NEW PRODUCT DEVELOPMENT PERFORMANCE: 
THE CASE OF A SMALL CANADIAN AUDIO COMPANY¹

This paper is based on a study into new product development in the high-end audio industry during which 21 British, Japanese and North American companies were benchmarked. The original research sample contained data on product development performance and practice obtained from 31 new product development projects. Performance was gauged by several measures, including lead times, cost and schedule adherence, internal and external quality and product profitability. In this paper we give a close look at two projects that had achieved performance levels that were remarkably different even if they were conducted within the same small Canadian audio company. Our results suggest that some of the characteristics of small companies may favor new product development performance, providing that the company evinces a certain level of formalism.

Introduction

Many observers claim that pressures of global competition, the fragmentation of markets into smaller segments, and the rapid pace of change in many industries, mean that companies’ product development capabilities are crucial determinants of business success (Brown & Eisenhardt, 1995; Clark & Fujimoto, 1991; Schilling & Hill, 1998). As organizational success oftentimes depends on the timely and consistent introduction of new products, it is unsurprising that the new product development (NPD) literature contains many prescriptions for high performance product development (Brown & Eisenhardt, 1995; Clark & Fujimoto, 1995; Crawford, 1992; Griffin, 1997; Lee, Lee & Sonder, 2000; Loch, Stein & Terwiesch, 1996; Parnaby, 1995).

However, there are many difficulties in assessing the effectiveness of development activities (Schumann, Ransley & Prestwood 1995; Loch, Stein & Terwiesch 1996), aside from the difficulty of defining the concept of ‘success’ in new product development itself. For example, recognizing that innovation has multiple dimensions, Gopalakrishnan (2000) distinguishes between rapid new product introduction, namely innovation speed, and the number of new products introduced, that is innovation magnitude. However, speed and magnitude do not capture

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the full extent of successful new product development. For example, an engineering function may be very good at rapidly developing numbers of new products, yet these products may fail to meet customers’ expectations and/or generate significant revenues and profit. Although studies have examined the relationship between product development processes and product success (Clark & Fujimoto 1991; Cooper & Kleinschmidt 1996), difficulties in assessing success have meant that the focus is often on process performance, as indicated by measures such as leadtimes, engineering hours and late design changes. Indicators of how the product is received in the market are often neglected in such studies.

This paper reports the findings of a study into new product development performance and practice. The study focused on the problem of measuring the performance of new product development processes. We specifically set out to take multiple measurements of performance and to investigate the associations between them. The results questioned whether it is sensible to adopt a unitary conception of ‘good’ new product development, and imply that product development performance may be better conceived as a profile where high performance on some elements, perhaps of necessity, means lower performance on others. This points to a need to conceive of the product development process as one in which there are trade offs between various performance dimensions. While some commentators believe in the existence of a global formula for successful NPD (Lee, Lee & Sonder, 2000), our results question the existence of universal best practices and indicate that different companies, in different contexts, manage new product development differently. In this paper, we look at the particular ways of doing things of a small Canadian audio company.

**Theoretical Background**

**New Product Development Practices**

Practices supportive of successful product development, whether judged by product or process performance, may be analysed at a number of levels, the two main levels being the company and the individual development project (Wheelwright & Clark 1995; Clark & Fujimoto 1995). Good practice has been characterized by team-based organization and product champions (Markham & Griffin, 1998; Wheelwright & Clark 1995); formalized (but flexible) design and development processes (Iansiti 1995); cross-functional integration (Cooper 1995; Dimanescu 1992; Keller 2001, McDonough, 2000, Tatikonda & Montoya-Weiss, 2001); and high autonomy and authority on the part of project leaders (Clark & Fujimoto, 1991; Crawford, 1992; Jassawalla & Sashittal, 2000).

The organization of development teams within the NPD process has received extensive attention (Wheelwright & Clark 1995). In particular, relatively autonomous, multi-functional teams have been advocated as routes to effective product development. However, it is recognized that although project team organization is significant, so are appropriate techniques of planning, controlling and communication (Clark & Fujimoto 1995; Munns & Bjeirmi 1996). Concurrent engineering has been widely advocated as a tool for reducing time-to-market, as has the related practice of overlapping different stages of the development process (Birou & Fawcett, 1994; Haque & Pawar, 2001; Iansiti, 1995; Thomke, 1997), although McDermott & Handfield (2000) have recently suggested that concurrent development activities are not suitable for radically new projects.

Given that many products comprise a high proportion of components from suppliers, the ability to manage interactions with external parties is also clearly important. Good practice is said
to involve the early integration of customer requirements into the design process (Gruner & Homberg, 2002; Huang, Soutar & Brown, 2002; Khurana & Rosenthal, 1997; Neale & Corkindale, 1998; Souder, Buissson & Garrett, 1997), the extensive involvement of suppliers (Birou & Fawcett, 1994; Handfield et al, 1999; LaBahn, 2002; McGinnis & Vallopra, 1999) and the early inclusion of manufacturing personnel in concept generation (Srinivasan, Lovejoy & Beach, 1997; Ettlie, 1995; Swink, 1999). Such actions facilitate the inclusion of down-stream information at the front-end of the process, thereby decreasing the probability of problems later in the project when solutions may be much more costly.

Strong supplier relationships, it is claimed, are linked to growth and profitability (Karlsson & Ahlstrom 1996). There are a number of reasons for this. Supplier involvement in the cost-determining early stages of the design process allow customers access to suppliers’ technological and design expertise. Long term commitment from a buyer to suppliers encourages suppliers to be more creative, to accept risk and to make investments in technology and R&D relevant to that buyer. Close relationships facilitate communication of greater quality and consistency between buyers and suppliers than do distant, antagonistic ones (Birou & Fawcett 1994).

Cusamano & Nobeoka (1998) emphasize the need to consider product development projects as part of a portfolio. They argue that good practices at project level, such as those described above, should be combined with a multi-project thinking, allowing organizations to make the best out of potential connections between projects that share technologies and components.

Some authors have combined the above practices to create integrative models of new product development. Brown and Eisenhardt’s (1995) Academy of Management Review article is probably the best known example of this and has inspired a large amount of research (for example, Song & Montoya-Weiss, 2001). Similarly, Cusamano & Nobeoka (1998) distinguish between what they call “lean product development”, a model which combines many of the practices described above and more traditional “functional product development” in which there are lightweight project coordinators, high levels of in-house engineering and less need for cross strong functional integration.

**New Product Development Performance**

In this paper, new product development performance is conceived as a multidimensional concept that includes the performance of the development process itself, the performance of the product, and financial performance. The latter is considered as an outcome of both process and product performance (Brown & Eisenhardt, 1995). Product performance refers to the success of the product in the market place, and addresses whether the product development process has led to the creation of a product that is attractive, functional and reliable. This is what Brown & Eisenhardt call the “fit with market needs” (1995:34). Product performance can be gauged by indicators such as sales and market share, the number of awards received, and the number of customer returns. In their study of NPD in the automotive industry, Clark & Fujimoto (1991) used a “total product quality” indicator based on general measures of customer satisfaction. In their recent review of research in product development, Krishman & Ulrich (2001) argue that different academic fields differ in the emphasis they place on different metrics of product development performance. For example, research conducted from a marketing perspective tends to focus on the “fit to market” while Engineering Design is primarily concerned with the “form and function” of the product. This study attempts to integrate these perspectives.
Indicators of new product development process performance typically include schedule and budget adherence (Keller 2001), as well as lead time (or speed) and productivity (Brown & Eisenhardt, 1995; Clark & Fujimoto, 1991; Eisenhardt & Tabrizi, 1995), with Iansiti (1995) distinguishing between ‘concept’ lead time and ‘development’ lead time. As mentioned above, external quality is a key indicator of the performance of the product developed. However internal failure rate can also be regarded as a measure of the performance of a development process. Indeed, it has been estimated that as many as 85 per cent of manufacturing problems have their genesis in poor initial design (Schonberger 1982). A consistent new product development process should result in fewer manufacturing problems and, thus, in fewer requests for engineering changes.

Figure 1 illustrates the conceptual framework used for this research. In keeping with the literature reviewed above, the proposed model focuses on factors that the literature suggests the process, product and financial performance, such as concurrent engineering, the early inclusion of the views of manufacturing, co-location, stability of team membership, good communication, project planning and control, strong project leadership and so on.

Methods

Data to test this research framework were gathered during a benchmarking study of the new product development processes of 38 consumer electronics firms in Japan, North America and the UK. The study followed the style and approach of Clark and Fujimoto’s (1991) study of the automotive industry, but focused on consumer electronics (specifically, high-end audio equipment for home use). The emphasis was on like-for-like comparison across new product development projects.
FIGURE 1. Research Framework

Practice in NPD projects

- Co-location
- Size of development teams
- Composition of development teams
- Interaction between the members of the team and others in the organization
- Methods of information recording and capture
- Concurrent engineering
- Strong supplier relationships
- Project planning and control
As the focus of the research was on the organization of the new product development process, the study targeted products sufficiently complex to require a range of specialist skills to develop and produce them. Audio products comprise internal functional electronic components, requiring the skills of electronics, software, mechanical and acoustic engineers as well as those of industrial designers – there are therefore a significant coordination and integration challenges. Audio products also require a substantial number of bought in parts, so they are also suitable for investigating supplier involvement in the development process. Being manufactured products, high end audio products also reveal issues around the manufacturing/development interface.

High end audio companies were identified, approached, and an initial meeting and interview requested. These interviews typically lasted between two and three hours, and reviewed the nature and characteristics of each firm’s new product development process. They were usually conducted with the product development director or manager. In line with the integrative research framework, a protocol containing open-ended questions about the company’s general approach to new product development was used to conduct these initial interviews.

As Table 1 shows, a total of 38 companies participated in the first stage of the research, comprising eight companies located in Japan, 14 companies in the UK, and 11 in United States and five in Canada. At the end of this process, recently launched products were identified for inclusion in the subsequent and more detailed data collection process, and companies were invited to take part in a full benchmarking exercise. Participation in this exercise involved completion of two questionnaires. The first of these covered company characteristics and the characteristics of the product development process in the company or business unit as a whole. The second questionnaire covered a recently completed new product development project, and comprised measures of development performance and practice. Each company provided data on one or two projects; a separate questionnaire was completed for each project. A total of 21 companies participated in the full benchmarking exercise, comprising a total of 31 new product development project. Companies were given several weeks to complete the benchmarking questionnaire. The research team then returned to each site for a second visit, and reviewed the completed questionnaires on site. On average this review of the questionnaires took a complete day and allow the research team to gather qualitative material to complement the benchmarking data. All the interviews were taped and transcribed. In combination, the data from the business unit and project questionnaires yielded a dataset of 473 fields per case.

<table>
<thead>
<tr>
<th></th>
<th>Total no of Companies interviewed</th>
<th>No of companies (benchmarking data)</th>
<th>No of NPD projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>8</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>UK</td>
<td>14</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>US</td>
<td>11</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>Canada</td>
<td>5</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>21</td>
<td>31</td>
</tr>
</tbody>
</table>

Comparison between the two product areas (loudspeakers and amplifiers) revealed a number of significant differences on the performance measures, due to inherent differences in the characteristics of the products. Performance measures were therefore converted into standard (z) scores for each product. Simple regression analysis between these multiple performance indicators indicated some clusters of inter-correlation. However, it was striking that overall there
did not appear to be a single common performance factor with which all the performance measures correlated. This initial result questions implied that product development performance may be better conceived as a profile where high performance on some elements, perhaps of necessity, means lower performance on others. Moreover, the case of the Canadian company presented in this paper suggests that new product performance can vary considerably from one project to the other within the same company.

While the quantitative results of our study have been presented elsewhere, in this paper we mainly use the qualitative material collected in a small Canadian audio company, where a number of interviews were conducted before and after the benchmarking exercise, over a period of six months. All the interviews were recorded and transcribed and the transcriptions were analyzed to identify potential determinants of new product development performance. The results of the analysis are presented in the next section.

Results

Company Profile

Located in a small industrial estate of a suburban city, the company studied was an entrepreneurial firm employing eight people and owned by a music enthusiast MBA graduate with a mechanical engineering background. At the beginning of the first interview, the company owner recalled how he succeeded in repairing the transmission of a Honda mini-trail vehicle when he was a child and he concluded by saying the he “had an incredible feeling” and added that “this was a turning point in his life.” This company was typical of other small companies in the research sample in that the personality and taste of the owner seemed imprinted on the organization. Indeed, small audio companies are often more technology than market driven and develop audio products that their owner “would like to have it their living room”. The small Canadian company’s owner used to work as a manufacturing manager in an electronics component company that supplied the audio firm that he eventually purchased. He initially became a partner to the audio company founder but after a year of collaboration the two partners came to realize that they could no longer work together. The actual owner explained that he had a long-term expansion vision while the founder essentially wanted to earn money.

As indicated in table 2, the company was the smallest of the sample in terms of annual sales and production volume, but showed an average profitability and export ratio. It should be mentioned that North American companies in our benchmarking sample showed the highest profit margins. A number of the Japanese companies had been making a loss in the two to three years preceding the study, and the overall average of profit margin on sales for Japan was 0.9 percent, approximately one-seventh of the figure for the US. The relatively buoyant condition of the US economy at the time the study was conducted may be one explanation of this, as the North American firms were relatively dependent on a domestic market, with the lowest export ratio of the three countries. The small Canadian company showed the highest share of the domestic market in the sample, however some companies in the sample defined their markets very narrowly, which had the effect of apparently increasing their estimate of market share.

The last three measures presented on table 2 are indicative of the general approach to new product development within the small Canadian company compared to the rest of the sample. In general, Japanese companies clearly showed more innovative activity than their UK or North American counterparts, specifically in the percentage of sales from recently launched products, patents, and the number of people - and products - in development. However, when the number of
development projects in progress was divided by the number of development staff, the Japanese firms show more modest levels of activity - less than one development project per member of development staff. Interestingly, as shown on table 2, this measure accounted for 4.2 in the small Canadian company studied here, which is above the sample average. Moreover, this small company also had the highest percentage of sales spent on new product development as a percentage of sales, reflecting the fact that a large proportion of employees working in R&D, that the owner himself was very much involved in R&D, and that the assembly employees were hired by a subcontracting firm operating on audio company premises. However, the percentage of sales from products launched in the last two years was lower than average.

Table 2. Company Characteristics

<table>
<thead>
<tr>
<th>Measure</th>
<th>Average</th>
<th>Lowest</th>
<th>Highest</th>
<th>Company’s position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual sales (averaged over the last three years)</td>
<td>$140,488,470</td>
<td>$616,666</td>
<td>$1,534,668,400</td>
<td>$616,666</td>
</tr>
<tr>
<td>Profit as percentage of sales (averaged over the last three years)</td>
<td>5.5%</td>
<td>-0.3%</td>
<td>32.1%</td>
<td>6.17%</td>
</tr>
<tr>
<td>Number of employees (three year average)</td>
<td>248</td>
<td>5</td>
<td>2,048</td>
<td>8</td>
</tr>
<tr>
<td>Production volume (in units), last year</td>
<td>990,695</td>
<td>600</td>
<td>11,931,500</td>
<td>600</td>
</tr>
<tr>
<td>Percentage of sales exported</td>
<td>52.3%</td>
<td>10.0%</td>
<td>94.0%</td>
<td>40.0%</td>
</tr>
<tr>
<td>Market share in the domestic market (average for last three years)</td>
<td>8.6%</td>
<td>1.0%</td>
<td>30.0%</td>
<td>30.0%</td>
</tr>
<tr>
<td>Expenditure on new product development as a percentage of sales</td>
<td>5.9%</td>
<td>1.3%</td>
<td>16.0%</td>
<td>16.0%</td>
</tr>
<tr>
<td>(last financial year)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of product development projects started per member of development staff (last three years)</td>
<td>2.4</td>
<td>0.2</td>
<td>12.0</td>
<td>4.2</td>
</tr>
<tr>
<td>Number of people in R&amp;D</td>
<td>36</td>
<td>2</td>
<td>296</td>
<td>4</td>
</tr>
<tr>
<td>Percentage of sales from products launched in the last two years</td>
<td>55.0%</td>
<td>8.3%</td>
<td>97.0%</td>
<td>30.0%</td>
</tr>
</tbody>
</table>

While Canadian tax saving programs are an incentive to invest in R&D, this small company high level of R&D expenditure also very much reflected the owner’s vision. During the first interview, the owner insisted on how his objectives were different than that of the founder. The latter had developed an amplification technology “without any overall feedback” which he wanted to make quick money with, while his partner, the actual owner, wanted to exploit this competitive advantage with a long-term perspective. It should be added that many audio companies visited in the course of this study boasted about the unique technological characteristics of their product. However, the small Canadian company seemed to have genuine reasons to be proud as a French audio magazine had made a very good review of their product and its “no feedback” characteristic.

It appeared that the MBA graduate had brought formalism to the small company. When he acquired it, he conducted a questionnaire-based market survey (an approach he has learned in his marketing class) and prepared a five-year strategic plan. The new owner wanted to understand why the company did not enjoy the growth that he thought it could have, given the quality of the products offered. He realized that the product suffered from an aesthetic problem, that it did not
look sophisticated enough for the European market. With its new owner, the company seemed to have become much more market driven. During the first interview, the owner insisted on the large R&D effort that the company was making and his remarks were later confirmed by the benchmarking data on R&D expenditure. The personal involvement of the owner in the new product development process was visible when he interrupted our interview to chair an engineering meeting that was held to discuss how the design team could modify the specifications of an integrated amplifier that they were currently developing, in order to be able to sell it at lower price point than their competitor.

Projects Performance

The case of this small Canadian company was quite unique since, as indicated in table 3, its integrated amplifier project (Project 1) achieved the worst performance in the sample in terms of schedule adherence, while its power amplifier project (Project 2) achieved the best performance for the same indicator. Interestingly, during the questionnaire review interviews, the respondent did mentioned that these two projects represented the best and worst of the company, in terms of product development process performance. The analysis of the benchmarking data later confirmed this. The small Canadian company’s owner commented on the technical problems experienced with the integrated amplifier (Project 1). While these problems considerably lengthened the integrated amplifier manufacturing process, the sound quality was nevertheless very good. During one interview, the company’s owner mentioned that this product had achieved market success and again this was later confirmed by the benchmarking data. Indeed, table 3 indicates that the deviation of actual sales compared to forecast sales was more that 200% during the first six months of production. Moreover, as mentioned above, this product was praised in a French hifi magazine.

In keeping with our research framework, the case of the small Canadian company strongly suggested that new product development performance should be conceived as a multidimensional concept that includes the performance of the development process itself, the performance of the product, and financial performance. Indeed, while the development process performance was extremely low during the integrated amplifier project, the output in terms of product quality and product sales was very good. However, while the small Canadian company showed a good profitability, it was experiencing typical cash flow problems, which the owner attributed to the large R&D expenditure and the difficulty in raising money. He was concerned about the hard time that the company could have to finance the sales increase that he was foreseeing at the time of the study.
Table 3. Projects Performance

<table>
<thead>
<tr>
<th>Measure</th>
<th>Average</th>
<th>Lowest</th>
<th>Highest</th>
<th>Project 1</th>
<th>Project 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommended retail price</td>
<td>$3,191</td>
<td>$545</td>
<td>$13,722</td>
<td>$2995</td>
<td>$3295</td>
</tr>
<tr>
<td>Number of parts per unit</td>
<td>787</td>
<td>270</td>
<td>1,564</td>
<td>300</td>
<td>270</td>
</tr>
<tr>
<td>Percentage of parts used in the previous generation product</td>
<td>24.2%</td>
<td>3%</td>
<td>76%</td>
<td>80%</td>
<td>96%</td>
</tr>
<tr>
<td>Number of months for which the concept had existed ‘ unofficially’</td>
<td>117.5</td>
<td>4.0</td>
<td>1,040.0</td>
<td>99.9</td>
<td>8.0</td>
</tr>
<tr>
<td>before development began</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concept to production time (weeks)</td>
<td>73.2</td>
<td>21.9</td>
<td>316.4</td>
<td>52.0</td>
<td>21.9</td>
</tr>
<tr>
<td>Percentage deviation from plan:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Issuing of requirements definition</td>
<td>-29.8%</td>
<td>-197.7%</td>
<td>0.0%</td>
<td>-197.7%</td>
<td>0.0%</td>
</tr>
<tr>
<td>- Freezing the design specification</td>
<td>-12.4%</td>
<td>-39.9%</td>
<td>0.0%</td>
<td>-39.9%</td>
<td>0.0%</td>
</tr>
<tr>
<td>- Start of pre-production</td>
<td>-3.6%</td>
<td>-46.8%</td>
<td>62.8%</td>
<td>-33.2%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Concept to production time - deviation from plan</td>
<td>-5.4%</td>
<td>-49.0%</td>
<td>+60.9%</td>
<td>-49.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Total engineering hours - unadjusted, excluding manufacturing</td>
<td>3,932</td>
<td>37</td>
<td>8,910</td>
<td>632</td>
<td>37</td>
</tr>
<tr>
<td>Total engineering hours - excluding manufacturing adjusted for</td>
<td>4,347</td>
<td>37</td>
<td>11,082</td>
<td>632</td>
<td>37</td>
</tr>
<tr>
<td>outsourcing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engineering hours per new part</td>
<td>17.1</td>
<td>3.4</td>
<td>64.5</td>
<td>10.5</td>
<td>3.4</td>
</tr>
<tr>
<td>Engineering hours per part</td>
<td>4.2</td>
<td>0.1</td>
<td>9.3</td>
<td>2.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Product cost as a percentage of recommended retail price</td>
<td>32.2%</td>
<td>20.1%</td>
<td>50.0%</td>
<td>31.6%</td>
<td>31.3%</td>
</tr>
<tr>
<td>Deviation of actual product costs (per unit) compared to forecast costs</td>
<td>6.3%</td>
<td>-12.1%</td>
<td>50.0%</td>
<td>-2.1%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Number of weeks for volume production to settle to target levels of</td>
<td>5.2</td>
<td>0.0</td>
<td>17.0</td>
<td>1.0</td>
<td>2.0</td>
</tr>
<tr>
<td>productivity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of weeks for volume production to settle to target levels of</td>
<td>6.7</td>
<td>0.2</td>
<td>17.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>quality</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>‘Right-first-time’ rate during the early months of production</td>
<td>91.2</td>
<td>70.7</td>
<td>98.9</td>
<td>94.3</td>
<td>92.8</td>
</tr>
<tr>
<td>Deviation of actual sales in units compared to forecast sales in units</td>
<td>+56.6%</td>
<td>-10.0%</td>
<td>+233.3%</td>
<td>+233.3%</td>
<td>+25.0%</td>
</tr>
<tr>
<td>during the first six months of production</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

While our benchmarking questionnaire was designed to measure whether or not the so-called new product development best practices were used during the project studied, the use of open-ended questions during the interviews allowed us to gather more detailed information about the various companies’ ways of doing things. During the interviews, the small Canadian company came across as considerably formalized. Indeed, the obligation to rigorously keep track of the number of development hours for tax saving purpose seemed to favor the formalization of the product development process as did the management training of the owner. MBA graduates were rare birds in the smaller audio companies of our research sample.
When commenting on one item of the benchmarking questionnaire that measured the reliance on formal and informal methods for recording of information about how problems were resolved during the development process, the company’s owner mentioned “Everything we do, everything we need to write, to draw, goes in the product file. If there were specific problems it will go in there as well. You will have, revision one, revision two, revision three and all the changes between all revisions.” Asked whether the company had always operated like this, the owner said that before he arrived “there was nothing.”

Referring to how the company had moved from a technology to a market driven company, the owner said “we do it the hard way”, meaning that the company really made the effort to take the information from the market, through warranty cards and market surveys, and apply it to the product they were developing. The respondent thought that market surveys were not typical in small high end audio company, and the interviews that we carried out in the industry tended to confirm this.

As mentioned earlier, cross-functional integration has been advocated as a key route to effective product development in the literature. However, cross-functional integration could be interpreted as an attempt by large and somewhat bureaucratic organizations to emulate smaller ones. The implementation of digital design and cross-functional integration at Boeing during the 777 project (Brown et al., 2002) is an example of this: through the new design practices, the aerospace manufacturer could enjoyed some of the benefit of the smaller and more organic organizations that it was in the late 1940s. Clearly at the small Canadian company, the owner played an integrative role and therefore the new product development process was naturally multi-functional.

Authority on the part of project leaders is also identified as a key determinant of new product development performance in the literature. It could therefore be argued that the small Canadian company benefited from its owner active involvement in the new product development process. During one interview, the owner explained that on that very day he had wrote a message to express his dissatisfaction to one of the design engineer who had recently made a mistake and, as a result, a supplier had delivered a wrong component. The owner commented that he “really wanted zero design defects”.

It could be argued that the way the small Canadian firm went about developing products, using strong leadership, a multifunctional approach, and a formal and market driven process, had a positive impact on its new product development performance. Therefore, how could this seemingly well-organized company manage to deviate so much from the integrated amplifier (Project 1) development schedule? Moreover, could the excellent performance on the power amplifier project (Project 2) mean that the small Canadian firm was able to learn from its own mistakes?

In order to control for the degree of project newness, the very first question of our project-level benchmarking questionnaire, was whether the project was a radical departure from previous products offered by the company, or a major or minor adaptation from previous product. The integrated amplifier was indeed a radical departure from previous project and, according to the owner, this was the key reason why it was so late:

This was quite a radical departure because we decided to give a new look to the product. Moreover, the technology was new and it was the first product using infra-red. The design philosophy used was also different as we did not use any protective circuitry around some component in order to get a better sound. Also, as we wanted a new
aesthetic, we had to look for a long time to find the right chassis supplier. We also changed our mind on a number of issues after pre-production started, so there was a slippage between the scheduled date for volume production and the date it actually started. We were faced with a product that could not be manufactured like the others we made. It was all new for us and it took us some time to react to this. I also misjudged “Murphy”: various things happened, a screw that was too long in one place, a connector that was too short in another place. And because of all this, there was a slippage of about 30 to 35% from the planning. But this was an exceptional case that does not have anything to do with the other projects. However, this product did well on the market. We sold more units of this one than of the other products in this series that were less expensive. This was a bit of a surprise. And because we sold a lot, we could quickly get some feedback from the market.

As indicated in table 3, the power amplifier (Project 2) was the only one of the 31 projects in the benchmarking sample that achieved perfect schedule adherence. The project also achieved perfect manufacturing cost adherence (“We were dead on”, commented the owner), which was also very good although not the highest score in the sample. The trigger to start this new product development project was a forthcoming audio show, where the company felt the need to answer the market need for a less expansive product in an existing product category. While the company sold 25 percent more units than planned during the first six months of production, this deviation was smaller than in the case of the integrated amplifier (Project 1) that have achieved outstanding market success, as indicated on table 3.

“It was a piece of cake”, commented the owner of the small audio company: “It was in a field that we knew well, there were not many uncertainties in the project, unlike Project 1 in which there were four or five technological aspects that were new for us. It should be added, however, that power amplifiers are products that are simpler than integrated amplifiers, as they do not require any software. Power amplifiers solely amplify sound and they do not “control” elements such as the input that will be selected, the balance level between right and left, whether the tape monitor is activated, or whether the mute is on, etc.

There is no argument that Project 2 was much less complex and much less new than Project 1. Nevertheless, the performance achieved on the power amplifier project, as well as the general performance of the small company presented here, suggested that this organization was good at retaining knowledge. In this company, it was more difficult to develop products that were radically new, however when the development effort took place in a simpler domain that the small company knew well, things had all chances to go smoothly. Whether it was due to the formal management training of the owner or the Canadian tax saving programs, the company appeared to be somewhat formalized. The reliance on formal mechanisms to record information about how problems were resolved from one project to the other seemed to favor knowledge retention. However, formal mechanisms of information recording have their limitations in terms of knowledge retention in new product development. Cusumano & Nobeoka (1998) have distinguished between two types of knowledge: the local knowledge, which is related to the development of specific component, and the system or integrative knowledge, which is related to the integration of different components. They argue that local knowledge can be recorded with archival-based mechanisms. System or integrative knowledge, however, is much more complex to manage because much of it is tacit knowledge embedded in people, developed through routines that they perform. However, this is a challenge that must be faced according to Iansiti and Clark (1994), who argue that the integrative capabilities of an organization are based on its ability to generate, merge and accumulation knowledge. The owner of the small audio company presented in this paper seemed to have this capability, developed through his role of heavy weight development team leader and functional integrator. Indeed, during one of the interviews he
commented that “if it is a product of which I master every elements, I could design it very quickly.” Interestingly, it was not clear whether he was referring to his own or his company’s design capabilities. Moreover, if the company were to become larger, this ability to generate, merge and accumulate knowledge would most probably be lost.

Conclusion

Using benchmarking data and qualitative material, this paper has explored a number of product development performance and practice issues within a particular industry. The strength of the findings is inevitably limited by the small number of projects in the international benchmarking sample and by the fact that we gave a detailed look at a single company. Nevertheless, the results pose some important questions about new product development practice and performance. The findings suggest that new product development performance may be better conceived as a ‘profile’, with individual projects high on some indices and low on others, rather than as a unitary entity. This is in keeping with Lambert & Slater (1999) who have questioned the correlation between schedule adherence in new product development and subsequent profit and market share. Moreover, looking at a small company has led us to realize that some of the new product development best practices, such as co-location and multi-functionality, are attempts to emulate characteristics of smaller and more organic organization. This may mean that small firms have intrinsic advantages in new product development. However, to enjoy the full benefit of these advantages, a certain level of formalism of the product development process needs to be achieved. It should be added that the lack of financial resources can jeopardize small companies’ survival, no matter how good and experienced they are at developing new products.

References


