1 NEW PRODUCT DEVELOPMENT

Success in innovation appears to depend upon two ingredients – technical resources (people, equipment, knowledge, money, etc.) and the capabilities in the organisation to manage them.

Tidd et al., 1997

The main thrust of requirements capture (RC) occurs at the front end of product development, but it does not stop there. New requirements may be discovered during the development of the new product, or requirements may be modified in the light of user tests. The process of RC involves collecting, recording and analysing information. The information gathered will cover markets, customers and technologies. Careful analysis of this leads to the identification of requirements essential for product specification. Integral to the process of RC is that of identifying the key stakeholders and collecting their needs, preferences and requirements – and also ensuring that they buy into the product that is under development. As discussed in the Introduction, effective RC at the early stages of product development can contribute positively to quick response, cost and reduce risk. Companies that invest in the front end of product development are more likely to produce successful innovations (Cooper and Kleinschmidt, 1988). However, RC does not stop at the front end of product development. Effective requirements management is needed throughout the product development process from inception to commercialization and post-launch. Requirements management is the activity and process of managing, controlling and refining requirements as the product undergoes development.

In order to establish the relationship between RC and new product development, this chapter highlights the salient aspects of new product development management.

THE NEED FOR PRODUCT DEVELOPMENT

New product development (NPD) is a process that transforms technical ideas or market needs and opportunities into a new product that is launched into the market. Developing new products is an essential aspect of business activity. However, managing the NPD process is complex and risky. It entails managing people who have different backgrounds ranging from marketing to R&D to design. NPD entails substantial investment, both in capital and time. Nonetheless, if it is commercially successful, then the benefits gained are considerable. NPD is a term used to capture a range of different types of innovative activities leading to the production of a new service or product from radical innovations to simple modification and adaptations to existing products. Radical innovation is much more risky and unpredictable. Companies can decide to be first in the market with a radical innovation, or adopt a 'wait and see' approach where they can be followers in a new market. When mobile phones were introduced into the UK market, different technologies were available and the risk for the first mover in the market was related to which technology they should use to operate the mobile service. Hutchinson launched the Rabbit phone using cellular technology and adopted a system of base stations. This failed spectacularly. Within 18 months, and following millions of pounds worth of investment, Rabbit was withdrawn. Competing operators were able to take advantage of the promotional activity associated with mobile phones and attract early adopters of the technology to their service. Backing the wrong technology cost Hutchinson its market advantage and the company was unable to re-enter the market quickly. However, when it did eventually, it launched its Orange service with a vengence and was able to steal a march on its main competitiors.

NEW PRODUCT DEVELOPMENT – THE RELATIONSHIP

Importance of New Product Development

New products enable firms to maintain competitive and healthy product portfolios, and also contribute to long term sustainable competitive advantage. Those companies that fail at NPD may face competitive problems or even collapse (Cooper, 1993). According to Cooper, 'The winners are those firms . . . who have an enviable stream of new product successes year after year'.

A number of factors have a bearing on the importance of NPD, now and for the future. Increased competition in the market place may occur in many ways, e.g. through privatization of government organizations or the increasing power of large multinational companies (Cooper, 1993).

In the increasingly competitive market, the need for time management is essential in order to gain competitive advantage in existing and new markets. A reduced time-to-market is the mechanism for time-based competition (Tersine and Hummingbird, 1995). (See also Cooper 1993; and Coombs 1998.)

> *Speed and Leanness seem increasingly the tombstones of R&D management.*
>
> Coombs, 1988

The product lifecycle (PLC) is based on the belief that most products go through similar sets of stages in their lifetime, from introduction into the market place through to maturity and decline (Bruce, 1997). Product development may occur at any stage of the PLC in order to extend the product's life by rejuvenating the cycle, for example by relaunching the product with new packaging. PLCs are becoming shorter for several reasons, including the increasing sophistication of consumers and improving technology. (See Cooper 1993; and Cooper and Kleinschaft, 1987.)

> *. . . responding to short cycles is a key part of today's hyper-competitive market.*
>
> Grantham, 1997

Emerging foreign markets and globalization can be apparent in a variety of ways, and are vital for NPD in terms of the type of product developed and where the product will be manufactured and sold. For example, the World Trade Organization reached an agreement early in 1997 whereby many developing countries are opening their markets to some degree of competition. Another aspect of emerging foreign markets and globalization is the emergence of low-cost-labour countries becoming more attractive for production from organizations in developing countries (*The Economist*, October 1997). Globalization has many profound effects, not least in the sheer number of markets that have opened up for Western companies. The rapid advances in communication are aiding the rate of globalization through entities such as the Internet and satellite equipment. (See Sheridan, 1998; and Coombs 1998.)

> *Innovation processes are more and more often targeted on global markets ... Globalisation creates a more demanding innovation process ...*
>
> Coombs, 1998

The emergence of the European Union (EU) is a major example of a changing business and legislative environment. The EU has enforced the CE mark on certain products manufactured within the EU, which forces manufacturers to comply with certain safety and regulatory standards for the product to be sold in the EU market. (See Wind and Mahajan, 1997.)

The importance of supply chain integration, with factors such as increased competition in all areas, means that companies can no longer rely on their own internal resources and often need to outsource and partner within the supply chain, in order to maintain competitive NPD (Coombs 1998). (See also Sheridan, 1998a.)

Changing customer needs and the rapid pace of technological change affects NPD not only in terms of the product itself, but also in terms of the way the development process is managed and the communication techniques used by the teams involved. For example, globalization of the world market increasingly finds NPD teams in different countries of the world. Virtual project teams that meet via information technology (IT) are increasingly common in that business.

The advantage is that the best talent in the world can be brought together to work on a project. Management of a virtual project team is an emerging management skill. Communication and effectiveness of the teams has improved and contributed to the success of NPD by technologies such as video conferencing. Customers also witness the technological breakthroughs and consequently demand better-quality products faster and at lower prices. (see Cooper, 1993; and Coombs, 1998.)

Strategic Management of Product Development

The management of NPD must be considered in a strategic fashion, in order that the right type of product may be developed in terms of, for example, the target market, the company resources, and the company product portfolio. A nonstrategic approach to NPD may involve development of a highly technological product, but if the market does not have a need for this type of product, it will fail, even though it may be a superior product. Marketing and promotion and identifying the channels to reach the customer are all essential to the innovation process. Tidd et al. (1997) define a number of advantages that can be gained through strategic NPD projects (Table 1.1). This table accentuates the importance of strategy in NPD. Although a certain type of new product may offer a strategic advantage, the organization must assess how the product strategy fits into the overall strategy of the organization.

Table 1.1 Type of innovation by strategic advantage

Type of innovation	**Strategic advantage**
Novelty	Offering something, that no-one else can
Competence shifting	Rewriting the rules of the competence game
Complexity	Difficulty of learning about technology keeps entry barriers high
Robust design	Basic model product or process can be stretched over an extended life, reducing overall cost
Continuous incremental innovation	Continuous movement of cost–performance frontier

Source: Tidd et al., 1997. Reprinted by permission of John Wiley and Sons Ltd.

Some academics and writers suggest that NPD is not the important strategy for future success of organizations, but rather that sustained competitive advantage is to be gained through intelligent marketing, as mentioned in Bissell (1998). However, new products not only account for 40 per cent of total company sales, but they are also important for profits and market share (Cooper, 1993). Deloitte and Touche (1980) conducted a study, *1998 Vision in Manufacturing*, which showed that by 2000, a majority of manufacturing companies plan to intensify and re-engineer their NPD efforts. It is estimated that over this time, revenues from the sale of new products will have increased by 11 per cent (Sheridan, 1998b).

Cost or Investment?

Companies regard NPD as a costly process. The failure rates of new products are extremely high and have not improved much since NPD was first studied (Wind and Mahajan, 1997) so the cost in relation to failure rate is an important issue. Tidd et al. (1997) suggest failure rates of new products to be between 30 and 95 per cent, with an accepted average of 38 per cent. In addition to this, Cooper (1993) states that 46 per cent of total product costs spent on NPD are used entirely on products that fail and that one in three new products fail at launch. This issue of failure in NPD highlights the enormous importance of achieving effective management of NPD, to reduce the failure rate of new products. This emphasises the need for RC to tighten up the front end of the product development process to improve the success rate.

Success in New Product Development

Much has been written on what contributes to success in NPD. There are a number of factors that contribute to the success of a new product, although it is unlikely that any organization would be able to institute a formula for persistent success in NPD (Wind and Mahajan, 1997).

Cooper (1993) has carried out several extensive studies on the success in NPD. He divides success factors into three categories: luck, tailwind and actions. In his study *NewProd III*, he studied 203 new product projects in 125 industrial product firms. All the new products were launched on to the market - some were successful, some failed. The study compared the similarities in successes and the differences between winners and losers. Several significant factors emerged, resulting in ten key factors underlying success:

1. A superior product that delivers unique benefits to the user.
2. A well-defined product prior to the development phase.
3. Quality of execution of technical activities.
4. Technological synergy.
5. Quality of execution of predevelopment activities.
6. Market synergy.
7. Quality of execution of marketing activities.
8. Market attractiveness.
9. Competitive situation.
10. Top management support.

Of the hundreds of characteristics studied, only these ten had consistent impact on success, although not all had the same impact. The results of the study showed that luck could be ruled out as a success factor, and that tailwind and actions were the important factors in successful NPD, with action factors being of particular importance.

Hart (1995) has developed six major themes for success in NPD, which can be considered at project level or strategic level (Figure 1.1).

Project Level Themes

Process

> *The process of NPD involves that activities and decisions from the time when an idea is generated (from whatever source) until the product is commercialised (i.e., launched onto the market).*
>
> Hart, 1995

Many studies, for example Cooper (1979, 1980), and Cooper and Kleinschmidt (1987), state that the choice of process for NPD is vital to the success of the project (Hart, 1995). An important consideration when choosing a process is the contingent circumstances that apply to the particular process (Tidd et al., 1997) (see Table 1.2).

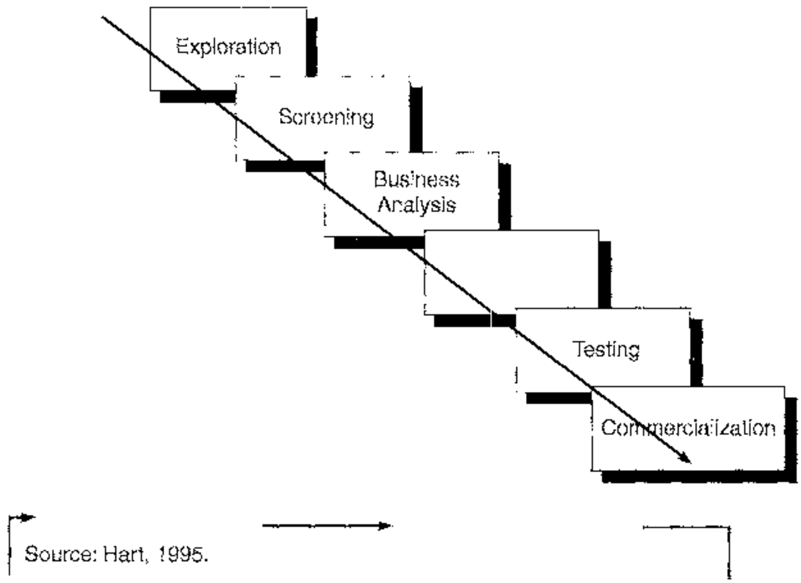

Figure 1.1 The process of NPD as a series of activities, from Hart S. (1995) in Bruce and Biemans. Reprinted by permission of John Wiley and Sons.

Table 1.2 How context affects NPD process

Context variable	**Modifiers to the basic process**
Sector	Different sectors have different priorities and characteristics, e.g. scale-intensive or science-intensive
Size	Small firms differ in terms of access to resources, etc. and so need to develop more linkages
National systems of innovation	Different countries have more or less supportive contexts in terms of institutions, policies, etc.
Lifecycle (of technology, industry, etc.)	Different stages in lifecycle emphasise different aspects of innovation, e.g. new technology industries versus mature, established firms

Source: Tidd et al., 1997. Reprinted by permission of John Wiley and Sons Ltd.

Early Sequential Models of New Product Development

Linear models were developed in recognition of the fact that each stage of the process has to be completed, in order that the product should have more chance of being successful (Cooper and Kleinschmidt, 1986). However, these sequential models are regarded as relatively simple, standard processes for NPD.

The Booz, Allen and Hamilton (1982) model (Figure 1.1) shows the basic sequential approach to the NPD process. This model is the basis for a large number of similar sequential type models, including those of Kotler (1980) and the British Standards Institute (1989)

Cooper and Kleinschmidt (1986) focused more closely on the process of NPD. They produced a 13-stage model with distinct activities at each stage (Table 1.3). Crawford (1988) simplified the Cooper and Kleinschmidt model into six stages (Table 1.4).

However, these sequential models tend to be prescriptive and mechanistic, and fail to take into account overlaps of activities that will occur naturally in the workplace. They can also increase cycle time and provide no early warning system for problems that may occur later in the process (Schilling and Hill, 1998). The weaknesses apparent in the sequential models led to the development of more complex models.

Later Complex Models of New Product Development

> *Concurrent engineering has become the norm for successful product development.*
>
> Design News, 1993

Increased competition in the market place has placed more pressure on companies involved in NPD to reduce their time to market or to gain quick response. Products have become more complicated resulting in more people being involved from a variety of functions (Jones, 1997). This has brought about the more complex parallel processing in NPD models, which reduce time to market, provide smoother transition between stages of the process, promote shared responsibility, co-operation, involvement and commitment, and improve the problem-solving focus, initiative, diversified skills and heightened sensitivity to market conditions (Hart, 1995).

Table 1.3 Cooper and Kleinschmidt's 13-stage model of the NPD process

Activity	Description
1. Initial screening	The initial go/no go decision where it was first decided to allocate the funds to the proposed new product idea
2. Preliminary market assessment	An initial, preliminary, but nonscientific market assessment; a first quick look at the market
3. Preliminary technical assessment	An initial, preliminary appraisal of the technical merits and difficulties of the project
4. Detailed market study/market research	Marketing research, involving a reasonable sample of respondents, a formal design and a consistent data collection procedure
5. Business/financial analysis	A financial or business analysis leading to a go/no go decision prior to product development
6. Product development	The actual design and development of the product, resulting in, for example, a prototype or sample product
7. In-house product testing	Testing the product in house, in the lab or under controlled conditions
8. Customer tests of product	Testing the products under real-life conditions, e.g. with customers and/or in the field
9. Test market/trial sell	A test market or trial sell of the product – trying to sell
10. Trial production	A trial production run to test the production facilities
11. Precommercialization business analysis	A financial or business analysis, following product development but prior to full-scale launch
12. Production start-up	The start-up of full-scale or commercial production
13. Market launch	The launch of the product, on a full-scale and/or commercial basis; an identifiable set of marketing activities specific to this product

Source: Hart, 1995.

Table 1.4 Crawford's six-stage model of the NPD process

Activity	Description
1. New product planning	Emphasising NPD as an element of corporate planning process
2. Idea generation	Seeking ideas internally and externally (from management, research, competition, consumers and employees)
3. Screening	To analyse corporate and technical synergy and feasibility of the project
4. Technical development	Concepts developed into physical forms
5. Market appraisal	To assess user opinions
6. Commercialization	Launch of the product or service

Source: Roberts, 1996

Sequential models provide a good basis for planning projects, but in practice, the process is often comprised of '. . . a parallel set of sub-activities in which the technical and marketing disciplines interact to evaluate and develop further the product concept' (Walsh et al., 1992). These parallel processing models involve overlapping stages in the NPD process (Hart, 1995). Takeuchi and Nonaka (1986) produced a diagram showing the differences between the sequential and complex models of NPD (Figure 1.2).

Walsh et al. (1992) show in a fairly simple fashion a number of different approaches to the NPD process corresponding to the Takeuchi and Nonaka (1986) diagram. This approach is designed in an attempt to break down the functional barriers between departments, so that activities in the NPD process are carried out concurrently. The process is therefore managed by multidisciplinary teams, meaning that the outcome is owned by all functions. Thus ideas are not rejected by downstream partners as they may be in the sequential processes. Information is shared by functions, which allows functions time to prepare and position themselves for future stages of the project. This approach reduces the time to market, avoids bottlenecks and improves quality.

The major benefit of concurrent engineering in NPD is that it speeds up time to market by reducing the cycle time (Anderson, 1993 and Biemans, 1995). In addition, the needs of the project are better

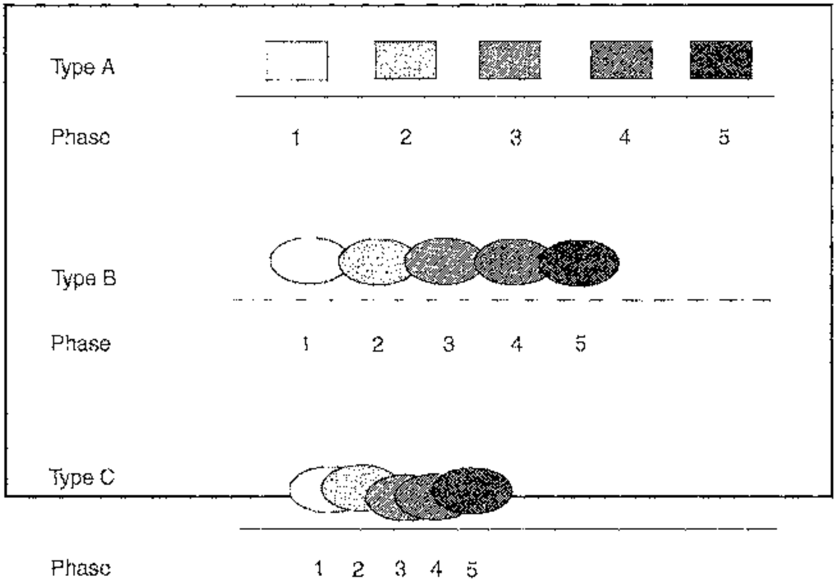

Figure 1.2 Sequential (A) versus overlapping (B and C) phases of development, from The New Product Development Game by Hirotaka Takeuchi and Ikujiro Nonaka (1986), Harvard Business Review.

satisfied (Jones, 1997). There are some limitations to parallel processing. Generally, these types of projects require more effort from all concerned, and more effective management. Some types of product development projects are not suitable for parallel processing, for example, R&D-led projects require a large amount of time at the beginning stages and cannot be integrated easily (Jones, 1997).

Parallel processing requires large-scale organizational changes in the entire supply chain, and many companies may be unwilling to introduce this during recession (Palframan, 1994). In reality, most companies are not willing to deal with the culture shock that accompanies a change in routine. Most organizations tend to provide quick one-shot programmes that do not do much to alter the traditional method of NPD (Anderson, 1993).

In the concurrent NPD process, it is critical that the traditionally separate functions of design and manufacturing are merged. However, in practice, combining the two can be difficult in terms of logistics and in relation to issues of diversity (Anderson, 1993).

Table 1.5 The results of phase review

Result	**Implication**
Pass – all deliverables complete and objectives met	Move on to next phase
Conditional pass – minor actions identified	Project can move on to next phase if actions are completed to the satisfaction of the chairperson within 30 days
Fail first time – major problems identified	Review will recommend to business that further investment be withheld
Conditional fail – major problems identified	Major corrective action required; rerun review within 30 days having cleared actions
Fail second time	Review with business about whether project should be cancelled

Source: Grammer, 1992

Communication between functions is also essential, for example in terms of sharing information. However, geographic location can be a hindrance to this, so electronic communication is becoming increasingly important. For example, members of the design group at AT&T in the USA work in the parallel process, communicating between the manufacturing site in Denver and the design labs, which are 1500 miles away in New Jersey, by fax, email, teleconferencing and high-speed data links.

> *...the two areas have been able to achieve their goal, which was to improve circuit-pack design and manufacturability.*
>
> Anderson, 1993

RC falls into the front-end and early phases of these models. Requirements management is needed throughout the product development process to ensure that all relevant information is gathered from key stakeholders in the process (e.g. marketing, technology, design) and that this is used to optimize the requirements that will enhance the attractiveness of the product for its target market.

Alternative Approaches to New Product Development Process

The Phase Review Process – First Generation

The first-generation model of this process was based on the sequential process of NPD, similar in features to a relay race, and was developed by NASA in 1960. Each activity has a review point (Grammer, 1992), which evaluates certain criteria, such as:

- performance
- reliability
- availability
- instability
- maintainability
- usability
- testability
- manufacturability
- profitability
- timeliness

This is to decide whether or not more funding should be allocated, and whether the project should continue. According to Grammer (1992), the phase review process helps the organization to:

- *Authorise* any project in terms of return on investment and risk analysis before major resources are committed.
- *Apply* the disciplines and project management that enable businesses to bring a product to market against challenging time and cost targets.
- *Define* customer requirements and expectations clearly and prove that these have been met prior to delivery.
- *Ensure* that product announcements and availability dates are consistent with achieving key milestones.

Cooper (1994) analysed the first-generation phase review process and emphasised several problems associated with the model. In general, the main problem was the number of tasks that had to be completed at each stage before the project could progress. The process was too narrowly focused, ignoring all stages except development and failing to integrate marketing functions in the process.

Table 1.6 The advantages and disadvantages of the stage gate process over the phase review process

Advantages	Disadvantages
Better cross-functional teamwork	Projects must wait until all tasks are completed; this may lead to delays, as a project may be held for the sake of one activity that remains to be completed
Less reworking and recycling	Overlapping of stages is impossible; one stage has to be completed before a project can move on to another
The early detention of failures	Projects must go through all stages and gates; this can make the process very rigid, especially for low-risk projects, and may create unnecessary delay
A better launch	Project prioritization is not accounted for as the stage gate concentrates on individual projects rather than the spectrum of product portfolio projects
A shorter time to market	Some processes are spelt out in too much detail, leaving no room for creativity
Not a rigid system – some stages may be omitted	Too bureaucratic because of the imposed meeting, paperwork and red tape

Third-Generation Models

Cooper (1994) agrees that the stage gate models provided improvement in process, but require improvements to allow better integration and flexibility. He therefore developed the third-generation models, which he described as '...fluid and adaptable, they will incorporate fuzzy gates which are both situational and conditional, they will provide for much sharper focus of resources and management of the portfolio of projects, and they will be much more flexible than today's process'.

Table 1.7 The four types of partnerships

Supplier partnerships	**Lateral partnerships**	**Internal partnerships**	**Buyer partnerships**
Goods suppliers	Competitors	Business units	Intermediate customers
Services suppliers	Non-profit organizations	Employees Functional departments	Ultimate customers

A fluid process should reduce the cycle time because stages will be overlapped. The notion of 'fuzzy gates' implies that the gates are not absolute, but are considered more in terms of the 'situational' and 'conditional' factors involved. The clearer focus is achieved, as the third-generation models are compared against other projects. The process is, in essence, a formal process with rules and protocol. A deviation from these rules should be carried out consciously and deliberately with awareness of the consequences. However, project managers should be given the freedom to make these decisions, because of their greater experience with the project, and management should back the decision (Cooper, 1994).

The stage gate system is used to improve efficiency and effectiveness of the NPD process. The gates are used to control the process and provide a quality control checkpoint. Each stage is used to gather information to progress to the next stage in order to drive down uncertainties. The stage gate system is designed to facilitate and speed up time to market (Cooper, 1993). Stage gate systems incorporate many of the factors for success in NPD and reinforce the role of RC, for example:

- More emphasis on predevelopment activities (discussed in Chapter 3).
- Multidisciplinary and multifunctional.
- Parallel processing speeds up process.
- Strong market orientation is part of the stage gate system.
- More focus.
- Product definition step is included.
- Focus on quality of execution.

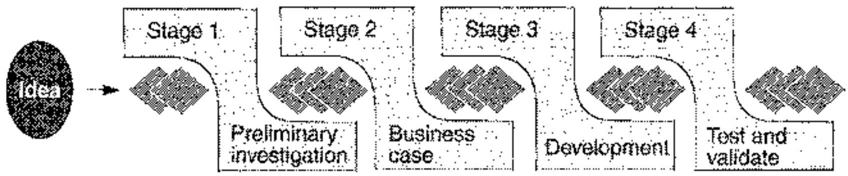

Figure 1.3 Third generation process with overlapping, fluid stages, and 'fuzzy' or conditional go decisions
Source: Roberts, 1996

> *The benefits of the stage gate system are evident. The model puts discipline into a process, that in too many firms, is ad hoc and seriously deficient.*
>
> Cooper, 1993

The Stage Gate Decision

Evaluation techniques, such as stage gates, are used in order to reduce uncertainty and make go/no go decisions in NPD. Evaluation is different at each gate and deals with a variety of different complexities (Cooper, 1993), including:

- The information and stakes at each gate increases through the process.
- There are a variety of methods of evaluation to use at each stage, requiring a decision for the best technique to be used for each gate.
- At each gate the decision on the go/no go basis has to be made in relation to the portfolio of products that the company is developing. There will always be certain payoffs to other projects.
- The go/no go decision actually involves a go/no go/hold/recycle decision.

So the purposes of the gate, according to Cooper (1993), are:

- To make go/no go decisions.
- To make prioritization decisions.
- To serve as a quality control check.
- To chart the path forward.

It is important that managers look for 'killer' variables, for too often, managers proceed with a project without realising the flaws and weaknesses, leading ultimately to failure. This may be due to the failure of managers to accept problems or to seek more information on problems when they become apparent (Cooper, 1993). Making decisions about the product, its cost and potential market benefit are all relevant to requirements management. RC fits in with a stage gate process.

According to Cooper, any project can be reduced to three simple questions:

- Is it real?
- Is it worth it?
- Can we win?

Cooper describes a typical approach to a project team stage gate decision. Stage gate decisions are usually based on written criteria (it should be noted that too much bureaucracy can delay projects and reduce time to market). The project leader will submit a set of deliverables/inputs a few days before the meeting. These should be short and to the point, e.g. some organizations may place a limit on the number of sides used to write this. Gatekeepers receive copies to prepare for the meeting. At the meeting, the project leader will bring any new team members up to date, although in many organizations, the gatekeepers are the same throughout the project. A question-and-answer session is used to share information and opinions. Gatekeepers use evaluation techniques to decide the go/no go decision, with each criterion being discussed.

Debriefing is important so that the gatekeepers can reflect on the opinions of others in the project team, and thus perhaps operate more efficiently as a team for other projects. This may include (Cooper 1993):

- areas of disagreement;
- areas of ignorance and uncertainty;
- strengths and weaknesses of the project;
- go/no go decision reached; and
- prioritization set.

Despite the support for the stage gate process in much of the literature, there are some schools of thought that suggest that the stage gate system is not as successful as described. Although it is designed to work in a parallel process, it often becomes a linear process. Wind and Mahajan (1997) depict the stage gate process as shown in Figure 1.4. They describe the gate process as 'cumbersome and inappropriate'. Nevertheless, RC is an important aspect of the process and needs to be seen with the process description and activity.

Communication

RC and requirements management is dependent on effective communication between key activities, especially marketing, production, finance and design. Without empathy for each other and an understanding of each other's needs, then agreement about the main requirements to build into the product will be difficult to achieve. Engineering may argue for a greater performance or range of functions than marketing regard as necessary for the target market, and

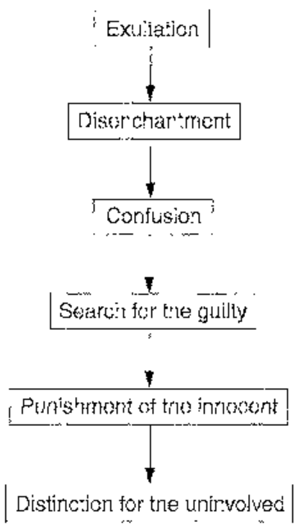

Figure 1.4 Wind and Mahajan's diagram of the stage gate process. Reprinted with permission from *Journal of Marketing Research*, published by the American Marketing Association, Wind, J. and Mahajan, V., 1997, Vol. XXXIV and p. 1–12

so on. Cross-functional project teams can speed up communication between departments such as marketing, R&D and manufacturing, all of which are vital for the NPD process (Schilling and Hill, 1998; and Calabrese, 1997).

Functional integration can reduce time to market, save costs, and improve communication so that any potential problems can be detected early on in the process (Hart, 1995). Cross-functional teams should also minimize mis-communication, provide a broader knowledge base, increase the cross-fertilization of ideas, draw from more information sources and increase the fit between product attributes and customer requirements (Schilling and Hill, 1998). In addition to these advantages, functional integration ensures alignment of product concept with company and functional strategy and promotes concurrent engineering (Verganti, 1997). Tidd et al. (1997) describe the problems that can results if full integration does not occur. One of the most consistent problems in multifunctional teams is the failure to include those from outside the loop.

The extent of integration of the R&D and marketing functions has traditionally been the focus of research, due to the importance of their integration for the success of the NPD process (Hart, 1995).

> *The R&D/marketing interface is critical for new product success.*
>
> Wang, 1997

These two areas are traditionally uncooperative - there is often a debate as to which department should drive the NPD process. The R&D and marketing functions tend to grow and become increasingly specialized in their own field as the organization grows larger (Wang, 1997). Close collaboration between R&D and marketing enables the production of a product that fits well with customer requirements. R&D cannot design a product that fits with customer requirements without contribution from marketing (Schilling and Hill, 1998). Wang (1997) defines four kinds of barrier to good interface between R&D and marketing.

1. *Perpetual* - a study by Gupta et al. in 1986 proved that the personality traits of R&D and marketing managers were similar,

thus the barrier between the two is actually more of perceived stereotypes rather than actual differences.

2. *Cultural* – resulting from training in different backgrounds.
3. *Organizational* – arising from different task priorities, ambiguity, tolerance and departmental structures.
4. *Language* – marketing managers and R&D managers have different terminology that is specific to their training and area of expertise, making communication between the two very difficult.

Techniques are available to those involved in NPD to encourage communication between these two functions. For example, quality function deployment (QFD) is designed for engineering production and marketing functions to identify opportunities for product improvements or differentiation. Customer requirement characteristics can be translated through a matrix so that the engineers can understand them (Tidd et al., 1997). However, integration may be simpler than employing tools such as these. Promoting teamwork through exercises, and teaching team and team leader skills and related communicative skills (Anderson, 1993), can promote company-wide skills that can be exploited in the NPD process.

Souder (1988) describes the ways in which organizations should attempt to integrate the R&D and marketing functions:

- Make personnel aware that interface problems occur naturally.
- Make personnel sensitive to the characteristics of disharmony.
- Give equal praise to both functions.
- Continuously reinforce their desire for R&D and marketing collaboration.
- Use teams of R&D and marketing personnel at every opportunity.
- Solve personality clashes as soon as possible.
- Avoid complacency – too much harmony is a bad thing.

Although the benefits and advantages of functional integration have been outlined, it should be noted that there are a few problems with function integration. Firstly, the depth of knowledge within each function has decreased because individuals are spending too much time on product development projects, rather than their own function. Involvement in both NPD projects and functional activities can also result in individuals feeling torn between the respective managers of each area (Sobek et al., 1998). Finally, it is often impossible in today's business environment to actually get all the project team together for every meeting. The global feature of many organizations today means that certain functions of the firm may be in a different country or, at the very least, several hundred miles away. Many project teams function on the basis that the whole team has to be present at every meeting, but it is possible to achieve resourceful input from team members in different ways, e.g. through electronic or telecommunication or through partial collocation.

THE ENTIRE SUPPLY CHAIN INTEGRATION

Most industry sectors are becoming more competitive, with customers making higher demands upon suppliers and products. Inevitably, in response to these constraints, new management philosophies are introduced. One such philosophy to be applied is supply chain integration and partnering. There has always been a plethora of collaborative strategies, such as co-makership, co-design relationships, strategic alliance, network, hybrid organization, virtual organization, concurrent engineering, and parallel product development, which facilitate co-development.

Formal partnerships vary from full joint alliances to collaborative R&D. Relationship management theory proposes four types of partnerships (Table 1.7). Whether the relationships are formal or informal, didactic or multiple, the information and knowledge held throughout the entire supply chain is extremely beneficial to the innovation and product development process.

Partnerships are considered as a means of harnessing more effectively the knowledge and skills in the supply chain in order to compete in a global market place. A three-stage strategic development programme is proposed by DTI (1995) consisting of survival, bootstrapping and expansion. The survival stage is based on the prerequisite that the company must keep hold of its present position by meeting customer basic needs. Bootstrapping involves gaining knowledge and experience from customers and partners and utilizing this to improve internal performance. The expansion stage represents the application of new skills into product development and geographic markets. All stages demand the development of expertise in accessing information and data for new product development; establishing a good RC process that enables the capture of information throughout the entire supply chain from third- and fourth-tier suppliers through to end users is vitally important. However a more integrated and better-managed supplier, through relationship management and partnering, will facilitate easier and more accurate RC.

CONCLUSION

Product development and innovation management are necessary aspects of business. Despite all our knowledge about process management, the concurrent engineering, and effective interface between key activities, a high failure rate exists. What has been ignored is a detailed review of the early stages of the process. It is here that the need for a new product, or modifications, is decided and ideas generated for consideration. Once the idea has been selected for development, then it is difficult to abort the project because of the investments that have been made in this idea. If more attention were given to the front end of the process, in terms of creativity management and ascertaining the key product requirements, and subsequently to requirements management, then the outcome may be more successful.