

**An Integrated Model for Managing Innovation in the Early Stages of New
Product Development in SMEs**

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Abstract

This paper centralises the management of innovation in the early stages of the new product development (NPD) process. The purpose of this paper is to describe the critical episodes that enabled an SME to successfully manage the development of new product concepts from inception and, in so doing, presents implementable guidelines that can be used by SMEs to manage the delivery of creative and attractive new product concepts in the early stages of NPD. Action research was used to conduct a three-phase methodology involving a single case study. First, a diagnosis phase investigated the nature of innovation within the company. In the second phase, a series of iterative interventions by the researchers provided participants with both the theory and practice skills to manage innovation. The third phase involved an evaluation of the extent to which change in managing innovation in the company had occurred. The findings highlight a vast and sustained improvement in Dudley Europe's innovation management of their early NPD stages.

Introduction

It is only through the creation of new products that most small firms can hope to sustain growth and profitability in the long term (Booz-Allen and Hamilton, 1982). However, new product development (NPD) is a difficult task and failure rates of new products are regarded by most as being unacceptably high (Cooper, 1988; 1999). Why some products fail and others succeed has been the topic of a myriad of investigations (Calantone and Cooper, 1979; Madique and Zirger, 1984) dating as far back in time as the 1964 NCIB study (National Industrial Conference Board, 1964). While it would be erroneous to attribute product success to any single factor, there has been an emerging consensus that the factors which contribute to success are determined much earlier in the project's life, explicitly in the early or pre-development stages (Booz-Allen and Hamilton, 1982; Stevens et al. 1999; Khurana and Rosenthal, 1998; Cooper and Kleinschmidt, 1996; Cooper, 1993; Lynch, 2007). Developing a new product that delivers superior benefits presupposes an understanding of technical and market needs, company resource compatibility and product marketability, a process that should ideally be undertaken prior to the commencement of any actual development (Stevens et al. 1999; Cooper, 1988). Without this up-front homework, significant problems in later stages of the development process can be expected including likely product failure (Khurana et al, 1998; Cooper and Kleinschmidt, 2000). Indeed, the importance of predevelopment activities (idea

generation, idea screening, idea evaluation, concept development and testing) has been empirically validated by extensive surveys for quite some time (Cooper and Kleinschmidt, 1995; Cooper, 1994). However, despite the criticality of predevelopment activities to success, it is these stages that receive the least amount of management attention and resources, and more often than naught are only superficially carried out or even omitted (Cooper and Kleinschmidt, 1996; Cooper, 1988).

In a small firm context, relatively little empirical research indicates how small firms manage innovation in the early stages of NPD. Indeed, the primary focus of extant research has been on: (1) the large organisation (McAdam et al., 2007), (2) proving the importance of predevelopment activities to new product success, or (3) the pitfalls and factors conducive to innovation failure and success. The foregoing approaches have been criticised as providing limited insights into what management can or should do (Von Stamm, 2002). Further, as previously indicated in the small firm context, little research has been directed at the management of innovation during the critical predevelopment activities. Without a clearer understanding by academics of the managerial guidelines necessary to effectively transform ideas into product concepts, predevelopment activities will remain fuzzy and the creative benefits to SME's in practice will never be fully realised. Understanding the processes that enables a manufacturer to successfully build and manage innovation in their pre-development process is the focus of this ongoing study; the overarching outcome of the research is to present implementable guidelines that can be used by SMEs to manage the delivery of creative and attractive new product concepts.

This paper is organised as follows. In the next section, the study's action research design is presented which details the actions, diagnosis, interventions, and evaluation involved within the study's three methodological phases. The discussion in the second phase of the research presents an integrated framework for managing the innovation process in the early stages of the NPD process in SMEs. The paper concludes with a discussion on the research's limitations and future research directions.

Research Design

Participatory action research (PAR) was used to conduct this longitudinal study of managing innovation in the early stages of NPD. PAR builds on the idea that knowing about the subject under investigation cannot be imposed but must evolve in a collaborative mode as depicted in Figure 1. This action-oriented model involves diagnosis, intervention and evaluation phases that are often underpinned by principles of reciprocal collaboration and active consultant-client relationships (see Anderson et al. 2005). The collaboration extends to the joint planning and implementation of the project. The consultant-client aspect reflects the learning resources provided by action science (Argyris, 1995; Friedman, 2001). This approach allowed the participants of the study to engage with their own theories of action (at an intra and interpersonal level) in relation to how they have been managing innovation within the early stages of NPD, before attempting a collaborative intervention for resolving their innovation dilemma. The underlying assumption of this participatory method of investigation is: "if people can find the sources of ineffectiveness in their own reasoning and behaviour, or their own causal responsibility, they then possess some leverage for producing change" (Friedman, 2001:160). This fundamental assumption of action research involves continuous observation, reflection, planning and change, leading to continuous improvements in the organisational issue. In essence, PAR is concurrent with action; it is research in action, rather than research about action.

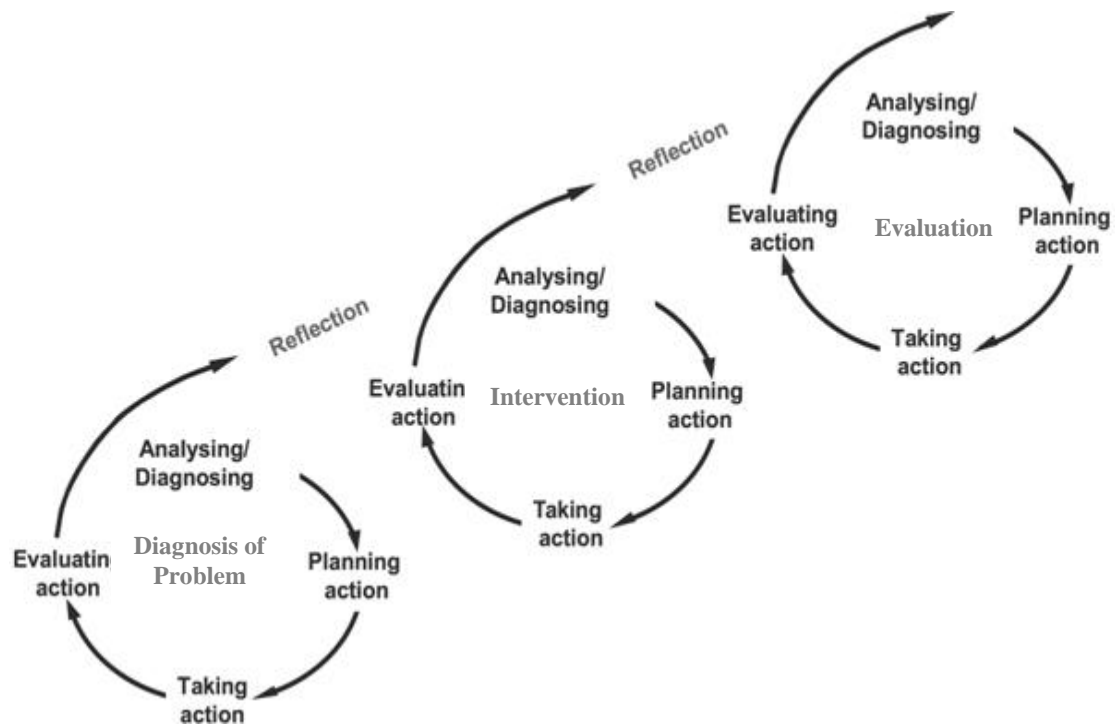


Figure 1. Action Research Cycle: Adapted from Coughlan and Brannick, 2005.

The action research methodology involved gathering data to inform a first (diagnosis) phase of research. This was followed by the second phase of research which involved a series of interventions that provided participants with targeted professional learning and development events for managing innovation in the early stages of NPD. Running in parallel with these two phases was an umbrella phase (Phase 3) which involved a continuous evaluation of the processes that had occurred in order to establish the extent to which: (1) change strategies had been implemented, and (2) learning related to the innovation dilemma and resolution had been internalised within the company. Nvivo, qualitative analysis software, was utilised by the researchers in order to manage the process of coding, retrieving, memoing and data linking.

The findings from Phase 1, and the theory-base associated with managing innovation in the early stages of product development, informed the nature of the interventions in Phase 2 which occurred between June 2009 and October 2009. To date, three iterative interventions have occurred.

Phase I – Diagnostic Stage

The first phase of the research began in June 2008 and ended in May 2009.

Three main sources were used to collect data from the research site: interviews, historical documents and observation of the NPD process. All in all, 11 interviews were conducted with the members of the Innovation Management Group (IMG) in order to ascertain their roles in the firm's NPD process and gain critical insights into the existing innovation process in the organisation. The personal interviews ranged in length from 1 hour to 3 hours each. An interview guide was developed before the interviews, yet the interviews followed an unstructured format. The individuals that were being interviewed were highly educated, competent executives and understood the innovation process in their company. The interviews had a very relaxed, conversational feel to them; it is perceived that rich, insightful data about the innovation processes emerged. As previously indicated, historical documentation was also reviewed. In total 102 documents, printed as well as electronic, were utilised. The researchers were allowed access to the idea generation and idea evaluation records dating back to a period of two years, December 2006-December 2008, which enabled the research team to track product ideas in the early stages of the process. Full data records representing the product development stages were only available for a period of 42 weeks – January 2008-December 2008. The product tracking allowed the researchers to become more familiar with the NPD process and, in turn, facilitated the researchers' close observation of the internal management meetings and other internal sessions. Access was also granted to the IMG meetings held every three weeks. These observations enabled the researchers to gain a clearer understanding of the internal culture and processes of the organization; further, it is felt that these regular interactions greatly assisted with building close working relationships between Dudley Europe management and the researchers through the development of mutual trust. In addition, being present at the IMG meetings also allowed the researchers to observe and evaluate the outcomes of the interventions.

Findings of the Diagnosis Phase: Understanding Innovation in the Early Stages of NPD at Dudley Europe

The family owned U.S. business, Dudley Inc., was originally founded in 1964 by James Dudley to develop a range of consumer products for the skiing market. In the 1970's, Dudley Inc. expanded into the consumer electronics market with the introduction of an award winning audio visual accessory. It was the success of this "genesis product" that first led the company to expand into the global market, with the establishment of a European manufacturing subsidiary based in Ireland. The subsidiary was set up as a manufacturing gateway into Europe for its computer accessory and audiovisual care products that were invented for the U.S. market. This meant that whatever products were innovated in the United States, Dudley Europe simply incorporated them as part of their product portfolio; an arrangement that led to the continuous expansion of Dudley Europe.

However, in the early part of this decade, the dynamics of the relationship between Dudley Europe and its parent company began to change. Dudley Inc. became increasingly aware that Europe was an independent market and what was successful in the U.S. market did not necessarily transfer to the European market. Consequently, many product introductions resulted in failure. For Dudley Inc., its European operation needed to become a stand-alone entity and not be consistently relying on the U.S. division to come up with new product ideas for market. In 2004, a decision was made that Dudley Europe would evolve from a manufacturing company to a strategic innovating company that independently developed its own products for the European Market. This decision was further compounded by the fact that due to global economic changes and increasing production costs, Ireland was fast becoming an unsuitable location for manufacturing and Dudley Europe outsourced its manufacturing to cheaper economies in the East. Dudley Europe needed to demonstrate that it could add value to the Dudley Group and innovation was seen as the mechanism to achieve this.

To develop NPD in the company, an Innovation Management Group (IMG) consisting of six senior managers was established. From the outset, it is important to realise that because Dudley Europe is a small firm consisting of 30 employees, NPD was not assigned to a specific department, but was the function

of all departments. Dudley Europe wanted to introduce a traditional stage-gate product development process consisting of idea generation, screening, concept development and testing, development and launch. To manage the process, two focal meeting groups were established. An IMG meeting (to meet every three weeks) was set up to manage the early stages prior to any actual development, while a weekly New Product Summary (NPS) meeting was designed to manage the movement of new product concepts from their development through to market. Expectations of developing successful innovations within Dudley Europe were high. However, within a short period of time, serious difficulties began to surface.

When new product ideas were introduced at the IMG meeting, the new concepts were discussed, evaluated, screened, cut or approved for further consideration at the same meeting. Although the new idea had just been explained to the team, it was criticised, screened and evaluated based upon limited (if any) market or technical knowledge. A culture developed at the meeting where critical go/no-go decisions were primarily made by strong personalities within the group who were more outspoken or who had seniority. Ideas suggested by senior individuals were more likely to be actioned faster, and pushed through to development without any in-depth screening being carried out, while ideas suggested by other members were heavily criticised based upon personal judgment. The consequence was that there was a lack of motivation from some of the team members to put forward ideas. For example, the Quality Assurance Manager and the Personnel Manager stated, respectively:

"I find it very disturbing to have my ideas criticised the whole time....there should be a space where you can put your ideas forward confidentially or in an environment that supports idea generation".

"Our ideas were being dissected there and then in front of our colleagues....all you got was criticism... criticism and more criticism....those meetings would kill any aspirations to be creative".

Regardless of other roles and responsibilities within the company, team members were put under considerable pressure to come to each IMG meeting with an idea for evaluation. The consequence was that the quality of ideas generated was poor, as individuals focused on having an idea for the meeting and getting on

with their daily responsibilities rather than developing a good idea for market. Moreover, the meetings were exclusively limited to just IMG members and, due to the longevity and familiarity between the members, stultification and entropy ensued. Under groupthink conditions, high levels of familiarity created a sense of unanimity amongst the innovation management team that suppressed the expression of any alternative perspectives or ideas, which, in turn, resulted in poor product concepts and group decisions for product development. Comments from the Personnel Manager succinctly illustrate the foregoing:

“We are a small company and we don’t have the resources to have a NPD manager or function, so the new product development responsibilities are divided amongst ourselves. This causes problems because people have their day jobs and then they have this added extra job of new product development...often your new product development tasks gets pushed aside because you are so busy in your day-job. Then all of a sudden you have a meeting to go to and you are expected to have an idea...so you’re rushing trying to come up with something before the meeting but you haven’t giving any time to think on it. So of course it is not going to be good...then you present the idea...it’s criticised, rejected and then after the meeting I go back to my real job and the cycle continues to the next IMG meeting. The hardest thing is trying to get the time to think about ideas for the meeting....there is a need for space in our job to think about new ideas”.

Moreover, the three weekly intervals between IMG meetings limited flexibility and prohibited the progression of new product ideas through the process. At the meetings, action items were issued to team members according to their skill set and job roles within the firm, with a view to being discussed and evaluated at the following meeting. However, it often occurred that, due to specific responsibility in the day to day running of the company or due to the absence of individuals at the meetings, NPD tasks were not carried out for subsequent meetings and product development decisions were continuously postponed. Indeed, the CEO commented:

“The reason we end up with a lot of slippage in our innovation process is essentially because people arrive at the meeting and they haven’t done what they were supposed to do”.

Despite the small size of the company, interaction between team members on NPD issues outside the scheduled meetings was exceedingly light. Generally, NPD was not discussed outside of the formal meeting setting. The consequence of the over reliance on the staged meetings to manage NPD meant that concepts remained in the early stages of the process, on average, for a period of 9 months and often entered the development phase with critical decisions still outstanding.

"A lot of time is spent in these early stages and it's because we're just not organised enough at that point. We just don't have a system in which we make decisions...we're stuck from IMG meeting to IMG meeting without really coming to a head...there is no kill/go points in our decision process... there are so many ideas that are never going to make it to the light of day and it takes us so long to get to the point where we eventually realise, you know what...we're wasting our time on this...let's get rid of it!" (Sales and Marketing Manager)

The concepts that emerged from the early stages progressed to development and the weekly NPS meetings. Because of their engineering and manufacturing background, Dudley Europe was far more comfortable in the development phases than in the fuzzy front end and management attention peaked during prototype build, pilot production and manufacturing ramp up. Further, because there was insufficient feasibility testing, product screening or concept development carried out in the early stages of the process, the development stages of the process were very time consuming and inefficient, often resulting in products being developed that had no market need, profitability or sustainability. Indeed, a common occurrence was culling a product just before launch due to the discovery of vital market or technical information that could have been easily uncovered in the early stages of the process. Even when the information suggested that a product should be culled, there was a tendency amongst the development team to ignore it and re-design the product in the hope that it might become a success. The Engineering Manager highlighted that:

"It's in our nature to try and design something through building it rather than having an idea of what we actually want".

As a consequence, the development life-cycle of their products became so truncated that it took approximately 7 months to bring a concept to market, which meant that from idea generation to launch took approximately 16 months compared to a 3 month turnaround for their competitors.

"We've spent so much time on projects that the decisions should have been made earlier to snuff them out, but we went doggedly on thinking we could make something of this product. To me this is where we have lost most of our energy and enthusiasm on opportunities for success with the product: we spent too much time making the final decision rather than arriving at the final design freeze; we just kept on designing...we could have saved ourselves so much time and money". (CEO)

Finally, despite every effort to set up a structured process with specific stages, the NPD process that evolved in Dudley Europe was very ad-hoc, with no differentiation between stages, little decision making and modest or no management of the process. Consequently, Dudley Europe invested

considerable time, money and effort into a process that yielded very little benefits to the company – as evidenced by the CEO's remarks:

“We start with the product idea and we murder it all the way through, up to where we kick it out of the room or we nearly end up making the product here at the table. There isn't a segmentation of the different stages of treating the concept, of bringing it through an organised process to get it to the end and to avoid unnecessary and undue waste of time at different stages...”

In light of the foregoing diagnostic, three major interventions were designed by the researchers in order to establish an integrated framework for managing the innovation process in the early stages of NPD. The following project narrative traces the introduction and establishment of this framework.

Phase 2: Interventions

Without a doubt, the most challenging area of this action research study was not about identifying the areas of the innovation process in need of change, rather, the challenge involved in the designing of a framework that allowed Dudley Europe to fully understand the reasons for change and in so doing adopt a mindset that would insure, in the future, a successful innovation process in the early stages of NPD – changing mindsets was particularly challenging as well as establishing a collaborative process for change.

The innovation team at Dudley Europe communicated quite strongly in Phase 1 of the research that they knew that something was wrong with this process and that they wanted a quicker time to market, however they found it difficult to accept the reasons why and to implement the measures necessary to improving this process. Indeed, there was significant resistance to change from the outset. It is also critical to note that the interventions delivered not only rectified deficiencies in the activities of the early stages but also enhanced the professional development of the individuals involved (that is, the soft skills needed to manage the process (as depicted in Figure 2)).

The first intervention involved round-table discussions, consultations, and presentations, while the second and third interventions focused primarily on interactive workshops, consultations, and training.

Intervention 1: Changing the Organisational Mindset – Overcoming Avoidance through Co-developing a Model of Best Practice for Dudley Europe

For too long, Dudley Europe avoided dealing with the situation concerning their innovation process in the fuzzy front end. This was due to two major reasons. Firstly, they had been functioning around fixed NPD structures and processes in the organisation for a number of years and so they had essentially manifested a cultural belief that they were being innovative. Indeed, for the IMG members, the number of meetings equated to their innovativeness, rather than output of the innovation process. Secondly, as an SME, they did not have the time or resources to review their process to identify what was holding them back from being a truly successful organisation.

Mindsets change slowly, and so when the findings from Phase 1 were communicated to Dudley Europe, there was a general tentativeness and uncertainty about the need for changing the innovation structure in the early stages, as indicated in the following comment:

“I don’t think our own NPD process is so bad that we throw it out with the bath water. I am concerned that this won’t work and that we will be left with nothing, and the re-structuring of the early phases of our NPD process will become too complicated and not conducive to generating ideas and turning them into product concepts for development. I have also concerns that changing the process will lengthen the process, and not provide enough focus on innovative ideas...I think we need to be careful and not rush into anything without considering the alternatives”. (Operations Manager.

For this project to work, it was critical that changes in the innovation process at Dudley Europe not be imposed upon the participants, but that the changes evolved in a collaborative manner between the researchers and the innovation team. Indeed, a major component of the first intervention centred on overcoming defensive tendencies to change through challenging the participants in their beliefs and allowing them to uncover solutions to the barriers in the innovation process that they perceived were happening.

Based on the foregoing, a stage-gate framework (Figure 2) was developed, collaboratively, by IMG members and the research team – the implementation of this framework was the central focus of Intervention 3; however prior to the last intervention, it was perceived by the research team that a major building block in the success of the third intervention was reintroducing creativity to the entire firm (not just IMG members). The focus of Intervention 2 was to get the firm to realise that creativity, evaluation and screening needed to be separated.

Intervention 2: Introducing Creativity

To reintroduce creativity into the IMG meetings and into Dudley itself, the researchers organised a brainstorming workshop to take place offsite in a neutral environment. The workshop was primarily aimed at training – providing the Dudley IMG team with the skill set to conduct brainstorming as well as the up-grading of the team's ideation skills through incorporating other Dudley staff and outsiders such as lead users in the workshop. The underlying rationale for the workshop was to establish a firm-wide creativity ethos, to delineate creativity from the other early stages of the NPD process, and to introduce the concept of structured brainstorming.

The attendees were divided into two groups, and people of authority and of stronger personalities were placed on opposite teams. Each team was allocated a chair and a scribe. The chair's role was to keep the discussion from getting off-track and maintain order in the group, and the scribe's job was to record all ideas that were generated. Ground rules were established, and each team had a researcher to observe the brainstorming and note the forums of ideas that were generated. Criticism and interrupting others' flow of ideas was strictly monitored whilst wild and unusual ideas were magnified and encouraged throughout the session.

Intervention 3: Introducing Structure into the Early Stages of NPD

As depicted in Figure 2, a stage-gate framework was introduced to Dudley Europe, which clearly differentiated between stages, stage procedures, with specific stage outcomes. Briefly, to ensure operationalisation of the process, concept formulation was introduced as a stage, and a New Concept Coordinator was appointed to liaise

between departments and to organise innovation meetings. Sets of critical criteria to screen the new product concepts were developed in collaboration with the IMG and introduced at two levels - in the preliminary screening stage, and again at the detailed feasibility screening stage. An individual outside of the original IMG was appointed to chair the screening meetings to ensure meeting outcomes were not based on seniority or personalities but based upon sets of critical criteria relating to business capabilities. In addition, the IMG team was opened up to outside members such as users and suppliers so as to enhance diverse thinking within the group. Periodic reviews were also integrated into the innovation process as a parallel component; this review allows the reflection of the revised NPD process itself as well as its continuing evolution: What are we doing right? Are the new structures increasing innovation and creative thinking? Is the changed structure slowing us down or improving productivity? What can we change?, etc.

The new structures were implemented over time, so has to allow individuals time to become accustomed to a new way of doing things. To facilitate the introduction of this structure, two workshops were delivered over five days. By dispersing the workshops over a time period, it was felt that it would allow learning to be delivered in an iterative process, where the learning could be put into practice and reflected upon. The first workshop centred on the procedures that needed to be conducted within each stage (idea generation, screening, concept development and testing) and their operationalisation. The second workshop focused on providing individuals with the skill sets to manage projects from their inception right through to market within planned parameters of cost, schedules and quality. This workshop was delivered in four individual sessions conducted on different days, covering: mindset, project management tools, behavioral aspects, and project management in the NPD context. The workshops were designed to train those members of the organisation who were most likely to deal with project management on a day to day basis. Additionally, follow-up consultations were provided by the researchers in order to alleviate confusion over some issues – this was ongoing throughout the intervention.

New Product Development Stages

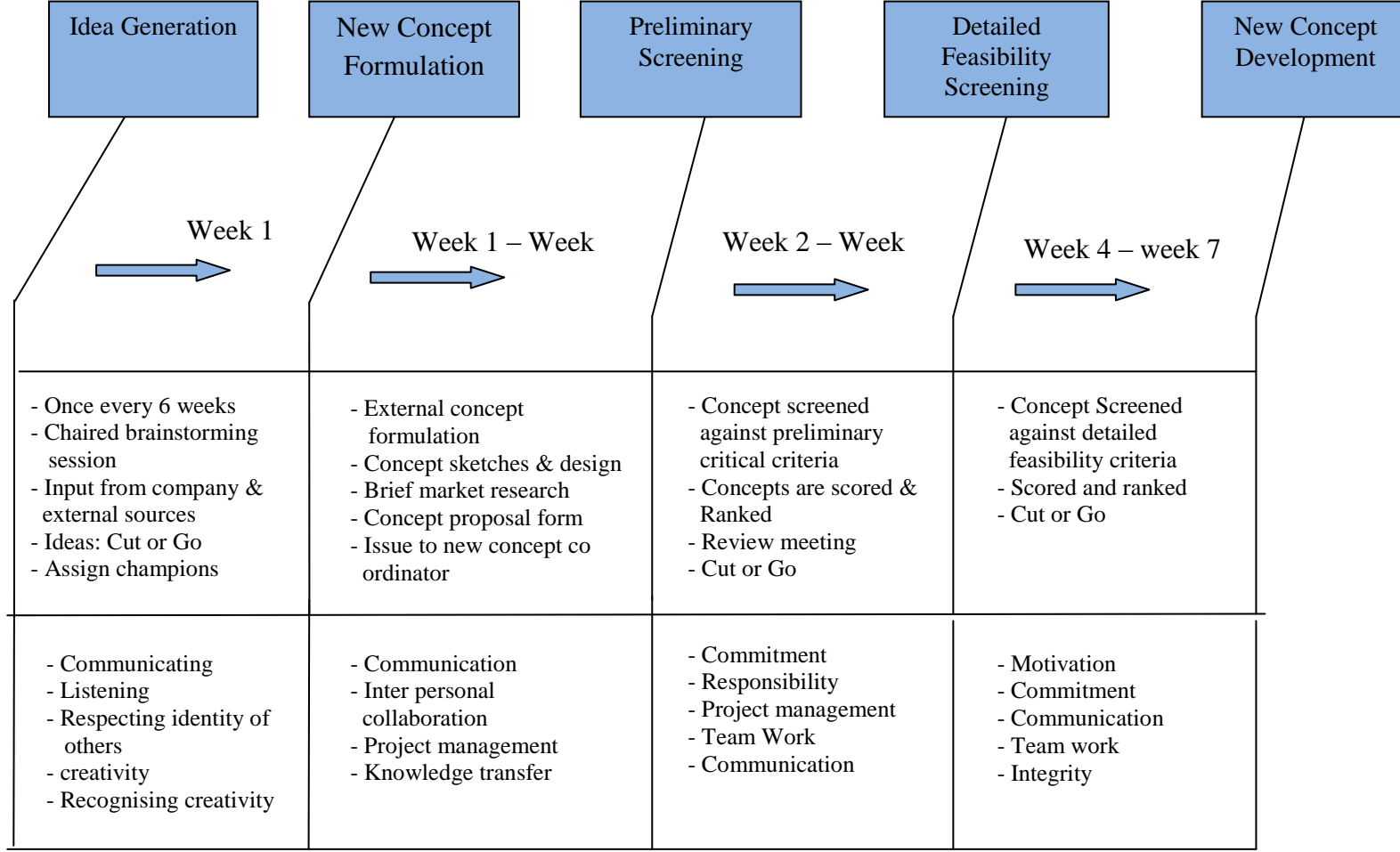


Figure 2: An Integrated Framework for Managing the Innovation Process in the Early Stages of New Product Development in SMEs.

Phase III - Preliminary evaluation of the intervention

Although evaluation has been on-going though out the entire action research process, it has to be stressed that insufficient time has elapsed between the introduction of interventions and evaluations to categorically state the extent to which the innovation interventions had been internalised. Nevertheless, preliminary evaluations tend to suggest that as a result of the intervention cycle, the innovation team at Dudley Europe have applied the learning to date. Observation of the current post-intervention stage of this ongoing study suggests that Dudley Europe have adopted a clear differentiation between the early stages of NPD and have demonstrated that learning has occurred in each stage. Feedback suggests that the IMG now look forward to the brainstorming sessions which are immensely productive with hundreds of ideas being generated each time. The IMG members are now formulating new concepts outside of the update meetings by tapping into the expertise of their team members if and when they need it.

The IMG is ranking the new concepts against the preliminary and detailed feasibility screening tools introduced by the researchers. Based upon the successes and failures of past products, and the company's capabilities, Dudley Europe designed the criteria themselves which has resulted in greater confidence in the results of the screening process.

Conclusion

Purpose of this paper was to illustrate how a small firm could overcome the management dilemmas in relation to the innovation process in the early stages of NPD. The apparent poor management of the innovation process in Dudley Europe was proving detrimental to the overall product success. Products were not being brought through the correct stages, in the correct way, in the correct time, or by the correct people, hence the firm was wasting considerable resources in a process that also lead to an unacceptable time to market. In collaboration with Dudley Europe, the research team designed and implemented three major interventions which were also accompanied by round-table discussions, consultations, and presentations with all stakeholders. A major outcome of the study is the integrated framework which delineates stages, stage procedures, and specific outcomes for each stage as well

as key skill sets. To date, feedback from Dudley Europe supports the validity of the new framework.

This study has highlighted that “messy” research and an action research approach can assist small firms in overcoming problems with managing their innovation process. It is perceived that organisational research must prescribe models useful in the context of small organisations, with a particular emphasis in the development of the “soft” skills that many small firms do not have due to their lack of resources and the informal nature and size of the firm.

A major limitation to this research is that the framework's development and validation is based upon a study of just one SME. However, the depth of the study allowed the researchers to realise considerable insights into the complexity and problematic areas of the pre-development stage of the NPD process, especially in a small firm context. A major future research direction for the researchers is to test the framework in other small firms.

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