patterns in NPD’, which reports on results from analysing the data with various quantitative methods.

##### Practices

In his review of the empirical literature of success factors of NPD, Ernst (2002, p.31-32) systematically summarises the most essential conclusions of almost 30 years of empirical NPD research. For the purpose of the descriptive interpretation, we would like to call back in mind some of the starting points for our research mentioned in from the introductory paragraph, where we cited a number of authors whose work suggest that various NPD patterns may be effective. We then said that if this is true, *rather than an emerging best practice, empirical holistic research of the type we intend to undertake would show considerable variety in NPD configurations*. Even though we set out to undertake the quick scan without concrete hypotheses, the search for variation might be seen as a proposition guiding the interpretation of the data. For this reason we chose to use the ‘best practice description’ of Ernst as the starting point for our discussion of the results, systematically followed by a discussion of the variety found.

To start with, Ernst states that an organisational requirement for the success of NPD is the creation of a dedicated project organisation which ought to have certain generic characteristics, such as a cross-functional NPD team where people are especially assigned to the NPD team who have enough time to work on the project, and where the project leader has access to team members from other departments. This way it is expected that the project organisation ensures that the NPD project will not be negatively effected by daily routines and/or departmental influences. These practices in organising NPD are reflected in the quick scan questionnaire in the *structural type* employed, which captures both the way NPD activities are grouped (functional – project), and the role and responsibilities of project managers as well as functional managers involved (see appendix A). Figure 2 shows that still a good 5% of the companies employ a pure functional NPD structure, whereas 66% has a functional or balanced matrix in place. Explicitly project-based NPD is again only 5% of the population, but still 29% either employs a project matrix, project-led or project-based structural type.

The dominance of functional and balanced matrix structures in our sample indicates that although the teams

are cross functional by composition, team autonomy as well as project leader authority over team members involved is in the majority of the cases much less than indicated as ‘best practice’ by the literature cited by Ernst.

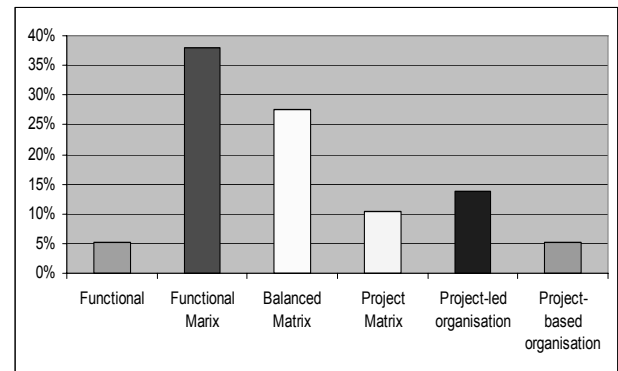


Figure 2, Structural types

In addition we also measured the *structure characteristics* complexity, centralisation, integration and formalisation. Table 3 summarises the scores, which point at a normal distribution for the constructs, and thus a considerable variety, especially for the Complexity construct which also has the highest Cronbach’s Alpha (see also table 6).

Structure-Complexity	Low (26%) Average (52%) High (22%)
Structure-Centralisation	Low (9%) Average (72%) High (18%)
Structure-Formalisation	Low (8%) Average (63%) High (29%)
Structure-Integration	Low (18%) Average (68%) High (14%)

Table 3, Structure characteristics results

The combined results of the descriptive analysis of the structure part of the Quick Scan do look promising, although the structure type graphics alone might just give a too small insight in the NPD roles employed (including project manager characteristics!), which is the reason for us to expand this category for the extensive patterns in NPD questionnaire with questions on presence and emergence of critical NPD roles per phase of the process (Altena 2005, referring to Roberts and Fusfeld, 1981, Howell and Higgins, 1990 and Boer and During, 2001) as is also stressed by Ernst.

According to Ernst, the impact of organisational culture and NPD strategy on the success of new products has not been adequately researched to date. He mentions the important personal engagement of people and that it appears to be helpful to undertake activities to encourage the emergence of individuality and creativity. Overall he concludes that the impact of organisational *culture* on

innovation success requires more sound empirical research based on valid measures of culture. In the quick scan the well accepted items and scales of Hofstede were applied, which can be accepted as valid measures of culture as meant by Ernst. However, these measures were taken only in a single respondent design, which most probably accounts for problems when trying to further analyse the data as we will show later on. However, for the descriptive interpretation of the data, we can have a look at a selection of Hofstede's items, which might be related to personal engagement and the encouragement of individuality and creativity, for which the scores are summarised in table 4. It may be clear that although the relatively high mean for 'each day brings new challenges' and 'people put in maximum effort' might be scores fitting with innovative culture as described by Ernst, apart from the fact that again there was considerable variety in the scores (but there was no normal distribution found neither on item nor on construct level), not much more can be done with these results in terms of pattern finding as will be shown also later on (see table 6). An even more important lesson to be learned from this culture measure when relating it to Ernst's research, is that although Hofstede's measure was chosen for its high validity, it is not really an innovation culture measure per se, and most probably measures that indicate innovative climate (see Altena 2005, referring to Ekvall, 1996, and Isaksen and Lauer, 2002), which do address individuality, creativity and personal engagement, will give a much better insight.

<i>Items</i>	<i>Mean</i>	<i>SD</i>
People feel comfortable in unfamiliar situations	3.39	0.90
Important decisions are made by individuals	2.22	1.00
Each day brings new challenges	3.82	0.93
People put in maximum effort	3,81	0,89

Table 4 Selected items and scores for culture characteristics

Ernst does highlight some findings that point to the importance of *strategy*, indicating that the NPD programme ought to have a strategic framework which offers orientation to the sum of single NPD projects, and have a long-term thrust (going beyond the completion of short- and medium term NPD projects). In the quick scan strategy or strategic focus was assessed through items based on descriptions of Miles' and Snows overall business strategy types Prospector, Analyser, Defender and Reactor. Although these clearly are not specific NPD strategies, the characteristics for successful NPD strategy as highlighted by Ernst, seem mostly to be in line of what can be expected of a Prospector's strategic focus. Table 5 summarizes the scores for the items taken from Song and

Dyer's description of this strategy type. The relatively high mean for 'technological flexibility' is an interesting one for sustained innovativeness, but might also be biased by our choice of the convenience sample (which would be the more prospective companies anyway since they have various types of contacts with university etc.). These scores again show considerable variety, but no normal distribution. In the same line as what we said about extending ur measures for NPD culture, the results above and our ongoing literature search have led us to include more NPD strategy specific measurements in the extended questionnaire (see Altena, 2005, referring to Cooper and Kleinschmidt, 1995; Clark and Wheelwright, 1993, Cooper at al 2004; Danneels and Kleinschmidt, 2001; Hultink et al, 1998)

<i>Items</i>	<i>Mean</i>	<i>SD</i>
Conducts its business in a broad and ever changing product and market domain	3.18	1.26
Technologically attempts to maintain flexibility, thus allowing early response to signals concerning areas of opportunity	3.84	1.04
Values being first and taking risks in new product and market areas	3.35	1.14

Table 5, Selected items and scores for strategy characteristics

### *Patterns in NPD*

From the descriptive interpretation of the data above already some interesting findings emerged, indicating considerable variety in NPD structure, culture and strategy, which is one of the 'requirements' for the equifinality assumption, namely that there is no *one* best way to organize NPD. However, we set out to undertake this quick scan as a pilot study with the objective to investigate whether different types of consistent configurations (*various* best ways, see also Gomes and Weerd-Nederhof, 2002) might indeed be identified through a quantitative research design. Consistent configurations were stipulated as configurations of elements of NPD systems fulfilling the fit requirements of alignment and compatibility between the elements of the system (and its context). For the NPD system elements investigated with the quick scan, this would mean that we would at least have to look into the emergence of certain combinations of NPD structure, culture and strategy from the data. This, of course is easier said than done, first of all because of the large amount of factors combined with the holistic viewpoint.

### Scale validity

Since many of the factors are operationalized as multi item scales it is necessary to start with discussing the

validity of these scales, before any further examination of the data toward pattern finding can take place. Table 6 shows the validity of the scales, which as we can see, leave much to be desired. Especially the validity of the strategy types is extremely poor. Only the structure scales might be classified as sufficiently valid.

Construct	Cronbach's Alpha
Strategy – Defender	.19
Strategy – Reactor	.39
Strategy – Prospector	.43
Strategy – Analyser	.11
Structure – Complexity	.77
Structure – Centralisation	.70
Structure – Formalisation	.64
Structure- Integration	.60
Culture – Process- vs. Result oriented	.59
Culture – Employee- vs. Job oriented	.22
Culture - Parochial vs. Professional	.32
Culture - Open vs. Closed systems	.38
Culture - Loose vs. Tight control	.31
Culture - Normative vs. Pragmatic	.35

Table 6, Scale validity (Cronbach Alpha)

As already suggested in the previous section, the lack of validity of the culture scales for us at first was most disturbing, since those scales were literally copied from the work of Hofstede et al.(1990), who validated the scales using a large reasonably comparable sample group. It seems therefore likely that the survey method itself is partly responsible, possibly partly because of the large amount of interaction between researcher and respondent coming forth out of our facilitated approach, but also because of single respondent bias (see also Ernst 2002), whereas Hofstede applied a multiple respondent research design.

For the strategy scales it is likely that the descriptive sentences extracted from the strategy type descriptions were unsuitable as separate questions as they cannot be taken out of the context of the total description. Added to that, only three items per scale were measured which is most probably a too small number anyway. Since the validity of the strategy scales was so poor, a factor analysis was performed (principal components, varimax) to investigate if an alternative scale could be derived. This factor analysis resulted in one usable, 4 item, factor which yielded a much higher Cronbach's Alpha than the original scale (.71) although not the original intend of this analysis, this factor was also used in further analysis. This factor can be characterized as the amount in which a company is the first to enter a new market, and will for the remainder of the text be referred to as the 'First to Market' factor. A comparable factor analysis of the culture items did not yield better scales.

The lack of validity has obviously significant consequences for the 'pattern finding' analysis, since for these constructs it is no longer possible to look for relationships on the construct level, and further analysis would have to be restricted to individual variables. So

from this point on, only the structure will be retained, the other items will be viewed at as separate variables. Obviously this limits the usability of the analysis of the pilot survey data enormously. The other consequence is that further research will have to include a radical redesign of the conceptual model and the survey.

## Pattern Finding

Based on Ernst (2002), a *best practice* pattern of a consistent NPD configuration consisting of NPD structure, culture and strategy, might be:

- a dedicated project organization employing sufficiently autonomous cross functional teams and project leaders with adequate authority over team members, combined with
- an organizational culture fostering personal engagement of people and encouraging individuality and creativity, and
- an NPD strategic program with a long term thrust

For reasons explained above we cannot really get meaningful results for culture, but we did look into the relationship between companies with a higher score on the First to Market strategy factor and the structural type employed, to see whether this would give a hint for dominance of this best practice. The table again shows variety, and it is a pity that it is not statistically significant for this might be a start towards a pattern indication of Low First to Market strategic focus related to more functional structural types, and higher First to Market strategic focus more tending towards balanced matrix and project based forms, while at the same time indicating equifinality.

	F	FM	BM	PM	PL	PB
High First to market	7%	29%	43%	14%	7%	0%
Average First to market	4%	48%	24%	8%	12%	4%
Low First to market	10%	60%	30%	0%	0%	0%

Table 7 'First to Market' and structure type (F=Functional; FM=Functional Matrix; BM=Balanced Matrix; PM=Project Matrix; PL=Project-led).

We employed a number of analytical statistical operations to see whether any patterns at all would emerge from the data, that might point to consistent NPD configurations which in a later step might be related to performance for the purpose of assessing their contribution to sustained innovation, and subsequently could lead to a set of **various** best ways to organize NPD.

The first thing we looked at, in order to determine significant differences between the responses in the different countries was the testing of the equality of the groups (Kruskal-Wallis). Although most variables yielded little or no significant differences, some did, and table 7 indicates the variables with significant differences.

<i>Variable</i>	<i>Mean Netherlands</i>	<i>Mean Finland</i>	<i>Mean Portugal</i>	<i>Chi-Square</i>	<i>Sig</i>
The company uses task forces	3,6	3,9	2,6	24,661	.000
Degree to which decisions regarding operational issues are more or less centralised	2,1	2,7	3,2	15,72	.000
There is little concern for personal problems of employees	2,5	2,8	1,9	15,3	.000
Strategy Factor 1 (First to Market, added scores)	11,4	12,5	14,4	6,98	.030

Table 7, Analysis of equality, Kruskal-Wallis

These results might indicate that companies in Portugal less frequently use task forces, centralise operational decisions and have more concern for the personal problems of employees. Next to that they also indicate that they more often pursue a strategy to be first in the market. The latter result might of course be biased by differences in the convenience sample. The Portuguese data set contained a considerable number of business units

which could be traced back to a smaller number of parent organisations. It might however be interesting, for the analysis of data from the extended questionnaire, to see whether there are cultural and country differences which might account for these changes. Differences between Finland and the Netherlands are far less prevalent.

<i>Variable 1</i>	<i>Variable 2</i>	<i>Correlation Coefficient</i>	<i>Sig. (2-tailed)</i>
Places a high priority on monitoring the actions of its key competitors, and on being second-in with a more cost-efficient product or service offering – Strategy item	Formalisation – Structure construct	.303	.006
My organisation/business unit thinks three years ahead or more – Culture item	Integration – Structure construct	.247	.026
Conducts its business in a broad and ever changing product and market domain - Strategy item	Complexity – Structure construct	-.354	.002
There is a major emphasis on meeting customer needs – Culture item	Complexity – Structure construct	-.301	.010
There is a major emphasis on meeting customer needs – Culture item	First to Market Factor – Strategy construct	.282	.010
There is a major emphasis on meeting customer needs – Culture item	Attempts to maintain a stable, limited line of products or services while simultaneously moving out quickly to follow a carefully selected set of more promising developments in the industry – Strategy item	.409	.000

Table 8, Correlations

To get a first indication of possible relationships and the existence of consistent patterns a bivariate correlation analysis was performed (Spearman rank). Table 8 shows the most prevailing results. Only significant correlations with either one of the structure scales or the first to market factor-strategy scale are presented in the table. What may be interesting in search for patterns is that both the First to Market Strategy Factor and Complexity correlate with a perceived major emphasis on meeting customer needs, which is one of the culture items. Also the strategy item ‘attempts to maintain a stable, limited line of products

while simultaneously moving quickly to follow a carefully selected set of more promising developments in the industry’ correlates with this culture item. This and other relations, such as the relation between Integration and ‘thinking three years ahead or more’, and of Formalisation with ‘placing a high priority on monitoring the actions of key competitors and on being second-in with a more cost-efficient product or service offering’ may hint at a variety of configurations, which would merit further exploring patterns in NPD as envisaged in the Pattern in NPD project. For the validity reasons already outlined above, it would not be



right to further employ for example multivariate analysis with this data set, although as a last step we are exploring the added value of bivariate analysis using neural networks as was also done by Thieme et al (2000) and Song and Zhao (2004), but mostly for the purpose of determining possibilities for later use with the data set gathered through the extensive questionnaire (Altena 2005), which is currently being tested.

## 5. Conclusion: Implications for Further Research

The pilot study data gathering and analysis based on the Quick Scan questionnaire has taught us many relevant lessons for both the further development of an extensive questionnaire as well as the research design and methodological issues to deal with. To start with the latter, we can again go back to Ernst (2002) who criticizes the fact that, with a few exceptions, the vast majority of NPD studies have hardly made use of the methodological advancements in data collection and evaluation. Among others, Ernst stresses that more rigorous statistical techniques should be applied in empirical studies, and that minimum reporting standards should be introduced in publications (e.g. giving reliability coefficients!). Also citing Brown and Eisenhardt (1995), Ernst calls for reliance on well defined constructs, derived from theoretical considerations, and careful consideration of 'single informant' bias (both in data gathering, and data analysis techniques applied).

In designing the extensive questionnaire for the Patterns in NPD Descriptive Database, for which the study described in this paper served as a pilot, based on our results first of all the need has become clear to measure more NPD specific constructs next to the overall strategy and organisational constructs of structure and culture included in the questionnaire. In fact, the pilot case has led to the belief that it would be

better to design a two tier questionnaire, one to be filled in by a respondents at a more general management level, in order to get sufficient insight in strategy type and the cultural context in which NPD is embedded, and then design a part to be filled in at the level of NPD managers, which includes assessment of specific NPD strategy characteristics, and NPD climate respectively. Assessment of NPD structure should be enhanced, among others by also characterising relevant NPD roles, and complemented by NPD process characteristics. Altena (2005) proposed to base NPD process measures on Griffin, 1997 and Clark and Wheelwright (1993). Because of our focus on NPD organisation, NPD process characteristics had been neglected for the quick scan questionnaire design, but as Ernst stresses in the very first place in his assessment of previous empirical NPD research, the presence of a formal or informal NPD process in the firm establishes the basis for success of new products.

A very important step in the search for Patterns in NPD and the identification and subsequent classification of consistent NPD configurations is to enable the analysis of the link between the configuration of the NPD system on the one hand and its performance on the other. Only if we can establish a measure also of a company's ability to successfully deal with the tensions between today's work and tomorrow's innovation through its NPD organisation, including dealing with the tensions between firm competencies and market demands, as well as the dynamics and characteristics of their specific industry and context, can we determine which NPD patterns might be related to sustained innovative performance. The operationalisation of the performance dimensions of Operational Effectiveness and Strategic Flexibility, capturing these tensions for NPD performance, for the purpose of the extended questionnaire is reported in a separate paper (Weerd-Nederhof et al, 2005). The first test results (n>15) show encouraging reliability and validity of the items and constructs (including sufficient variety).

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## Appendix A

### Strategy

<p><b>Defender</b> Defender maintains a secure market niche with relatively stable services. It operates in a narrow and limited product and market domain. It concentrates on a focal, core technology, and is led by individuals with backgrounds in finance, production, or accounting. Defender markets fewer products or services than their competitors and aggressively protects its domain by offering excellent quality, superior service, and low prices. It lags behind the rest of the industry when it comes to innovative behaviour. In fact, the Defender appears to change only when forced by environmental threats and problems. Finally, the Defender prides itself on being extremely efficient.</p>	<p><b>Prospector</b> Prospector is much the opposite of Defenders. It conducts its business in a broad and ever changing product and market domain. It values being first and taking risks in new product and market areas. Technologically it attempts to maintain flexibility, thus allowing early response to signals concerning areas of opportunity. Top managers in Prospector firms often have backgrounds in marketing or research and development. Prospector firms encourage participative decision-making and structure themselves on a product or a service, as opposed to a functional basis. While the organization is successful overall, it may not maintain market strength in all areas it enters.</p>
<p><b>Analyzer</b> Analyzer is a hybrid organization and represents a cross between the Defender and Prospector styles. It attempts to maintain a stable, limited line of products or services while simultaneously moving out quickly to follow a carefully selected set of more promising developments in the industry. Analyzer does everything in moderation. Thoughtful analysis always precedes decisions that involve risk. Seldom is this type of organization first in the market with new products or services. However, Analyzer places a high priority on monitoring the actions of its key competitors, and on being second-in with a more cost-efficient product or service offering.</p>	<p><b>Reactor</b> Reactor moves across the pure styles. For example, it may act like Defender when confronting new competitors, Prospector when conducting environmental surveillance, and Analyzer when entering new markets. Defending existing markets is Defender's primary objective. It (Reactor) becomes aggressive only when risk is low or action is forced by outside pressure. It usually does not take as many risks as their competitors, nor is it as persistent as some competitors when it comes to protecting established product and service areas. Reactor organizations generally drift along, responding to opportunities and threats as they arise.</p>

Table A1, Four Strategy types, Descriptions Song, X.M. and Dyer, B. (1995).

### Culture

Dimension	Definition (Hofstede et al., 1990; Cabrera et al., 2001)
Process-oriented vs. results-oriented	Degree to which an organization is more concerned with the means and procedures that must be followed to carry out the work or with the goals that are pursued with that work
Employee-oriented vs. job-oriented	Degree to which an organization is more concerned with the well-being of the person or with getting the job done
Parochial vs. professional	Reflects the weight that is given to the occupational cultures of the members of the organization. In parochial organization employees identify strongly with their organization, whereas in professional cultures employees identify more with their profession
Open systems vs. closed systems	Communication climate within the organization. In an open system culture information flows easily through the organization, whereas closed cultures are more secretive.
Loose control vs. tight control	Amount of control exerted over individuals, from loose to tight control
Normative vs. pragmatic	Degree of conformity to institutional pressures. Pragmatic cultures are more market driven and are open to ad hoc solutions, while normative cultures are more concerned with following institutional rules

Table A2, Culture Constructs, (Hofstede et al., 1990; Cabrera et al., 2001)

## Structure

Dimension	Characteristics
Organizational complexity or differentiation	<ul style="list-style-type: none"> <li>- Functional differentiation (or departmentation or departmentalisation)</li> <li>- Vertical differentiation (or hierarchical)</li> <li>- Horizontal differentiation (or occupational differentiation, or role specialization)</li> </ul>
Centralization of decision making	<ul style="list-style-type: none"> <li>- Participation in decision-making, strategic decisions - marketing</li> <li>- Participation in decision-making, strategic decisions - innovation</li> <li>- Participation in decision-making, line-operating decisions</li> </ul>
Formalization	<ul style="list-style-type: none"> <li>- Formalization at the strategic level</li> <li>- Formalization at the operational level (operating procedures)</li> <li>- Formalization at the operational level (job responsibilities)</li> </ul>
Use of integration mechanisms	<ul style="list-style-type: none"> <li>- Integration through interdepartmental committees</li> <li>- Integration through task forces</li> <li>- Integration through integrative personnel</li> </ul>

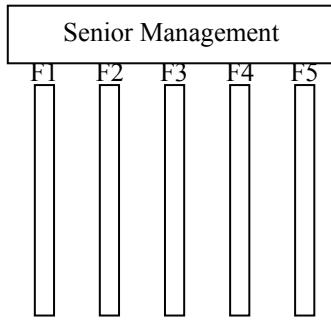
Table A3, Structure constructs

Song, X.M. and Dyer, B. (1995). Innovation strategy and the R&D-Marketing interface in Japanese firms: A contingency perspective. *IEEE Transactions on Engineering Management*, 42(4), 360-371

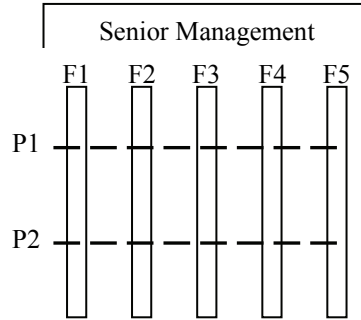
Cabrera, Á.; Cabrera, E. and Barajas, S. (2001). The key role of organizational culture in a multi-system view of technology-driven change. *International Journal of Information Management*, 21, 245-261.

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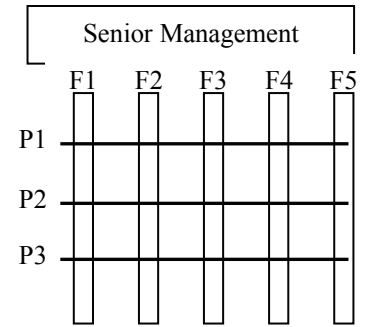
## Structure Types



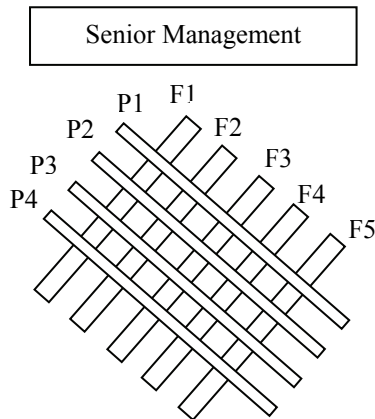
Functional: activities are grouped together by common function from the bottom to the top of the organisation, usually by departments.



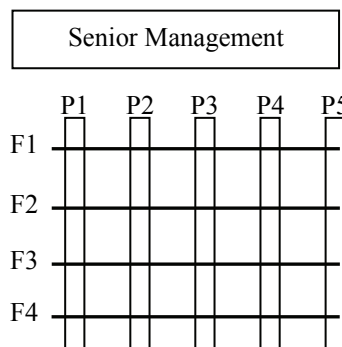
Functional Matrix: a project manager oversees the project across functional areas. S/he has limited authority over functional people involved and serves primarily to plan and coordinate the project. Functional managers retain primary responsibility for their specific segments of the project.



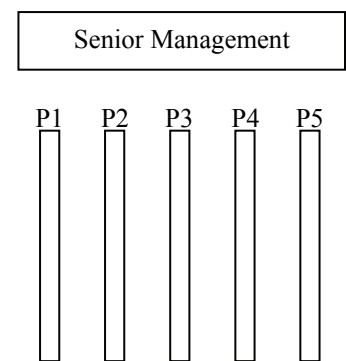
Balanced Matrix: project manager is assigned to oversee the project and interact on an equal basis with functional managers. Project managers and the functional managers jointly direct workflow segments and approve technical and operational decisions.



Project Matrix: project manager assigned to oversee projects and responsible for their completion. Functional managers' involvement limited to assigning personnel as needed and providing advisory expertise.



Project-led organisation: the needs of projects outweigh the functional influence on decision-making and representation to senior management. However, functional coordination still exists.



Project-based organisation: activities are grouped together around projects. Projects are the primary business mechanism for coordinating and integrating all the main business functions of the firm.



**Legend:** F1-F5: functional departments of the organisation (e.g. Marketing, Manufacturing, R&D)  
P1-P5: projects within the organisation