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AN EMPIRICAL STUDY OF IMPORTANT DIMENSIONS OF NEW PRODUCT DEVELOPMENT PRACTICES IN SMALL AND MEDIUM ENTERPRISES IN NEW ZEALAND

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This paper presents results from the research on New Product Development (NPD) in New Zealand, based on a similar survey conducted in the US, UK and Ireland by Kahn, Barczak and Moss in 2006. Kahn et al.'s study identified seven dimensions of NPD practices – strategy, process, research, project climate, company culture, metrics and commercialisation. The survey measured the relative importance of each of the dimensions, and listed characteristics under each dimension for poor to best practices. Strategy was ranked the highest among the seven dimensions followed by commercialisation, research, company culture, process, project climate and metrics. The results were broadly consistent with those from the US, UK and Ireland, with strategy the highest and metrics the lowest ranked. Commercialisation was ranked the second most important dimension among small and medium enterprises (SMEs). Further results are analysed, discussed and recommendations for effective practices are made. The characteristics of SMEs in New Zealand are outlined, in order to better understand their product development practices, the results of this study, and to be able to compare these with the characteristics of large organizations published in the literature.

Keywords: product development dimensions, SMEs, best practices.

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1. INTRODUCTION

The New Zealand manufacturing sector is dominated by Small to Medium Enterprises (SMEs). SMEs make up more than 97% of all businesses and account for about 30% of total employment. There is, however, limited research available on the New Product Development practices of these companies. For New Zealand to compete with major economies of the world, investment in innovation is paramount. This can be achieved by effective management of New Product Development (NPD) practices and systems.

Product Development is a complex and risky process. Most of the successful innovative companies have well-defined New Product Development (NPD) processes and practices. A study of the NPD practices of Small to Medium Enterprises (SMEs) in New Zealand forms the basis of this research.

1.1 Small to Medium Enterprises (SMEs) in New Zealand

Table 1 suggests that SMEs in New Zealand are enterprises employing upto 99 employees, resulting in SMEs making up 99.4% of New Zealand enterprises (Massey,C., et.al 2005). For the purpose of this research it was chosen to use the common classification of SME by employee numbers.

Table 1. International definitions of micro, small, medium and large firms in terms of number of employees

Category	New Zealand		Australia	Europe	UK	USA
	No. of Employees	*Enterprises %	Employees	Employees	Employees	Employees
Micro	0 to 5	86.9	0 to 5	0 to 10	0 to 9	0 to 9
Small	6 to 49	11.8	6 to 19	11 to 50	10 to 49	10 to 99
Medium	50 to 99	0.7	20 to 200	51 to 250	50 to 249	100 to 499
Large	100+	0.6	200+	250+	250+	500+

*A breakdown of enterprise percent for each category is provided for New Zealand (adapted from Massey,C., et.al 2005)

A Product Development process generally consists of idea generation, market research and analysis, design and development, testing and commercialization. These are applicable to both product-oriented and service-oriented companies. Most of the companies follow some or all of the above steps during their Product Development process. What separates "the Best" from "the Rest" however is, the ability to develop and implement a systematic process of New Product Development and in the use of best-practice tools. "The Best" are those companies that follow a diligent NPD process and have systems in place to cover any eventuality. Product Development should always be proactive rather than reactive. "The Best" generally anticipate the need for new products and place a great emphasis on the front-end phases. This is achieved by having a robust process in place (Adams–Bigelow, M. E., 2004, Barczak, G., Griffin, A. and Kahn, K. (2009).

1.2 New Product Development in New Zealand

The need for better product innovation is as important or more so for SMEs in New Zealand due to their significant contributions to the economy (Ministry of Economic Development, 2010). In such a scenario, where the success and failure of a company rests on its ability to innovate, effective Product Development practices are vital to company survival. According to a survey of Australian SMEs, execution was regarded as the single NPD activity making the greatest contribution to NPD success, it was also regarded as the activity second most in need of improvement (Huang et al., 2002).

The innovation sector in New Zealand is dominated by Small to Medium enterprises. Product Development requires considerable investment of time and money. This may lead to many in the industry cutting corners when it comes to implementing an NPD process, due to pressures of limited time and resources.

New Zealand, as a country, is in a unique position. It is very small compared to the big economies like US and Japan and emerging economic powerhouses like China and India. While it is difficult to compete with relatively cheap manufacturing and service oriented economies like China and India, there is a case to carve a niche identity as an innovator. Perhaps there has never been a greater need to invest more in innovation. This can be achieved to a great extent by the effective management of Product Development processes and systems.

Souder et al (1997) compared NZ and US SMEs and found that NZ firms showed a greater blurring of roles (across functions), flatter organisational structures, and greater emphasis on oral learning. Other local research has found that NPD processes are generally informal (Gawith, Grigg, Shekar, & Anderson, 2007), and many firms follow a 'niche strategy' of product development.

1.3 Seven Dimensions of NPD

The PDMA (Product Development Management Association) has been carrying out a study on Best Practices among companies in the United States of America for well over a decade now. The reports generally focus on trends in New Product Development and separate "The Best firms" from "The Rest" (Adams–Bigelow, M. E., 2004). The six dimensions originally identified by Kahn et.al (2006) were later refined to the following seven dimensions by Kahn's research (2009).
This paper focuses on these important dimensions of NPD Best Practices among small to medium enterprises in New Zealand. Similar studies have been conducted in the US, UK and Ireland by Kahn, et.al (2009). The Ireland study offered the most similarities in terms of firm size, with those in New Zealand. The study looks at the seven dimensions of NPD and the relative importance of these dimensions.

The seven dimensions of NPD practice:

1. **Strategy**: the defining and planning of a vision and focus for research and development, technology management, and NPD efforts
2. **Process:** the implementation of NPD stages and gates for moving products from concept to launch
3. **Research**: the application of methodologies and techniques to sense, learn about, and understand customers, competitors, and macro-environmental forces in the marketplace
4. **Project Climate**: the means and ways that underlie and establish NPD intra-company integration at the individual and team levels
5. **Company Culture**: the company management value system driving NPD thinking
6. **Process, Metrics & Performance Measurement**: the measurement, tracking, and reporting of NPD project and NPD program performance
7. **Commercialization**: activities related to the marketing, launch, and post-launch management of new products.

1.4 Objectives of this Research

This research addressed the objectives of identifying the most important dimensions in terms of new product development according to practitioners in New Zealand SMEs. It also identified the 'poor' and 'best' characteristics of these dimensions of NPD practices, and compared the results to a similar study carried out in the US, UK and Ireland.

2. SURVEY METHODOLOGY

The research survey questionnaire was sourced from the authors of the paper by Kahn, Barczak, Moss on their best practices framework used for the US, UK and Ireland surveys (direct communication with K.Kahn, 2009). The comparative results of which have been presented later in this report.

The survey had three parts – the first part dealt with demographic information regarding title, industry type, years of experience, company size along with innovation performance characteristics. The second part provided the definitions of the seven dimensions and asked respondents to indicate the relative importance of each element by allocating 100 points across the seven dimensions. The third part of the survey provided respondents with the list of characteristics outlined for a particular dimension and asked them to indicate, for each element, whether it represented poor, good, better, or best practice.

Changes were made to the original survey to mirror local conditions. These were related to Part 1 of the survey and questions 7 and 8 in particular. The value of the options under size of companies was reduced to reflect New Zealand conditions. The same was done under options for annual sales of companies. The survey was also designed to identify the best practices across a range of NPD activities.

This research process consisted of identifying small to medium enterprises in some of the core areas of innovation vital to New Zealand's future. Product manufacturing, Food and Biotechnology firms were considered. Manufacturing contributes 13.1% of the GDP and employs 12.4% of the labour force. Food (Dairy and meat) are New Zealand's biggest export industries (www.investmentnz.govt.nz). Biotechnology was one of three sectors prioritized under the New Zealand Government's Economic Transformation Programme. Hence a conscious effort was made to target companies involved in these three sectors.

Pilot surveys were carried out to determine response time and initial feedback. The pilot surveys indicated that the survey was quite complex in parts and the characteristics defined under each of the seven dimensions may be more suited to large corporations rather than small to medium enterprises. Professor Kenneth Kahn was consulted regarding the complexity of the survey for New Zealand respondents, and the discussions resulted in respondents being given Part 1 and Part 2 of the survey with Part 3 being optional. There were also considerations given to such things as say a reference to 'department' in the survey, whereas in a SME, there may not be a separate department for each function.

Among those surveyed, 40% of the respondents were from the Manufacturing sector, 32% of the respondents were from the Food Technology sector, and 28% of the respondents were from the Biotechnology sector. Follow-up interviews were carried out on a selected sample to elaborate on the quantitative results and to seek verbatim comments and feedback on the results.

3. SURVEY RESULTS

The seven important dimensions of NPD practice, namely, Strategy, Process, Research, Project Climate, Company Culture, Process, Metrics and Performance, and Commercialization (Kahn et.al, 2006) were rated on importance by participants of the survey.

Strategy was identified as the most important of the seven dimensions listed in the survey followed by Commercialisation, Research, Company Culture, Process, Project Climate and Metrics & Performance Measurement.

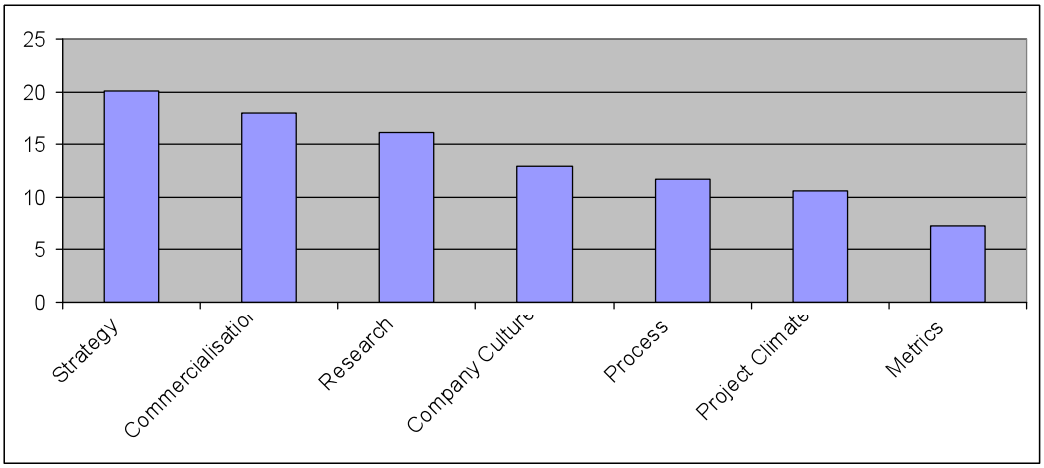

Figure 1. Importance of the seven dimensions

Respondents indicated that a formal strategy helped reduce processing time. Decisions were taken quickly because the head of the firm was directly involved in the product development process. A vision statement for the company which incorporates NPD was also cited as an important part of the overall NPD strategy. This includes "well-defined NPD goals and long-term strategic support for NPD projects".

Barczak, Griffin and Kahn (2009) argued that because a majority of companies may have had a formal NPD process in place for several years and hence use of their process may be part of standard best practice, this led them to place less emphasis on process in relation to other dimensions. The other side of this argument was that a majority of the NZ SMEs surveyed did not have a dedicated NPD team and a lack of standard NPD process and hence, the emphasis on strategy and commercialisation. Gawith et al. (2008) stated that only few SMEs in New Zealand had formal product development processes.

3.1 Characteristics of the Seven Dimensions

New Zealand SME participants also rated the seven important dimensions from best to poor practice, from a list of characteristics outlined for each dimension. Table 2 provides the descriptions of the seven dimensions in terms of 'best' and 'poor' practices in New Zealand SMEs.

Table 2 indicates that NPD managers in New Zealand support having a strong strategy, a flexible process, an innovative culture and close customer relations, and described these as 'best' practices in their comments as well. There were many unsolicited comments on 'Culture, climate and commercialization' being important to NPD success, as within a SME it was felt that team-work and good leadership played a critical role in the progress of a project. An effective team structure, like a formal NPD strategy, can reduce cycle time by accelerating decision processes and the acquisition of resources (Parry et al., 2009). They also expressed the importance of commercialization and export to SMEs in New Zealand as the domestic market is too small to be financially feasible.

Table 2. Elements of Best vs. Poor Practice for each Dimension: Best versus Poor Practices Receiving a Majority Response in New Zealand

Dimensions	Best Practice	Poor Practice
Strategy	– Opportunity identification is ongoing and can redirect the strategic plan real-time to respond to market forces and new technologies – The organisation views NPD as a long term strategy – NPD projects and programmes are reviewed on a regular basis	– No NPD goals – The organisation views NPD only as a short-term tactical initiative – Unclear NPD goals – No prioritisation of NPD projects
Process	– The NPD process is flexible and adaptable to meet the needs, size, and risk of individual projects – A clear NPD process exists	– No NPD process exists – Minimal testing (concept, product, market) performed – There is no discipline in using the organisation's NPD process – Projects are not reviewed at completion
Culture	– Top management supports the NPD process – The company actively works with customers to develop new solutions – An innovative culture pervades the organisation	– NPD is not a management priority – All NPD ideas come from within the company
Project Climate	– Each project has a clearly identifiable project leader – Product champions are critical for project success – NPD is team-focused	– No identifiable NPD group – No project leader(s) – Interaction and knowledge transfer between functional areas is poor
Research	– Customer/user is an integral part of the NPD process – Results of testing (concept, product, market) are formally evaluated.	– No real evaluation of testing (concept, product, market) results is undertaken – Little if any market research is undertaken No market studies are undertaken to understand market place
Metrics	– Board of Directors must approve really new ideas/projects and/or big projects – Business plans must be approved by Directors, VP's – A set of general guidelines for evaluating projects exists	– One person does all NPD project evaluations – Projects are never killed – No standard criteria for evaluating the overall NPD effort exist
Commercialization	– Sales force training is an important consideration before launch – Customer service and support are part of the launch team – A launch process exists	– Launch decisions are kept confidential by the launch team due to fear of public announcement – Marketing budget decisions can dramatically change up to the point of launch – 1 department leads the launch process

An international comparison of the New Zealand results with those of the US, UK and Ireland was also undertaken. The US, UK and Ireland samples indicated that poor practices were more well-known than best practices were for each of the seven dimensions. There was one significant difference between the NZ results and those from the US, UK and Ireland. NZ professionals identified best practices for the Metrics dimension. This indicated that even though Metrics as a dimension ranked the lowest among the seven for NZ professionals, there was a general awareness of the characteristics that constitute best and poor practices for this dimension.

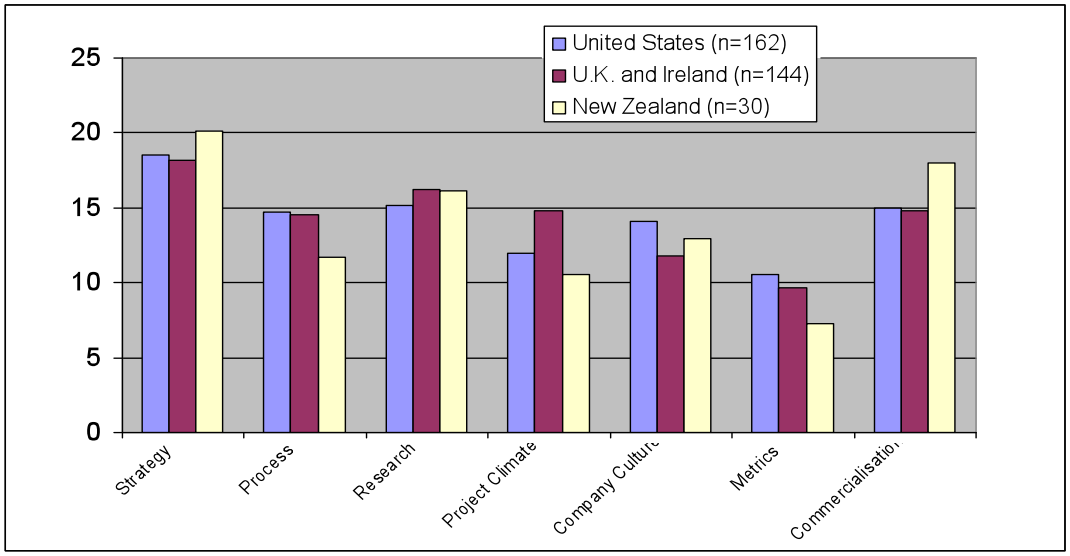

Figure 2. Relative importance of NPD Dimensions across United States, UK, Ireland, and New Zealand samples

The results of this survey were broadly consistent with those from the US, UK and Ireland. Strategy was identified as the most important of the seven dimensions and Metrics was ranked the lowest. Kleinschmidt (2006) argued that companies that had the most well developed portfolio management approaches relied more on having a strong NPD strategy, suggesting that the presence of a strategy is prerequisite for having successful portfolio management. NZ respondents also rated commercialisation higher than research compared to US, UK and Ireland professionals. Company culture also ranked higher than both process and project climate with NZ respondents.

Metrics ranked the lowest across US, UK, Ireland and NZ results. This could mean that most respondents consider other dimensions to be more important than Metrics. In terms of Metrics, some respondents commented that they '*rarely killed projects once started'*. *"Within our firm, often it is the managing director who initiates a project and it often goes right through till the end"*.

NZ respondents also ranked process lower than research, commercialisation and company culture dimensions. As the literature review indicates, a lot of research has been focused on NPD process over the years. The results of this study and those from the US, UK and Ireland seem to indicate that process is no longer considered as important as other dimensions like strategy or commercialisation. In the US studies it is probably because of the maturity of firms with reference to the adoption of a systematic process. In the case of New Zealand SMEs, *"process is "perceived" as being restrictive and a form of management control more suited to larger companies.*

The study also considered the characteristics of the seven dimensions of NPD. Respondents were asked to review those characteristics and indicate whether they reflected a Poor, Good, Better or Best NPD practice. The US, UK and Ireland samples indicated that poor practices were more well-known than best practices were for each of the seven dimensions. The NZ sample was consistent across the seven dimensions for both poor and best practices although strategy, process and research dimensions had more listings of poor practices. There was one significant difference between NZ results and those from the US, UK and Ireland. NZ professionals identified best practices for the Metrics dimension. This indicated that even though Metrics as a dimension ranked the lowest among the seven dimensions for NZ professionals in terms of importance, there was an awareness of the characteristics that constitute best and poor practices for this dimension.

Given that the success rate of new products worldwide has been low, increasing understanding of what drives new product success is critical (Ledwith and O'Dwyer 2009). There was overall, a greater understanding of the poor, good, better and best practice characteristics associated with each of the seven critical dimensions. Even though the literature on

the study of best practices in New Zealand could be considered scarce, this study indicated that NZ professionals were aware of the poor and best practices of NPD.

3.2 Characteristics of SMEs in New Zealand and their impact on New Product Development

SMEs in New Zealand have been described as having their own set of difficulties often associated with their size. Examples of such difficulties include:

Difficulties influencing their target markets.
Often rely on one person (generally the owner or manager).
Relatively high failure rates, especially during the start-up years.
Often affected by Government decisions.
Limited and/or restricted access to specialist services.
Difficulties raising finances due to their high risk nature.
Limited resources (MED, 2010).

These characteristics of SMEs in New Zealand have a significant impact on NPD practices, and help explain some of the results of this study. Due to limited resources, SMEs often tend to rush from one project to the next without being able to spend time to review a completed project in terms of metrics and performance, and hence the Metrics dimension was found to be the lowest in importance.

From this research it was found that some NPD practices for SMEs appear to be managed slightly differently than large firms. Despite the lack of a rigid formal process in many SMEs they appeared to favor a flexible process that can be adapted to sudden changes in their environment. These changes are mainly around fluctuations in internal and environmental constraints, that can affect a smaller company much more than large companies. SMEs have a more informal and people-centric culture, reflecting the small numbers of individuals involved. In uncertain environments, adaptive strategies outperform prescriptive ones (Pich et al., 2002). NPD in general is a sufficiently uncertain environment that adaptive approaches are often suggested (Akgün, Byrne, Lynn, & Keskin, 2007). It is therefore reasonable to suggest that an adaptive approach might be particularly suited to NPD in SMEs.

The informal but more direct communication among staff, the teamwork, social aspects and culture of SMEs in New Zealand, as commented by senior managers who were interviewed, appear to be their strengths despite the challenges (mentioned above) faced by SMEs. *"When there's an issue to be discussed, we simply walk over and talk to the R&D team, face-to face. We may not have everything as well documented as our larger counterparts, but I think we are able to move quickly due to this flexibility of our working conditions."*

3.3 Limitations of the Study

The research addressed the objectives of the study in identifying the most important dimension, the relative importance of the seven dimensions of NPD and comparisons across those from the US, UK and Ireland. However, the sample size, even though it attained normality, may be considered too small to reflect the overall trends and best practices across all NZ companies. This limitation was partially addressed by follow-up calls and qualitative research with the respondents, to ascertain the rationale behind their responses. The findings were based on the selected industry groups of food, biotechnology and product manufacturing, within the SME sector, hence reflects the performance of these industries.

4. CONCLUSIONS

Strategy was considered the most important of the seven dimensions identified in this research. This would suggest that companies need to have a strong NPD strategy tied in with their mission/vision statement. Metrics ranked the lowest. This was consistent with findings from the US, UK and Ireland. But this dimension may gain more importance over the coming years as companies gain a better understanding of measuring their new product development practices and successes. However, respondents were aware of the poor and best characteristics associated with the metrics dimension. This suggested that although there was general awareness about this particular dimension, it did not merit sufficient investment. The small size of New Zealand companies may not warrant a standard NPD process as smaller, agile companies can better adapt to changes in market situations than bigger companies. There was also a general understanding of the poor, good, better and best practices associated with each of the seven dimensions of NPD identified in this research.

The comments and feedback section to the survey indicated that respondents felt that some sections of the survey were quite complex and some of the questions were more suited to big companies rather than SMEs.

5. RECOMMENDATIONS FOR INDUSTRY

The research indicated that there was general awareness or understanding of the poor, good, better and best characteristics of NPD in New Zealand. The research suggests that SMEs would be well served by including product development and/or

its elements as part of the company's mission statement. Support for product development activities should be inculcated into the company culture and start from the top. As the research indicated, it is important to have a clear product development strategy and the management should champion its cause. Process did not rank highly among the SMEs involved in this research. They generally tend to think that structured processes are more important for large companies, as a form of control management. However, this aspect of new product development should not be ignored completely. Although it has been suggested that SMEs being small and agile tend to make decisions on the go and a formal process may not be necessary, it is recommended that companies have a process that is simple and flexible to suit their company size and product type.

There seemed to be a greater awareness of strategy, research, process and commercialisation among the SMEs involved in the research but not so much about metrics. Metrics and performance measurement is an area that SMEs should work on in order to gauge their current performance and set targets for improvement. It is important to have tools to measure product development success in order to improve on shortcomings. This is an area of NPD that requires more work in the coming years in New Zealand companies.

5.1 Future Research Suggestions

An applied study on the comparison of large enterprises and SMEs around their NPD practices and their perceived importance of the seven dimensions of NPD practices identified in this research would be a useful study. This could provide opportunities to explore the importance of process in large companies and whether there are any differences in the way some of the seven identified dimensions are applied.

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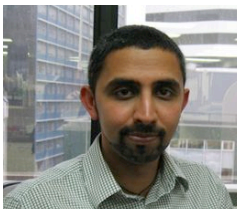
BIOGRAPHICAL SKETCH



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Aruna received her PhD in Product Development from Massey University, and has supervised several postgraduate students. She is part of the Innovationz group, a team of researchers funded by the NZ government to support local manufacturers enhance their product development practices.