PART 3

Structure for new product development - frameworks
Learning outcomes

When you have completed this chapter, you should be able to:

- Describe the evolution of innovation management over the past 50 years.
- Explain the major components of ‘stage-gate’ development models, and how these components interact in a cohesive framework.
- Understand the benefits and problems of adopting a structured methodology, such as the stage-gate innovation system.
- Show how ‘stage-gate’ models are evolving to address today’s increasingly complex customer and market needs.
- Appreciate through the specific example of the solutions approach the key challenges of network innovation.
- Explain how NPD frameworks might differ between a product- (or service-) focussed business, and one that is positioned as a network-based solutions provider.
Introduction

Innovation is central to corporate growth and prosperity and can be defined in many different ways. Broadly speaking, there are two theoretical approaches to studying business innovation: an enabling perspective and an outcomes perspective. The enabling perspective focuses upon factors that hinder or help innovation to occur. This perspective considers issues such as internal processes, systems, structures, culture, people and organisation. The outcomes perspective is much broader in its outlook and is focussed on transformation activities and processes. Transformation of inputs into outputs primarily defines the activities involved in the development and commercialisation of a company’s products or services – referred to as new product development (NPD). In theory, and unfortunately in practice, these two aspects have tended to be treated separately. However, they are closely intertwined and inseparable. The enabling part is directly responsible for the efficiency and effectiveness of the outcomes. A structured approach to product development process can help successful commercialisation of ideas, but how well it operates is constrained by organisational culture, general systems such as rewards, strategies and other resources.

Innovation is often measured from an outcomes perspective. One proxy measure of innovation effectiveness is new product development success. Because of this, there is a tendency to narrowly focus on managing the new product development process at the expense of managing the enablers of innovation. In this chapter, we examine innovation from the new product development process perspective. This is done at this stage to set the context for the enabling processes, systems, structures and strategies that are dealt with in later chapters.

Providing value and winning customers remains a constant business challenge. The main factor of change is the customer. Customers are becoming more and more demanding. They are on a constantly upward cycle of self-fulfilment. New products launched today seem to lose their appeal at an ever quickening pace. To survive in such environments companies have to keep pace with changing market needs. They must quickly and accurately identify changing customer wants and develop more sophisticated products to satisfy those needs. Customers increasingly demand greater functionality, greater performance and greater reliability from their products and services.

Innovation is fundamental in meeting this challenge, especially when you consider that 40 per cent of sales come from new products (Cooper and Kleinschmidt, 1991) and services (both ‘pure’ and product support) constitute around 70 per cent of the aggregate production and employment in the Organisation for Economic Co-operation and Development (OECD) nations (Berry et al., 2006). Unfortunately, a wide body of research has shown that companies undertaking this route encounter numerous problems and a high level of failure (e.g. Calatone et al., 1995):

- One product concept out of seven becomes a commercial success; and only one project in four results in a winner.
- Roughly half of the resources that industry devotes to product innovation is spent on failures and killed projects.
- Around two-thirds of executives are ‘somewhat’ or ‘very disappointed’ with the results of their firm’s NPD efforts.
- New products face an average 35 per cent failure rate at launch.

It seems ‘making’ innovation is no easy task. The capability to innovate is not a common one. It is a difficult and complex competence to nurture. However, those who can build this
capability can reap huge rewards. A large body of research shows a strong correlation
between innovation and company health. Indeed, long-term success and survival is heavily
dependent on a firm’s capability to innovate, and was illustrated in a survey that revealed
that 78 per cent of FTSE 100 respondents planned to invest in innovation in 2005 in order
to drive growth (Pure Insight, 2006). Additionally, it revealed that the creation of innovative
products and services ranks among chief executives’ top three concerns for the next five
years.

Notwithstanding the risks and problems, the potential benefits from innovation are such
that it is considered one of the most important processes within organisations. For many
companies, success in innovation has been brought about by development of a superior
NPD system or framework, and these frameworks are seen as an important source of com-
petitive advantage. However, the development and implementation of a NPD framework
is by no means simple, nor is it a guarantee for new product success; it should come as no
surprise that the causes of innovation success and failure can often be traced back to the
NPD framework.

Evolution of innovation process management systems

Diverse approaches to managing innovation have been attempted over the years, beginning
with rudimentary efforts to grapple with technology to sophisticated and encapsulating com-
plex systems of management. Fortunately, these approaches to new product development
can be categorised into relatively distinct patterns and evolutionary phases of development.

Stages in the evolution of innovation management systems

Adapting and extending Rothwell’s (1994) original phases of evolutionary development of
innovation systems we identify the existence of six phases of development. These develop-
ment phases are informative in that they help to define the likely trajectory for future
progress in the management of innovation (Figure 5.1).
The idea for Iridium was conceived in 1987 when a Motorola engineer and his wife were planning a vacation on a remote island in the Caribbean. The wife, a real estate executive, was wary of travelling to a spot where she’d be out of telephone communication with her office home. Just what would happen if travelling business people had the wherewithal to ‘stay in touch’ from anywhere in the world with a single, fit-in-your-briefcase telephone unit? The proverbial light bulb clicked on, the vacation was cancelled, and Motorola found itself on the threshold of wireless communications an industry that a decade or so later would have a global value in the hundreds of billions.

Iridium’s first-of-its-kind plan to utilise low-level satellite technology (called LEO, leap-frogged over the competition, which relied on more traditional high-altitude satellites requiring comparatively huge dishes. Iridium’s satellites would orbit the earth at an altitude of about 420 miles.

In November 1998, Iridium unveiled its first handheld satellite phone, after spending $140 million on an international advertising blitz and setting a goal to sign up 500,000 customers within six months. By April, however, only 10,294 people had signed up and they were to pay $3000 each for the clunky, oversized telephones and up to $5 per minute to talk on them.

‘We’re a classic MBA case study in how not to introduce a product’, John Richardson (Iridium’s CEO) said. ‘First we created a marvellous technological achievement. Then we asked the question of how to make money with it.’

Plagued by problems with its suppliers, batteries that needed to be recharged 2–3 times a day, frequent cut-off calls and interference, and limited global coverage, Iridium also had to compete against cheaper cellular competitors whose technology was considered better.

In July 2000, Motorola made the decision to pull the plug on the entire Iridium operation. Iridium was told to issue orders to its 66 LEO satellites – now effectively ‘space junk’ – to, individually and over a period of several months, fire their thrusters, and alter orbit to a new course that would send each into the earth’s atmosphere to burn up. For a moment it would blaze like a shooting star.

‘A lot of engineering went into making Iridium possible’, said Herschell Shosteck, a Washington DC based analyst, ‘Iridium can serve as a reminder to the entire wireless industry in the future... a reminder not to let technological exuberance override business prudence.’

(Source: Based on White, 2002)
The second generation: linear market-pull innovation process (mid-1960s–)

As competitive pressures increased it became increasingly clear that technology push was failing to cope with the new market circumstances. This resulted in the emergence of the second-generation or ‘market-pull’ (also referred to as the ‘need-pull’) approaches to innovation shown in Figure 5.3. The market-pull approach incorporates a market focus into the innovation process to overcome the technology-push blindness to customers’ needs. This is a simple sequential model in which the market is a primary source of ideas for directing R&D. R&D becomes a passive and in some regards even a reactive player in the process.

One of the primary dangers of following this model is that it produces a tendency to neglect long-term R&D programmes. Thus companies can easily become locked into a regime of technological incrementalism. For the most part, companies using this approach simply adapt existing products to meet changing user requirements along maturing performance trajectories. By doing so they run the risk of being outstripped by radical innovators.

The third generation: push-pull innovation process (early 1970s–)

In making the transition to the market-led model of innovation many companies began to suffer from a weakening of R&D. Companies using this approach produced few radical breakthroughs. To counter these weaknesses steps were taken to combine features of the market pull with the technology push model. This is sometimes referred to as the interactive, ‘coupling’ or push–pull model (see Figure 5.4).

This coupling model is deemed by many, certainly up to the mid-1980s and even presently, as presenting best practice. It essentially is a sequential process but with feedback loops.

Commenting on this approach Rothwell (1992) notes two sets of issues for success, namely, project execution and corporate level factors. These are summarised in Table 5.1.
These factors show that success or failure can rarely be explained in terms of one or two factors only. Success is multi-faceted and rarely associated with performing one or two tasks brilliantly. It requires doing most tasks competently and in a balanced and well co-ordinated manner. At the very heart of a successful innovation process are ‘key individuals’: people with ability, flair and a strong commitment to innovation.

**The fourth generation: interactive-parallel processing innovation process (mid-1980s–)**

As markets became internationalised, competition intensified and product life cycles shortened, speed of development became an important competitive weapon. Japanese companies pioneered a process that conducted activities simultaneously rather than in sequence. This
approach is called the interactive parallel process. In deploying this model of innovation Japanese companies began exhibiting remarkable performance in world markets because they were innovating more rapidly and efficiently than their western counterparts. The Japanese innovation system possesses two striking features: integration and parallel development. Japanese companies not only integrate external partners (such as suppliers) into the new product development process at an early stage but simultaneously integrate the activities of the different functional parties (working on the innovation) in parallel rather than sequentially (see Figure 5.5).

Many companies, even today are trying to come terms with the essential features of this fourth-generation process. Companies in the West trying to follow this model have found it a very difficult model to emulate. One reason for the difficulty is that they have focussed on the tangible skeleton of the process. The secret to the Japanese success is not just in the hard-wiring of the process but in the soft underbelly, i.e. it is in the wiring of the enabling factors. The Japanese culture of consensus and team, of individuals working together to succeed rather than individual victory, provided the tight coupling and alignment necessary for parallel processing to take place. In contrast, many Western companies paid scant attention to management of the softer issues necessary to enable parallel processing. Even when issues such as culture were considered, they were managed to further promote individualism and competition. In other words, the focus was heavily on the ‘outputs’ part of the innovation equation.

The fifth generation: e-integrated innovation process

As noted above, many companies in the West had problems trying to emulate the Japanese concurrent model since it is not possible to transfer a culture or ways of behaving with ease or immediacy. This can only come about gradually and slowly over time. Fortunately, the advent of new technologies provided an alternative solution to achieve a similar or the same solution. Developments in IT made it possible to induce integrated and concurrent product development.

The electronification of the innovation system is a major feature of the fifth generation system (Figure 5.6). Electronic product development tools allow efficient real-time handling of information across the whole system of innovation. In essence, 5G is a process of parallel information processing that enhances the traditional informal face-to-face interaction
Manufacturing companies across myriad industries are investing in PLM (Product Lifecycle Management) application suites – to the tune of $2.3 billion in 2003, according to AMR Research (Stackpole, 2003). Why? Because they see PLM’s potential to vastly improve their ability to innovate, get products to market and reduce errors.

PLM is an integrated, information-driven approach to all aspects of a product’s life, from its design through to manufacture, deployment and maintenance – culminating in the product’s removal from service and final disposal. PLM software suites enable accessing, updating, manipulating and reasoning about product information that is being produced in a fragmented and distributed environment. PLM allows the integration of business systems to manage a product’s life cycle.

MatrixOne Inc. is a recognised leader in delivering collaborative PLM solutions, giving companies the ability to rapidly deploy a secure collaborative environment for their value chain that eliminates the barriers caused by geographically dispersed organisations and multiple disparate systems. This enables companies to dramatically accelerate time-to-market and significantly reduce product development costs. For example: JDS Uniphase.

JDS Uniphase is a global leader in the design and manufacture of products for fibre optic communications for the industrial, commercial and consumer markets. Challenged with complex products, a fragmented and corporate structure due to a series of mergers and a globally dispersed value-chain, JDS needed to consolidate work practices and share information more effectively across many discrete entities. As a result of a MatrixOne solution, the product transfer process has been greatly simplified, resulting in design-to-manufacturing gaps being eliminated. This was illustrated by engineering changes being turned around in 5 days rather than the previous 50 days.

(Source: Based on MatrixOne, 2005)
through electronic means. Additionally, the electronification process has a positive side effect: it greatly increases the potential for sharing knowledge and learning. Electronic technology can add significant value to the process when the innovation system is developed with the intention to manage knowledge flows.

**The sixth generation: the open (network) innovation process**

By the late 1990s, most companies were faced with the challenge of creating speed to market. The early part of the twenty-first century added another element to this challenge: customers desiring customised products to fulfil their unique needs. This added a further dimension of complexity to the management of innovation. Organisationally, faster development and greater efficiency required the creation of tighter internal linkages and access to additional resources and capabilities. However, it was unlikely that a single firm would (or could) possess all the necessary competencies and content to deliver the unique solutions demanded by customers. In addition to this challenge, companies still recognised the need for incremental development (line extensions, next generation products, etc.), but breakthrough innovation was where the game-changing opportunities were found to exist. To be successful, companies needed to look externally more, and challenge their own business models and approach to R&D.

This began the move towards what is now recognised as ‘Open Innovation’. Open innovation is defined as the ‘leverage of capabilities and expertise of others to deliver differentiated and meaningful innovation’ (Perkins, 2008). The open innovation philosophy recognises that issues such as workforce mobility and venture capital have eroded the ability of corporate R&D labs to contain their knowledge and that significant innovation can often occur in smaller companies or global innovation clusters. In addition to this, a new breed of independent research labs has created a new source of R&D that has an increasingly active and distributed market for ideas.

In its initial incarnation, this model was based upon a partnership premise consisting of loose and tight relationships to form a network. Partnerships could include those from the entire value chain, from raw material suppliers to end customers, and even competitors. In this network, the partners became willing participants in the development process. As a result, it was no longer sufficient to just manage an internal process for successful development, but additionally a set of external interfaces and processes must simultaneously be looked at and managed. Consequently, greater focus was given towards the use of parallel and integrated (cross-functional) development processes which encouraged earlier participation by key stakeholders, including suppliers and leading-edge users in product development.

Open innovation is not about outsourcing innovation or surrendering an important competitive advantage. They key lies in achieving the right balance between internal R&D (where a core competency exists, or it is cost-prohibitive to go outside) and being capable of identifying and harvesting some of the great ideas that are being developed by start-ups, inventors, entrepreneurs and other companies. This requires organisations to be able to provide for the in-sourcing of technologies, products, or even businesses at various stages of the development life cycle. It also requires the ability to leverage or spin-out internally developed ideas and technologies that are under-utilised, and put them into the hands of external parties in order to capture value from them. This is depicted in DSM’s Open Innovation Model (shown in Figure 5.7), where different activities may come into play at different stages of the product development process, and includes licensing capabilities to others, rendering R&D services to others, venturing by participating in start-ups, mergers and acquisitions and disposals/divestments.
To fully benefit from the open innovation model, companies have now realised that they need to evolve from a technology scouting approach to one of developing an innovation ecosystem (or network of opportunities) made up of a series of nodes (small start-ups, brokers, inventors, etc.), which are held together by mutual self-interest, trust and open communications (see Figure 5.8). Nodes can be populated by a number of roles, with the most common including inventors, transformers, financiers and brokers.
Inventors are those individuals or organisations who create new ideas, products, services or business models and can be driven from within an organisation via R&D departments, advanced product development teams or any employees (e.g. via idea/innovation systems). Other sources of inventors include start-ups, contract labs, academia, freelance experts, consultants and creative customers.

Transformers take their inputs from inventors and convert them into market-relevant and usable products or services, and can commonly be seen in the forms of internal supply chain and operations departments, while external sources are found in the form of contract manufacturers, channel partners, consultants and lead users.

Another important node is that of the financier, who funds activities of inventors and transformers. Corporate venture capital groups and a company’s CFO may assume the role of finance internally, while externally, this may be satisfied by economic development agencies, risk-sharing business-to-business (B2B) clients and venture capital firms.

Since the businesses/nodes associated with an innovation ecosystem will already be focused on their own 12–18 month product pipeline, open innovation is best applied to game-changing opportunities. This means that companies need to know the sources of new ideas for the market (more obvious trends and sources will be open to heavier competition), so an ability to find information from non-traditional sources can be as important as the traditional sources. Brokers fulfil the role of finding and connecting inventors, transformers and financiers, which can be performed through internal groups (business development, IP licensing offices, etc.) or external forums (trade associations, solver network portals, loyal customers, etc.).

Moving from a closed innovation to an open innovation model is not easy. The organisation needs to be adapted in terms of breaking down any ‘Not Invented Here’ culture by adjusting compensation schemes to the market success of ideas, and by enabling the culture through the introduction of an idea submission and management system. Additionally, great care should be taken in how best to manage and govern partners, while also ensuring an effective sharing of intellectual property. And finally, serious consideration needs to be given to the ways in which customers are to be engaged in the innovation network, especially in moving away from a reactive towards a proactive approach to anticipate needs and satisfy customer needs.

These may seem considerable barriers to overcome, however the benefits can be equally considerable. Successful adopters of open innovation are able to leverage someone else’s R&D, allowing them to extend reach and capability for new ideas and technology while also re-focussing internal resources. Consequently, they are seeing a far greater impact on their own internal R&D performance. Additionally, Improved payback (up to 50 per cent) in internal R&D through sales/licences of otherwise unused IP are also generating otherwise untapped benefits. As an example, Nintendo has benefited from open innovation with the development of its Wii product. The company brought together a group of lead users, start-ups, academics and entrepreneurs to develop the brand new games console aimed at a new target customer group – specifically families.

Components of the generic NPD framework

Having sketched the evolutionary trajectories of developing new products, we present a detailed discussion of a basic generic framework that captures the common features across all NPD system models. A number of NPD frameworks have been developed to satisfy the needs of different organisations operating in different markets. Their goal is to bring products
Nanotechnology has opened up a wide frontier such as faster electronics, huge storage capacities for PCs, cheaper energy through efficient energy conversion, and so on. However, before these future possibilities become commercial realities, researchers must be able to fully characterise nanotech material and device properties.

Tools and techniques, such as scanning electron emission and ultra-violet microscopy, provide valuable information on nanostructures. However, electrical characterisation is essential to understand what is happening beneath the surface of nanomaterials. For example, gate dielectrics in advanced semiconductors can have thickness dimensions of less than one nanometer; the performance of these dielectrics can only be predicted by evaluating their equivalent electrical thickness. Similar considerations apply to carbon nanotubes (CNTs) and silicon wires, which are the basis for many nanotech innovations.

Government funding supports a large proportion of fundamental research in nanotechnologies. To move beyond basic research, it is crucial for companies to build partnerships with university labs and companies with complementary expertise. This is especially true in testing, where complex devices and materials have diverse properties that present unique measurement challenges. Historically, many scientific advances occur only after suitable investigative instruments become available, so nanotech researchers must either rely on instrumentation companies or take time away from R&D to develop their own measurement systems.

More often than not, research specialists know the material and device physics intimately, but are not experts in measurement technology. They are usually under pressure to commercialise research results as quickly as possible, and often do not have the time or resources to spare to develop in-depth measurement expertise.

On the other hand, instrument companies have the resources and expertise in measurement but do not have the insight that researchers possess to develop measurement innovations that will advance the state of the art more quickly. This is because nanotechnology cuts across multiple scientific disciplines, including electrical and electronic engineering, computer science, biotechnology, materials engineering, chemistry and physics. This translates into commercial pressures on instrumentation manufacturers that cannot afford the time needed to become experts in all these disciplines.

In this world, partnerships can allow them to leverage the expertise of individuals and organisations to create better solutions for researchers. Therefore, alliances between instrumentation designers and manufacturers of nanomanipulation and nanoprobe tools have become essential in constructing a complete measurement solution.

An example of this is Keithley’s alliance with Zyvex Corp., a manufacturer of probers and nanomanipulation systems. This allows scientists and engineers to manipulate objects ranging in size down to the molecular level under a scanning electron microscope. By integrating Zyvex technology with Keithley’s nano-level measurement expertise, researchers get powerful new solutions that neither company alone could provide.

By working together closely, nanotechnology researchers and instrumentation manufacturers can create innovative and comprehensive measurement solutions that are essential for developing the next generation of nanostructures, nanomaterials, and semiconductor devices. These partnerships are likely to be instrumental in speed up the transfer of nanotechnology from the research lab to the production environment.

(Source: Based on Keithley, 2003)
to market on time, to optimise business results by reducing cycle times and costs and to manage the programmes according to agreed business plans over a product’s life cycle. The majority of these NPD frameworks possess a number of common components, which when executed in a balanced and effective manner can significantly improve NPD performance. These components generally include:

- **Use of a Structured Development Process (SDP).** This comprises a structured process containing activities. The SDP serves to set the ‘rules of the game’ and describes entry and exit criteria between key programme milestones, primary tasks, schedules and resource assignments.

- **A team of senior executives, called a Review Board, provide oversight of the programmes by resolving cross-project issues, setting project priorities, resolving issues and make Go/Kill decisions.**

- **Use of Realisation Teams (cross-functional execution teams), operating under a product ‘champion’ and reporting to the assigned Review Board. Many terms are used to describe these teams, including Integrated Programme Teams (IPTs) and Core Teams.**

- **Phase (or Stage) Gate Reviews.** These represent decision points in the process, and define major development milestones. These are points in time when funding, resources and project schedules are approved or rejected by the Review Board.

A common way of looking at the NPD framework is to view it as a stage-gate system, in which a series of product development activities occur during each phase and are reviewed periodically by management at major checkpoints or gates. This is illustrated in the NPD Framework called ‘PACE’ (Product And Cycle-time Excellence) devised by the consultants PRTM (McGrath et al., 1992) (see Figure 5.9).

These key structural components through which the structured stage-gate model is executed and arranged will now be elaborated upon.

**Structured product development process (SDP)**

In many companies, the way products are developed is completely unstructured. There is no consistent terminology; each project team uniquely defines its activities even though many are similar. The need for additional structure is demonstrated by the high penalties arising from an unsystematic approach to development. The following problems are symptomatic of poorly structured development processes (McGrath et al., 1992):

- **Inconsistent terminology and definitions,** leading to garbled or confused hand-offs between functions or stages (up to 39 per cent has been estimated) causing wasted effort and misdirected work. This leads to an increase in the number of clarification meetings.

- **Inability to estimate resource requirements and schedules,** resulting in sub-optimal planning and execution in support of programmes considered vital to the company.

- **Excessive task independence,** resulting in complex and inefficient communication channels and plans being made disjointedly between groups and a poor understanding of responsibilities. In some instances, 42 per cent of work is repeated because of upstream change that occurred due to late customer input, something being overlooked or errors in specifications.

- **Attention focused on fire-fighting.** Estimates indicate that in some cases, at least 48 per cent of development work is spent fire-fighting caused by unplanned work, which appears unexpectedly but requires immediate attention.
Before going further, it is perhaps necessary to appreciate what we mean by a process. A process is a sequence of steps that transforms a set of inputs into a set of outputs. In this sense, a Structured Development Process (SDP) is simply a sequence of steps or activities to conceive, design and commercialise a product. Theoretically, numerous ways of conceptualising the process exist (e.g. Wheelwright and Clark, 1992). Most of the modern-day conceptualisations are based on these original descriptions. We re-conceptualise the process as a seven-stage description (see Figure 5.10). Note, in later discussion we compress the seven stages into fewer stages. We do this, firstly, for ease of presentation and discussion but also to demonstrate that the stage-gate can be (and often is) conceptualised in a variety of ways.

The Structured Development Process (SDP) offers a framework consisting of terms that describe what needs to be done in development and allows them to be consistently applied across all projects. For this the SDP must be used uniformly across the company and compliance must be mandatory. Through this process the SDP becomes part of the organisational culture. ‘Best in Class’ companies create guidelines around the SDP to ensure major tasks are performed across all projects and ensure mistakes, once identified, are not repeated. The clarity offered in these documents concerning key cross-functional linkages and responsibilities ensures an effective overlap of activities, improved hand-offs between functional groups, setting of realistic and more achievable schedules and improved planning and control.
The framework presented here is organised as a linear sequence of activities. However, the same activities can be structured and organised in parallel to reflect a concurrent, rather than linear, model. It can also be arranged in a completely different manner to meet the specific needs of the organisation (e.g. Rapid Application Development (RAD) environments).

Each of the stages outlined here will be elaborated upon further.

**Stage 1. Opportunity identification and concept definition and evaluation**

This stage starts the NPD process by defining the opportunity to develop a product and then developing a number of possible solutions to meet the requirements such that they fulfil customer needs. From these the best concept is selected. This stage is sometimes referred to as opportunity screening and feasibility study, or simply the ‘fuzzy front end’ in reference to the ambiguity that exists at this early stage.

Activities and tasks associated with this stage are:

- Identification of customer needs and market opportunity.
- Definition of the problem (statement of opportunity with the company as a reference point, i.e. assessing the corporate challenge).
- Market intelligence gathering (for opportunity assessment).
- Concept generation (development of a number of possible solutions for the problem).
- Concept evaluation (identifying the best solution to meet the needs).

**Stage 2. Planning and design**

During this stage the structured development of the concept occurs. The concept is embodied with the functional attributes that are required by the customer. The best configuration to meet customer needs is defined and appropriate plans to meet these specifications are defined.
Activities and tasks associated with this phase are:

- Breakdown of the problem (using techniques such as quality function deployment (QFD) and product design specification (PDS), benchmarking, project planning).
- Information gathering (for engineering design purposes).
- Design review (to assure that design is physically producible and economically viable).
- Review and refinement of product design specification (to ensure that selected alternative is feasible in terms of critical design parameters and cost versus performance trade-offs).
- Market and competitiveness assessment.
- Identification of legislative and regulatory requirements that will need to be addressed.
- Creation of a supporting contracts/bids, or a business case clarifying the financial attractiveness of an opportunity and its relative positioning in the market, and a business (or programme) plan which pulls together the individual functional plans (engineering, quality, operations, marketing, etc.) into a co-ordinated and aligned plan.

### Stage 3. Prototype development

This phase brings about a complete engineering description of a producible product through a process of preparing detailed engineering drawings and purchasing specifications. The process can be greatly aided by computer aided 3-D modelling and drawing.

Activities and tasks associated with this phase are:

- Detail drawings and specifications.
- Review to reconsider implications of the design for development activities that follow.
- Product architecture definition (divide the overall design system into sub-system or modules, which are then used to define the arrangement of physical elements to provide desired functionalities).
- Configuration of parts and components (preliminary modelling and sizing of parts and identification of suitable materials and manufacturing methods. Techniques such as simulation and prototyping aid this process).
- Sourcing of components and services from outside suppliers who might provide important content in the overall solution.
- Parametric design of parts and components (design configurations are tested for robustness through evaluations of exact dimensions and range tolerances).

### Stage 4. Manufacture evaluation and development

This stage involves assessing manufacturing capability to produce and assemble each of the components. This is captured in a process map that specifies the sequence of operations, materials, tooling and arrangement of machines to be used.

Activities and tasks associated with this phase:

- Engineering test and product certification (e.g. Health and Safety, etc.)
- Early market testing and controlled deployment into 'lighthouse' accounts.
- Specification of production plant to be used, and any specialised tools or equipment.
- Planning production arrangement and layout.
- Planning work schedules and inventory control (production system).
• Planning quality assurance.
• Establishing costs of production.
• Planning information flow to facilitate production.

Stage 5. Distribution and marketing

For the product to reach the consumer in the ‘way’ and place they wish to acquire it requires business as well as technical decisions. For instance, the shipping package may be critical and shelf-life also may have to be considered early on in the development. There is also the need to develop technical briefings for the sales brochure and performance test data to consider. All of these must be married with marketing decisions to portray the desired brand image and market positioning.

Activities and tasks associated with this phase are:

• Supply chain configuration.
• Marketing planning.
• Packaging design.
• Shelf-life planning.
• Shipping or transport design.
• Support material (performance specifications, etc.).

Stage 6. Market testing and launch

The use of the product by the end consumer is a key consideration since the customer ultimately decides the success of the product. Customers assess the performance of product along a number of critical dimensions such as product quality, reliability and safety, ease of maintenance, aesthetics, serviceability and of course overall performance to desired expectation. The company needs to ensure that the product complies with the needs of the customer. Otherwise it risks market rejection, i.e. even though the idea is good and a market need exists, the actual product that is developed may not always match sufficiently with the customers’ expectation of it. Thus, the company must trial products before full release into the market.

Activities and tasks associated with this phase are:

• Focus group testing.
• Marketing strategy simulation testing (adverts, communications, price etc.).
• Market testing.
• Launch planning (including localisation and channel validation).

Stage 7. Post-launch and product retirement

It is quite common to assume that the task of product development ends with market launch. On the contrary, it is necessary to ensure that the process remains alive for some time after the launch. After launch the company may find it needs to make minor modifications to the product, and if it is unfortunate major ones. Of course, if the company produces the right product with the right attributes and quality at the right time there would be no need for this. Unfortunately, nothing is completely certain in the real world.
An additional issue must also be considered in the post-launch planning phase, namely that of product retirement. This aspect is increasingly relevant with the growing concern for the environment and the enactment of laws constraining pollution and protection of the eco-system. Product developers must explicitly consider the disposal of a product when it is past its usefulness stage.

Activities and tasks associated with this phase are:

- Recycle and disposal plan.
- Market and competitive monitoring, resulting in incremental refinements to the product.
- Cost reduction activities to maintain margins.
- Product phase-in/phase-out plans.
- Discontinuation (including inventory management and depletion).

**ILLUSTRATION**

*Stage-gate innovation model*

A standard stage-gate innovation model is provided in Figure 5.11 (Cooper, 2006) and consists of five stages: Idea gate, Business case gate, Develop gate, Test gate and Launch gate. Each of the gate points has an associated set of mandatory documentation which helps decisions to be made, and complies with previously approved screening criteria. Different implementations of this basic model exist across many companies and industries (e.g. more gate reviews), but the basic phasing and focus remain the same.

![Stage-gate process diagram](image)

**FIGURE 5.11** Simple map of a stage-gate process
Source: Cooper, 2006

**Realisation teams**

The realisation team is a team given responsibility for a specific development project. The secret to successful product development teams lies in organising them to achieve effective *communication*, *co-ordination* and *decision making*. Many different organisation structures can be used to implement the innovation process. A large number of companies continue to use hierarchical structures to implement innovation processes. Hierarchical structures with extensive rules and procedures often create functional boundaries and barriers. They thus work against cross-functional co-operation which is required in the product development process. With premium rewards being accrued to those with speedier and improved
development processes, some companies, unfortunately a large number, have resorted to simply mimicking the concurrent approach by imposing their functional structures onto a parallel NPD framework. Not surprisingly, they have experienced low levels of success. To successfully move from a serial approach to innovation to a concurrent approach requires adjustment along numerous dimensions. Functional structures seem particularly inept at driving the transition to more advanced innovation processes.

A number of studies have been conducted to identify the most effective team structure to support NPD activities. They indicate many different approaches to teams can be employed. Work by Corey and Starr (reported in Cooper and Kleinschmidt, 1991) in their survey of 500 manufacturing firms, suggests that core teams or autonomous teams were the most successful amongst all alternatives. Use of traditional functional teams produces the lowest success in controlling cost, meeting schedules, achieving technical performance and overall results (Larson and Gobeli, 1989). The value of using empowered senior cross-functional teams to drive such programmes is one that is not lost to the majority of companies. Trygg (1993) found 96 per cent of all groups that had halved product development times employed cross-functional teams. A further contributing factor to the success of these teams was the extent to which leadership is provided by a ‘product champion’ (Frey, 1991). It would seem therefore that successful NPD teams are:

- Cross-functional.
- Empowered.
- Well supported by resources.
- Led by a strong product champion.
- Under visionary management and clear goals.

Self-managed cross-functional teams are a cornerstone to a leaner and more flexible organisation; one capable of managing the intensifying competitive pressures and the ineradicable acceleration of technology. They also appear to be the logical means to generate more creative, less problem-riddled solutions, faster. These teams are key enablers of the NPD framework. They facilitate a change in focus within the company away from the functional and towards project-specific goals. Their empowered accountability and responsibility for project-related goals fosters a greater sense of ownership and commitment and creates a highly effective and dedicated team.

**ILLUSTRATION**

Lockheed’s skunk works – probably the most famous team effort in the world

In 1943, a small group of aeronautical engineers working for the then Lockheed Aircraft Corporation (headed by Clarence ‘Kelly’ Johnson) were given the rush job of creating an entirely new plane from scratch, the P-80 ‘Shooting Star’ jet fighter.

This secret project was housed in a temporary structure roofed over with an old circus tent, which had been thrown up next to a smelly plastics factory. Staffed with the right mix of expertise, and given complete autonomy, unhampered by bureaucracy or the strict application of regulations, this team met their objective in 143 days – 37 days ahead of schedule.

*Source: Based on Quinion, 2005*
Review boards

Senior management monitor and control the product development process through formally designated Review Boards. These bodies are also referred to as the Product Approval Committees (PAC), Resource Boards or New-Product Executive Group. This group is responsible for approving and prioritising new product development investments. Specifically, it has the authority and responsibility to:

- Initiate new product development projects.
- Cancel and re-prioritise projects.
- Ensure that products being developed fit the company’s strategy.
- Allocate development resources.

Because this is a decision-making group it should remain small. It typically includes the Chief Executive Officer (CEO), Chief Operating Officer (COO) or General Manager, and the Heads of the Marketing, Engineering, Finance and Operations areas. In this capacity, each person is expected to dedicate around 10–15 per cent of their time on oversight-related activities. The specific roles expected of these members include:

- **Establish the vision**: Set strategy by establishing a vision for the company’s products. A clear vision is important in helping the entire company to achieve its development activities.

- **Make decisions**: Senior management needs to review project progress at each of the decision-gates to make ‘Go’ or ‘No-Go’ and other product portfolio decisions.

- **Cultivate the product development process**: The senior management group must garner support for the new product development process and the portfolio of projects going through it. It is important to have a standard common NPD process operated by the entire company to ensure smooth and consistent execution of product development activities.

- **Motivate**: The senior team must provide leadership and motivation for all participants involved in product development.

- **Recruit the best development staff**: It is of crucial importance that senior management have access to individuals with specific technical skills and expertise to work on development projects. If the best (most appropriate for the task at hand) staff are recruited into other tasks, product development projects will suffer.

It is important to get a balance between the review team’s authority and the empowerment exercised by the realisation teams. Top management need to balance their need for information and control against the development team’s need to own the process of conceptualising, designing, testing, manufacturing, launching and screening new products (Anthony and McKay, 1992). Too much control makes the review team overbearing and too little leads to poor alignment. The issue of project and resource management in NPD is an important one and can lead to the control of a NPD framework being unbalanced. Unbalance can be either through insufficient control, over-control, or inappropriate control because of poor information.

Four syndromes of unbalance can be discerned (Figure 5.12):

- **Autocratic leadership syndrome**: In this form of unbalance one senior executive dominates product development decisions. It typifies the ‘I know best’ and ‘Do as I command’ syndrome. It leads to frustration in the senior team as well as the development team.
Big brother syndrome. In this syndrome, the senior management team gets involved in low-level decision making. They oversee every little decision and create high loads of administration and bureaucracy for the development team. The development team feels powerless and unable to openly express their voice in the process.

Functional beauty syndrome. This occurs when one function exerts excessive control over the project. In the past this type of syndrome was prevalent in engineering and technically orientated companies, such as Rolls-Royce where engineering considerations led to constant refinements. In the modern day, this syndrome can be found in the heavy dominance by marketing of the development process leading to constant minor refinements that are of marginal value to the end customer.

Ricochet syndrome. Here control is passed from one function to the next as the project proceeds through the different stages of development. In principle this seems sensible enough, since the baton of control is being passed as a different role becomes primary. However, in practice it is easy to lose a sense of direction if the different individuals taking hold of the baton wish to stamp their own authority and direction on the project. The project thus ricochets from one direction to the next, and fails to make clear progress.

Improvements due to balancing the NPD framework can be dramatic: a 50 per cent reduction in cycle time is not uncommon. Other benefits include better products, lower development costs, improved predictability and the ability to handle more development projects concurrently (Anthony and McKay, 1992).

Phase review (decision point) process

All companies possess a decision-making process for new products, even though it may be an informal or non-explicitly defined process. Absence of a formal decision-making process
can lead to inconsistent and unreliable decisions, which consequently introduces significant delays to product development programmes. This can be overcome by applying a well-defined phase review process.

The phase review process drives the product development processes. It is the process whereby the Review Board:

- Makes the difficult strategic-level product decisions.
- Allocates resources to product development efforts.
- Provides direction and leadership to the project teams.
- Empowers the realisation teams to develop the programme on a phase-by-phase basis.

These decisions are made through approval at the conclusion of specific phases in the development effort, and are generally guided by a list of deliverables and milestones that are expected to be completed in support of a Go/No-Go decision.

The phase review process is intended to cover all significant product development efforts, including all major new product development opportunities. Very small projects, such as minor enhancements, can however be managed by a simpler process or grouped and managed as a package. While the NPD process can be conceptualised in different ways, most conceptualisations incorporate project review decision points. Review Boards use these review decision points to examine projected technical, marketing and financial performance of programmes to determine whether to proceed with developing the new product or to terminate it prior to commercialisation. The model shown in Figure 5.13 has five stages, although more or less may be employed by different companies. The phase review process can be viewed as a funnel with many ideas entering at the concept phase and through a series of screenings over the course of development narrowed to a few appropriately resourced projects with high likelihood of market success. At the conclusion of each phase, a review is held to determine the direction of the project: proceed, cancel or re-direct.

For instance, in a parallel arrangement of the stage-gate development a number of activities are executed concurrently across a number of different functions. At specific points,
these are brought together in the form of specific phase review deliverables that are presented to the Review Board. On the basis of the information provided, the product development project will be permitted to proceed to the next phase (with commitments in funding and resources given), given instructions to re-focus, or cancelled. This review activity ensures that funded programmes are consistent with the company’s strategic and financial goals and are supported and resourced in a manner that increases the likelihood of success.

The decision to proceed with the project or drop the project is usually made on the project meeting certain criteria. These criteria act as screens to help senior management arrive at a decision, and are often supported by a business case and plan. The screens define pertinent objectives and considerations that need to be assessed in order to facilitate the decision. Figure 5.14 provides an example of a screen to assess technical and commercial factors.

In addition to such screens, it is common that phase review checklists are applied to ensure due diligence is applied to complete prescribed tasks in a logical and effective sequence. These checklists enforce the use of the SDP and therefore reduce the level of variability in the NPD framework. An example of such a checklist is shown in Figure 5.15.

The use of screens and phase review checklists help to kill off unattractive opportunities earlier. It also is a process of committing increasing levels of investment to attractive opportunities as their associated risk is reduced.

Service innovation has, in the past, been seen to differ from product innovation in three important ways. Firstly, for labour-intensive, interactive services, the service providers (service delivery staff) were part of the customer experience and therefore part of the innovation.
Secondly, services requiring a physical presence of the customer necessitated ‘local’ decentralised production capacity. Finally, service innovators have not had a tangible product to carry a brand name.

However, ever-increasing economic and competitive pressures have forced product and service innovators to think in similar ways. Services can now be consumed at a considerable distance from where they are produced through the use of web-based technologies – while also allowing integrated service and product branding to be achieved. Similarly, the cost of product development from central manufacturing sites have given way to low-cost regional centres, resulting in an increase in globally distributed development and manufacturing models.

**FIGURE 5.15** Example of a phase review checklist (joint development and deployment review)
High levels of waste are not uncommon in many ‘funnel like’ NPD processes. According to Cooper and Kleinschmidt (1991) only one new product concept out of seven becomes a commercial success. This translates into 46 per cent of corporate resources being expended in cancelled projects or failures (see Figure 5.16).

Percentage of R&D spent on cancelled projects is a standard measure in NPD screening performance. Analysis of this metric suggests these figures have dropped to around 3–5 per cent as a result of more stringent screening, earlier in the NPD funnel.
With a convergence of thinking between product and service innovators, it makes sense that common innovation models are being applied within many firms. However, this has not occurred through design, but rather as a result of many service-orientated firms lacking appropriate innovation structures and processes, and now leveraging the extensive research that has been conducted for products. Many service-orientated firms now rely on formal review (evaluation) committees, new-service project teams and pre-defined review points. Additionally, they are increasingly employing models which are very similar in nature to the product development structures proposed by Booz, Allen and Hamilton (1968).

This was illustrated by Scheuing and Johnson (1989), who proposed a ‘Normative Model for Service Innovation’ based on earlier service innovation models (see Figure 5.17).

Each model considers the need for strong strategic objectives to be set before ideas are generated and screened. The best ideas are then analysed in more detail, before being developed and tested through a series of pilots and being successfully deployed. This sequence of activities, and the key review points closely mirror generic ‘product-related’ stage-gate innovation models (see Figure 5.18).

It is only when we drive down to the detailed implementation level of these process models that we might uncover differences, in terms of intangibility, customer contact, non-homogeneity and perishability.

- Service products are normally intangible and do not have components that can be perceived by touch. Consequently, the design of the production and delivery mechanism must be carefully planned and creative approaches will be required to help conduct effective market research in this area.
- Deciding on the appropriate degree of customer contact is essential. Timing, intimacy and information exchange all need to be considered, and this may necessitate re-training of staff should the new service offering be sufficiently different. In addition, new service prototypes can only be tested with customers – no laboratory testing is possible, so ways in which this is to be performed can also be critical.
- In terms of non-homogeneity, service innovations need to take account of the dependency of the service offering on both the consumer and either consistency or customisation.
can be a valid aim. Different customer segments can require changes to both the service and the service augmentation. It is important to identify the main market segments and drivers.

- Since services cannot be stored, the location and timing of the delivery are crucial. The production and consumption of a service are still essentially simultaneous, so it is important to identify the right capacity levels that are required, and where they are to be deployed.

While this does not change the shape of the NDP frameworks, it does introduce the need to be more cognisant of services needs from the customer. Additionally, the power of the internet and open-source communities have enabled customers to share their experiences more readily, allowing them to have a far greater impact on a company’s reputation than ever before.

However, it seems clear that these differences will continue to reduce as service and product innovators increasingly attempt to gain a competitive edge by leveraging any number of best practices, for example:

- Service innovation is more effective when the services are consistently defined, deployed and executed against. This attempt at reducing variability is conceptually the same as product platforming approaches.
- Service innovations will be continually defined, refined and improved through successive pilots. Rapid Application Development (RAD) approaches for software have achieved this same goal for many years.

Despite these nuances, it is fair to assume that while significant literature refers specifically to ‘product’ innovation, the lessons and practices can equally apply to services, with one caveat – the notion of service augmentation.

Customers generally consider both the service offering (the core service received) and the service augmentation (the delivery of the service in terms of customer contact and intimacy). Much research has shown that a competitive advantage is often gained as much by the service augmentation as the service itself. Often, competitors can easily copy new service products,
and the speed with which new services can be introduced can create an oversupply. As a result, great care should be taken to ensure service augmentation is explicitly included in the service development process in order to minimise the risk of the innovation being quickly copied. This also helps counter the problem that services are hard to protect through patents (Goffin and Mitchell, 2005).

**NPD practices in non-profit organisations**

Studies of practices in new product and service development have focussed predominantly on for-profit organisations. However, recent research in this area has yielded some interesting results and conclusions focussing on key areas of strategy, portfolio management, process, market research, people and metrics and performance measurement (Barczak et al., 2006).

Large non-profit organisations tend to be very good at articulating their mission, embedding it throughout, and using it to drive programmes and activities. These organisations tend to view product development as a tactical endeavour versus a strategic one, and do not engage in portfolio management practices. Instead, broad criteria such as fit with vision, funding availability, and presence of a champion are used for evaluation programmes. Additionally, the NPD process tends to be informal, with little structure, and individual departments tend to undertake their own NPD initiatives and have their own processes for doing so. Non-profit organisations also place a heavy emphasis on ideation and less emphasis on other activities such as concept development and testing, project evaluation, and business analysis. It appears that in many cases, the practices applied across for-profit and non-profit organisations are similar, although at different levels of maturity. It also appears that they share some of the same weaknesses, specifically around performance measurement.

**Product development performance**

Possessing a NPD process is not itself a guarantee for success. A number of factors determine whether a particular project is likely to be successful, and the types of benefits and problems arising from such frameworks can be wide-ranging. To understand the areas in which product development methodologies can be improved, it is beneficial to know the reasons why new products fail. We review the key success factors in NPD, and the benefits they can yield, before turning our attention to the challenges that these frameworks present.

**Key success factors in new product development**

According to Robert Cooper (1990), who is considered by many as the father of ‘stage-gate’ development models, there are eight key factors that distinguish winning projects from the losers. Briefly, these are (in descending order of importance):

1. A superior product that delivers unique benefits to the user, rather than ‘me too’ offerings with little differentiation. Superior products:
   a. Have a commercial success rate of 98.0 per cent, versus 18.4 per cent for undifferentiated ones.
   b. Experience market share of 53.5 per cent versus 11.6 per cent for ‘me too’ products.
   c. Rate profitability of 8.4 out of 10 (versus 2.6 out of 10 for undifferentiated products).
2. Possess a well-defined product concept prior to the development phase, which is more than three times more likely to be successful and capture higher market share (by around 38 per cent on average).

3. Are supported by high-quality technical activities, such as strong technical assessments, trial or pilot production, and/or in-house product or prototyping testing.

4. Driven from a strong fit between the needs of the project and the firm’s R&D or product development and engineering competencies and resources.

5. Possess highly effective practices at the (fuzzy) front-end of the development funnel; this includes initial screening, preliminary market and technical assessments, detailed market studies, and business/financial analysis.

6. Feature a strong fit between the needs of the project and its sales, distribution, marketing, advertising and customer services capabilities.

7. Involve effective execution of marketing activities, such as preliminary market assessments, detailed market studies, customer tests of prototypes and market launch. When well executed, success rate can be more than doubled.

8. Are more successful when targeted at more attractive markets (i.e. large markets with high growth rates, or high market need).

When implementing, or operating, a NPD framework, it is important to consider these key success factors and ensure they are being proactively and consistently driven. It is also important to consider the interplay between different success factors, and identifying and driving towards those which the company truly desires. A common example is the relationship between development speed (time-to-market) and product profitability. Companies that succeed in bringing new products to market faster than competitors can obtain first-mover advantages, however more innovative new products are associated with slower development speeds. Recent analysis has suggested that there is an inverted U-shaped relationship between development speed and new product profitability, and that the optimal point in this U-shape differs for product improvements and line extensions. This relationship is important for managers in determining to what extent they wish to accelerate development of new products, and how the associated spending should be spread across the product portfolio.

Benefits of a structured development process

The benefits to be gained from implementing a structured NPD process are many, and are generally divided into benefits that are experienced internally within the organisation (process and business benefits), and those benefits derived externally (market benefits), which are summarised next.

Organisation (process) benefits

Implementing a structured NPD process provides a discipline to what would otherwise be an ad hoc and chaotic process. The provision of a ‘roadmap’, defining the tasks and deliverables for the project leader, helps improve visibility and understanding of the process by the members of the company. The introduction of evaluation points focuses the attention on quality of execution and ensures no steps or activities are omitted. Its cross-functional coverage forces input and involvement from all parties at the right time, and can help accelerate the process by identifying and allowing opportunities for concurrent activity (Cooper and Kleinschmidt, 1991).
Organisation (business) benefits

A range of business benefits can be obtained by the effective implementation of a structured NPD framework. These can include:

- Improved new product success rates.
- Rapid generation of economies of learning curve with lower overhead and labour costs.
- More information sharing and problem solving across the organisation.
- Lower requirements of working capital.
- Less need for engineering and design changes due to environmental variations (Gehani, 1994).

External (market) benefits

In addition, structured NPD models have also been seen to deliver a range of key market benefits, including higher quality of goods and services, greater customer satisfaction, faster development and more effective and timely launch (Gehani, 1994; Cooper and Kleinschmidt, 1991).

Deficiencies of stage-gate NPD systems

Regardless of the potential gains from adopting a NPD framework, it is not a problem-free process and success is not guaranteed. Analysis of the adoption of NPD by companies raises a number of issues for concern. In some cases NPD programmes have even had a negative impact on the success of the organisation (e.g. Trygg, 1993). Some key causes for concern are:

- Around a quarter of companies who implemented a NPD framework reported worse ‘time-to-market’ performance.
- Almost two-thirds of company executives state they are ‘somewhat’ or ‘very’ disappointed in their firms’ new product efforts.
- About half of resources invested in new product programmes are wasted on technical and commercial failures.

The less than startling rate of success is associated with a number of problems and inefficiencies. Most of the potential problems arise from the implementation of the new product development structured methodology. Many implementations of the NPD process have been accompanied by increases in bureaucracy. Additionally, if controls are made too tight they can thwart creativity and slow down decision making. Instead of promoting innovation the process can easily become a deadly plague. Fortunately, many of the problems appear to be caused by implementation-related issues rather than any fundamental failing of the NPD framework. Planning and care in implementation can remedy the problems.

Analysis of product development failures shows a lack of market orientation, weak product uniqueness, little added value, consumer use dissatisfaction, high price, and low quality as the main causes of failure (Lee and Na, 1994). In an extensive study by Cooper (1988), the most common reasons for new product failure were identified as shown in Figure 5.19.

This seems to indicate that major external problems lie in the market-related dimension, particularly the lack of market analysis, reaction of competition and the lack of an effective marketing effort. Internal factors such as technical or production problems also contribute to this by raising internal costs or contribute to poor timing of product introduction. A
further breakdown of these figures offered by Cooper (1988) reveals deficiencies in the new product development process as highlighted in Table 5.2.

From the results shown in Table 5.2, it can be clearly seen that customer orientation is particularly important in successful innovation. It is surprising that many employees, not only scientists and engineers but even marketers, do not understand their customers. The problem is not just a lack of market research making the organisation unsure of customer needs but largely a result of the company’s inability to effectively transmit the ‘voice of the customer’ internally (the classic problem of the ineffective Marketing–Engineering interface). This requires the company to devise ways of correctly exposing employees to customers’ needs.

NPD frameworks are also plagued by many problems which are internal to the organisation, and which need not exist. Shortage of resources (time, money, people) occurs because too much attention is given to current activities, leading to insufficient efforts for long-term
and radical activities. The present versus future conflict is a central and common source of contradiction, and the problem of inadequate resources can also be felt by taking on an excessive number of projects (e.g. through weak 'kill' criteria or the tendency to consider too broad a range of development directions). Consequently, people work on too many activities, which leads to a tendency to pull expert individuals off one project to fix another one. In some cases, problems here can result in damaging competitive behaviours internally, as individual teams battle fiercely for resources, resulting in one or two teams winning out, but the organisation, as a whole, losing.

Aligned to this can be a vagueness resulting from poor planning, which leads to frequent changes in priorities. Additionally, poorly developed and poorly understood organisational goals lead to a lack of synergistic actions and behaviours. This compounds the problems that may already exist from the chopping and changing of personnel from one project to the next. Consequently, scarce resources are wasted by running in many and often wrong directions.

A lack of commitment and support from top management can also strongly dampen innovation. Leadership that leans toward excessive retrospection and possesses attitudes that reinforce a 'we have always done it this way' view deadens radical innovation. Management, by signalling and reinforcing the norms of behaviour, either encourages or stifles innovation. Innovation begins and ends at the top. One way to try to combat negative tendencies and turn them into positive ones is to introduce initiatives for creativity. Encouraging open communication and providing creativity training are good techniques for doing just this. However, at times it may be necessary to mandate sharing of activities across functional disciplines. Similarly, biases of senior management, especially if toward a single dominant functional area such as marketing or engineering, can actually be very troublesome for well-rounded decisions to be reached. Decisions that take longer than two months often deflate the energy to get things done. The net result: frustration in the recipients.

It is clear that a great deal can be gained if companies are able to improve their customer orientation, and their integration between the technical and marketing functions. Another area for attention is the quality of internal project and resource management. If product development projects are not controlled or poorly resourced the new product development effort will almost invariably end up being a failure.

Modern developments in managing the NPD process

The discussion thus far has presented a structured innovation process system that currently represents the majority of practice. It is a generic structure that is generally considered as a state of the art process. However, new developments are taking place that are taking the innovation and new product development process towards a more advanced stage. We will firstly discuss some significant incremental improvements that have been applied to the standard NPD framework. Next, we elaborate two models that are suggestive of the type of move towards a more advanced generation of innovation framework. The first model is essentially a refinement of the existing structured approach and the second is indicative of the transformation towards a network model (sixth generation) in response to environmental shifts and added complexity.

How companies are evolving their NPD frameworks

Research in the automotive industry has suggested that a third of companies have modified their NPD frameworks, and are likely to use (amongst other things) virtual teams and adopt
collaborative and virtual NPD software support tools (Etlie and Eisenbach, 2007). These companies are not alone, as others have adopted capabilities, such as:

- Tailoring to suit different risk level projects.
- Adaptable process to support different development approaches (waterfall and spiral models).
- Efficient, lean, rapid systems.
- More creative approaches towards NPD governance, including self-managed and virtual, electronic decision gates.
- Accountable and continuous improvement.

We will discuss each of these briefly in turn, and show how the NPD frameworks are continuing to innovate.

**Tailored NPD structures**

Perhaps the most significant change in NPD frameworks over the past few years has been that they have become a scalable process, scaled to suit very different types of risk level projects – from very risky and complex platform developments through to lower level extensions and modifications, and even to rather simple sales force requests (Cooper, 2006; Cooper and Edgett, 2005).

Many companies have attempted to apply a simple stage-gate model for all projects, but found it cumbersome and overbearing. As the NPD frameworks evolved, and were incrementally improved based on previous lessons learned, it became the collective knowledge and experience of those that used it. However, this tended to add administration and bureaucracy as the demands to adhere to the process became more onerous.

To address this challenge, many have tailored their NPD frameworks to allow only the relevant elements to be included in different projects based on need and applicability. One such tailored model is offered by Cooper (2008), who suggests that the initial gate (decision point) acts as a clearing house to direct different projects down different execution routes. The full-blown product developments continue to be driven through the formal NPD structure and decision-making processes, while smaller, low-risk, projects pass through different types of increasingly compressed and lean frameworks (see Figure 5.20).

**Adaptable development processes**

Just as NPD frameworks have been adjusted to become tailorable, so too have the underlying processes in the ‘Structured Development Process’ (SDP) become more flexible. Consequently, the concept of spiral/iterative or agile development is now accommodated, allowing project teams to move more rapidly to a final product design through a series of ‘build–test–feedback’ iterations (Cooper and Edgett, 2005; Hauser et al., 2005). This concept is covered more fully in Chapter 12.

**Efficient, lean, rapid systems**

In a series of bi-annual benchmarking activities, the Performance Measurement Group (PMG) (2003) identified and refined different stages of maturity in NPD frameworks. Many companies appeared to have stalled at stage 2(b), which was reflective of a mature, functionally strong and standardised NPD process which was beginning to falter as increasing and incremental improvements added further administration and bureaucracy (see Figure 5.21).
FIGURE 5.20 Tailoring NPD frameworks (the NexGen model)
Source: Cooper, 2008

FIGURE 5.21 PRTM NPD maturity model
As a response to this, some companies have made their NPD frameworks lean by removing waste and inefficiency at every opportunity. Key areas of focus have included documents and templates, decision processes, functional deliverables, and the use and attendance of various supporting committees and review boards.

**Creative approaches to governance**

Deficiencies in NPD governance have already been identified and addressed by some companies (see Chapter 6). Ensuring decision points have teeth, clarifying the roles of the Review Board (gate keepers), and applying portfolio management principles are becoming increasingly common.

Additionally, some companies are making use of scorecards and make better go/kill decisions (e.g. Procter & Gamble, ITT Industries, Johnson & Johnson), while others employ pre-defined success criteria at gates. Other improvements in this area include:

- **Self managed gates**: Where teams conduct their own reviews (or local reviews) for low-cost/low-risk projects.
- **Electronic and virtual gates**: Where decision point review materials are distributed and reviewed remotely by Review Board members, who score and recommend go/kill decisions, which are then consolidated and discussed via teleconference or video-conference, and aided by the use of collaborative IT tools.

**Accountable and continuous improvement**

Applying disciplined improvement methodologies, such as 6-Sigma, has allowed many companies to drive continuous improvements in NPD, focusing on three major elements (Cooper and Edgett, 2005; Cooper, 2006):

- **Having performance metrics in place**: These metrics measure how well a specific new product project has performed.
- **Establishing team accountability for results**: All members of the project team are fully responsible for performance results when measured against these metrics.
- **Building on learning and improvement**: When the project team misses the target, or when deficiencies occur, or variances to forecasts are seen, they focus on fixing the root causes, not the symptoms (Ledford, 2006).

**Iterative learning innovation model of new product development**

One interesting refinement upon the basic generic structured model is captured in the iterative model proposed by Hughes and Chafin (1996). Hughes and Chafin propose a value creation model, called the Value Proposition Process (VPP). The focus of this model is on continuous (or iterative) learning to improve the certainty of knowledge used in NPD decision making. By utilising an iterative methodology the model breaks the seemingly linear sequence of the generic model. The model encapsulates the basic steps of the generic model but configures these into a cyclical process. Whilst this departure is essentially incremental it does shows potential to refine and advance the current structured approach to new product development.
The objective of the Value Proposition Process is to determine if an organisation can convert an idea or an opportunity into a proposition that adds value to a number of stakeholders: the end users, the company, and the value chain. The VPP consists of a framework of four continuous planning cycles. Each cycle is based on going through a series of sub-loops and passing through an integrated screening methodology. The screens are very much like the stage-gate review point screens in the structured development process.

The VPP is essentially an encompassing life-cycle process that focuses on answering the question: Can we do it right? This is captured in Value Proposition Cycle (VPC). However, often there is an even more basic question that should be answered first: Is it the right thing to do? This question is tackled in the Value Sensing Cycle (VSC). After the VPP, there is another question that usually needs to be asked: Can we do it right the first time? This is answered by going through the loops of the Value Introduction Cycle (VIC). Once the product or service begins to be commercialised, there is an ongoing evaluation question: Did we do it right? This question must be answered from the point of view of the four stakeholders: the customers, the employees, the suppliers and the stockholders, and is captured in the Value Management Cycle (VMC) (see Figure 5.22). In other words, four cycles are used to answer questions that frame the portfolio of a product development life cycle.

**Value proposition cycle**

The VPC methodology is presented in detail, since the basic sequence is repeated in the other cycles but with a different set of questions and screens. The VPC comprises four iterative loops (see Figure 5.23). Each loop raises a set of critical questions and addresses the following activities: defining the market value of the opposition (Does the customer care?); developing the business value (Do we care?); delivering a winning solution (Can we beat the competition?); and applying project and process planning (Can we do it?).

Each turn of the VPC loop requires going through a screen, very much like the screens shown for the generic process. The screens summarise the critical factors for success. The number of success factors varies according to product newness, complexity, and amount of
risk. New and risky products with a high cost of failure require more items in the screen. A simpler project such as a line extension can use a reduced set of evaluation criteria.

Value Sensing Cycle

The portfolio life cycle process can begin at any point in the life cycle if a product already exists. A really new product would begin at the idea generation stage, known as the Value Sensing Cycle (VSC). This cycle continuously scans the market, the business environment, competition and technology to identify new ideas or opportunities. These ideas are screened and reduced to a manageable few, which are then passed along to the VPC.

Value Introducing Cycle

Once the team and the organisation have used the VPC and agreed that they can do it right, the proposition is translated into the final specifications and plans, and fed into the Value Introduction Cycle (VIC). This cycle consists of a highly disciplined process to develop, produce, verify and deploy the solution initially to all target market segments, and over time any additional market segments. The output of this cycle is products and services and the required support infrastructure that provides the input for the Value Management Cycle (VMC).

Value Management Cycle

The VMC, at the bottom of Figure 5.20, continuously screens market and business performance to answer the question: Did we do it right? The monitoring is from the point of view
of customers, employees, suppliers and stockholders. Critical questions must be answered at each of the four loops in the VMC such as:

- Do our customers perceive that they are paying a fair price for the benefit received?
- Do the project team members feel motivated by what they accomplished?
- Do we have strong supplier partnerships that will assure favoured customer treatment from them?
- Are we profitable and adding shareholder value?

Metrics from each of these four loops are an important part of the CEO’s dashboard. Critical feedback from the VMC is linked and fed into the VSC to complete the life cycle. The cycle is then continuously reiterated.

The iterative model is interesting because it reinforces the focus on the value delivery in innovation. But perhaps of even more interest is that it examines value from a number of stakeholder positions. Most models of innovation unfortunately just focus on one or two stakeholder interests: either the shareholder by looking after the bottom line of the organisation or the customer. Under such positions the role and importance of the other stakeholders is either completely ignored or given short shrift. Yet for a company to build an innovative culture and a positive image and standing in its environment it must provide value to its employees and society too. By examining development projects using a broader ‘stakeholder value’ approach, it is possible to identify the multiple dimensions a company must focus upon to drive sustainable success.

**Network innovation: the solutions innovation model**

As discussed earlier, there has been a shift toward network models for innovation over time. The questions arising are 'why is this move occurring' and 'what are the fundamental issues of this transition'. In order to illustrate these issues, we elaborate a specific variant of network innovation: the solutions innovation approach.

Companies that have relied on traditional structured NPD frameworks, such as those encapsulated by the generic development process described earlier, are coming under increasing pressure. Technologies are evolving ever more rapidly. This has reduced the span of an average product life cycle, making products less profitable than comparable offerings in previous generations. Products are also increasingly becoming commoditised and payback periods shorter. Furthermore, market segments have begun to fragment as customers’ needs become ever more sophisticated. Customers are demanding unique customised products or solutions. They are no longer satisfied with a generic fulfilment of their specific ‘individual’ needs. Adding to this, shareholders are also demanding greater returns on their investments, and unlike in the past they now exhibit a greater and quicker tendency to switch their investments to other more profitable portfolios. On top of all this, there is no let-up in the intensity of global competition. Given these changes, it is small wonder that many senior executives are becoming overwhelmed by the challenges facing them. They are experiencing pressures that undermine the advantages they have established over many years.

Some companies have chosen to address these problems by attempting to strengthen their current business models (e.g. by intensifying efforts to reduce costs and maintain margins) or rationalising their current portfolios (e.g. discarding less profitable product lines). Unfortunately for these companies, if they continue simply to drive incremental improvements internally, the nature of the external forces will be kept at bay only for a short while. In order to tackle these trends it is necessary to fundamentally question the existing new
product development framework. Shepherd and Ahmed (2000) propose solutions-based innovation as a method to cope with the new environment. They argue that under fast-changing complex environments, in which there is heightened demand for customised need fulfilment, companies must move to building solutions for end customers rather than just developing simple products. If they can do this they will be able to build long-term sustainable positions of competitive advantage and profitability.

Some features of this approach are already being observed in leading-edge companies. The solutions innovation phenomenon started in the corporate consultancy sector and the high-end computing and electronics sector. Faced with the new environmental challenges many leading-edge companies across all sectors have been quick to realise the importance of innovating ‘solutions’ as opposed to just products. So what exactly is solutions innovation? To answer this, we need first to examine the underlying features of the traditional product-led innovation paradigm.

Traditional NPD frameworks have been employed to effectively design, develop and manufacture products to meet the needs of established markets. In this paradigm, all decisions are made at the product level. This perspective is based on a simplistic and atomistic view of products and services. Each product is considered, developed and evaluated in isolation. The investment decision to develop a product is made on the product’s projected revenue stream, and each product that is developed is evaluated separately and independently (Figure 5.24). Additionally, each product is developed to meet a specific yet generic mass-market need. While the needs of end customers remained relatively simple this approach to innovation was able to deliver competitive advantage. However, when the needs become more sophisticated and complex this paradigm begins to reach its limits.

When customers begin to demand complex and uniquely customised ‘solutions’, the product-centric development process begins to break down. A few illustrative examples are helpful in understanding these developments. For example, a number of select and increasingly sophisticated holidaymakers are now looking for a customised solution to their needs. They do not just want to book an airline to fly them to their destination. They want a taxi to...

**FIGURE 5.24** Product focus in NPD frameworks

*Source: Shepherd and Ahmed, 2000*
take them to the airport, they may have a gluten food allergy or they may be diabetic and so they want the airline to remember their particular dietary requirement, they want an onwards taxi to their hotel and they want the hotel to know of their dietary restrictions too. They may even want their pets to be looked after while they are away on holiday. Now a traditional company would focus on providing a product, such as say pet care or booking tickets, but a solutions-led company would perceive the need to develop a total solution to fit the customer’s needs. They would compile the different narrow needs into a package that provides an entire solution. The solutions company would be able to offer a service for pets, taxi for transport, and have an interconnection with hotels to ensure dietary needs and other relevant information was communicated.

To deliver on such a promise the solutions company would need to possess an extended capability, one that is well beyond the realms of a simple product innovator. Let us look at a few more illustrations to demonstrate this point. In the banking sector, affluent customers are not just looking for safe deposit of their money but a financial solution to manage their income wisely. In addressing this need, leading-edge banks such as Lloyds TSB have for certain categories of customers (such as platinum card carriers) privilege managers, whose role is to provide an array of services, advice and support. These privilege managers assist in investment planning, insurance advice, pension planning to arranging a mortgage and so on. The emphasis is on providing a financial solution rather than just a product. In other words, they cater to the specific and complex needs of the end customer. An alternative example is from the telecommunications sector. This is a sector where solutions innovation is gaining increasing relevance. Telephones are no longer just devices for simple communication. Mobile phones provide a full connectivity solution. The range of features in a mobile phone are indicative of a complex packaged solution: voice communication, text-based communication, a camera facility, WAP-based internet connectivity, radio facility, time clock, diary organiser, calculator, and even applications that help to track and plan shares and stocks portfolios. In this sector, it is not possible to simply offer a narrow product. Mobile phone companies have to bundle a large range of component into a single package. This requires companies to either possess or have control over a vastly larger range of capabilities. For example, Samsung made great inroads into the mobile phone market because it was able to leverage a capability from its other operations, namely camera technology. The sharper picture resolution and design of Samsung mobile phones was in large part from the company’s strength in electronics and cameras. Bundling the camera facility into the mobile phone helped Samsung rise to a prominent position in the mobile market.

Clearly, when customers demand customisation or complex products the challenge of innovation becomes greater. Rather than just developing new products the companies are faced with the challenge of configuring a solution. This is a much more demanding task. Shepherd and Ahmed (2000) define a solutions company as one that integrates component products (or sub-components of a product) and services to provide a solution to a complex customer problem.

To further illustrate solutions innovation let us look at Automatic Teller Machines (ATM) as an example. Consumers come across ATMs as cash machines. ATM manufacturers are part of the computing and electronics sector. One of the largest companies in the sector is NCR. The clients of NCR are primarily banks and building societies. The end customer is however the person on the street, wishing to withdraw cash. The traditional approach to innovation at NCR was simply to focus on the hardware, i.e. develop a high-quality cash point machine. NCR’s market intelligence indicated that ATMs could be potentially turned into ‘solution providers’ rather than just cash dispensers for end customers. For instance, an ATM could function as a computer by allowing internet access, etc. If you examine newly
installed ATMs you are likely to find a number of additional features linked into the cash dispensation function. One that has recently taken off is the incorporation of a mobile phone top-up facility. Other features allow payment of bills and engagement in other financial transactions. To be able to incorporate these features NCR had to develop new software and services in the ATM hardware. In other words, to move from a product innovator to a solution innovator the company had to not only innovate new hardware, but also innovate in terms of creating new software and services. The hardware, software and services are separate components of product development. However, when appropriately combined they create a solution. This requires the company to innovate not just hardware but also software and services. However, once the software, service or hardware components have been developed for the specific needs of the client they can be used as components to develop solutions for other customers through a careful process of bundling and integration. In other words, each of the components maybe subsequently leveraged to compile bundles as customised solutions for other customers (see Figure 5.25).

The solutions innovator gains access to a double revenue stream: one from the product innovation alone (i.e. component parts of the solution, such as hardware, software or services in our example). The second stream is from creating the solution through effective bundling. In fact, the way this works is that the company first undertakes to provide a unique customised solution for which it can charge premium price. The customised solution is subsequently examined or broken down into components, and each component if possible is used to produce other unique solutions through recombination. In the process of innovating new solutions it is often necessary to innovate along one or more component parts. These component innovations can then be either used in future bundling of unique solutions or released/sold to the market as product developments of themselves. Thus, a dual stream of income is realised.

**FIGURE 5.25** Solutions portfolio – a generic model

Source: Shepherd and Ahmed, 2000
ILLUSTRATION

BASF looks to develop customer solutions

In 2003, BASF AG signed an agreement with Omya, a Swiss-based producer of white minerals, to co-operate in the development of paper making and coatings products by using each other’s R&D facilities. While Omya makes calcium carbonates and talcs for use as fillers and pigments, BASF produces binders and dispersions for paper makers.

‘Paper companies are increasingly demanding solutions from their suppliers that have already been tested and shown to work’, says a BASF official.

Under the agreement, Omya gets access to a pilot coating machine at BASF’s paper technical centre in Ludwigshafen, Germany, after closing its own testing coating equipment at its headquarters in Oftringen, near Zurich, Switzerland. At the same time, BASF will be able to test its products at Omya’s printing centre at Oftringen.

‘The alliance with Omya makes it easier for us to offer holistic system solutions to our customers’, says Hans Richard Schmidt, a spokesperson for BASF’s European business unit for paper. ‘It also enables us to make the process of rendering services less costly.’

(Source: Based on Milmo, 2003)

Any company embarking on this type of strategic repositioning must first establish exactly what kind of solutions it wants to provide as part of its solution portfolio, and also articulate a business model to drive growth through an effective move from ‘products’ to ‘solutions’. The realignment from a ‘product’ to ‘solutions’ focussed innovation model represents a significant strategic repositioning, for which senior executives need to provide answers to some fundamental questions, such as:

- Is there more money to be made in fixing more complex problems than the ones we address now?
- Is there more money in being the first to understand and fix a problem?
- Are we close enough to our customers (particularly high-level management) to understand their industry trends as least as well as they do, and influence those who make the key decisions?
- Which core competencies do we possess that offers a significant competitive differentiation?
- Since leverage is essential to profitability, what products, services and competencies are available to us to provide the necessary solutions, and which do we need to acquire through alliances/partnerships?
- What strategies do we need to fill the gaps in our intended solutions, and what is the desired roadmap?

An important challenge for the solution innovator is the dramatically higher requirement in terms of a company’s core capabilities. Creating a solution demands not only greater resourcea but more importantly much broader and wider capabilities. It is more than likely that no single firm alone possesses all the skills and expertise to produce a solution. To create the solution the company must link up with partner firms that possess specific skills and expertise in the components necessary to develop the solution. In other words, the innovation challenge is one that extends beyond the company’s boundary of expertise and
experience. The challenge of managing innovation in a solution-led organisation is one of managing external partnerships, and not just internal participants.

In moving to solutions innovation a company needs to extend its range of innovation competencies. A solution innovator requires to build four key competencies for success:

**Market/business knowledge competence**

The area that best articulates what it means to be a solutions-focussed company is defined at the customer interface. The success of solutions-based innovation rests on identifying customer needs for solutions in the first place. A key objective in defining solutions is to identify opportunities for increasing the mix of higher margin components. Ultimately, if no such complex need exists then there is little value to becoming a solution-centric organisation. The solutions provider must understand end customer needs in detail and more holistically since solutions require the bundling of what on the surface may seem to be separate product needs. To uncover, or better define, problems for which solutions are required the solutions innovator must find new ways of delving into customer need-bundles. As such, solutions innovators need a closer and deeper relationship with end customers than product-centric firms. They need to be involved in the customer’s world in order to uncover their complex bundles, and they need to involve the customer in their world by finding ways of eliciting customer participation in the innovation development process. Rather than conducting transactions the solution innovator must develop strong symbiotic relationships.

For instance, in a business-to-business context, where the customer is another business, the solutions provider must build a strategic understanding of the client’s business. The solutions innovator must understand the industry in which the client operates, its current position and future direction of development even better then the client does. Only by having such deep knowledge can the solutions provider begin to construct convincing solutions for the client themselves. This deep market knowledge capability is essential to develop long-term win–win solutions. Without such in-depth insight it is not possible to configure solutions. In a business-to-business context this would involve developing relationships not at mid-manager level, such as with the purchasing manager, as is the case in product-centric development but with senior executives. Links with the client company at the senior executive level are necessary to appreciate their strategic aspirations and long-term objectives. These become the basis from which to develop solutions.

**Technical competence**

Adopting a solutions-focussed business model requires a company to control and manage a wider set of competencies. The company needs to strengthen existing competencies and also develop new competencies either alone or in partnership with others. The technical challenge is to be leading edge in a number of key areas that are critical to the formulation and delivery of the solution. This can be achieved in a number of different ways other than just through internal development. Especially in making the transition from a product innovator to a solutions innovator, most companies will find they simply do not possess all the competencies to develop solutions. They can address this through a number of alternative routes such as mergers, acquisitions, sub-contracting or partnerships. This leads on to the next critical competence for solutions innovation, namely network or partnership competence.

**Partnership competence**

In highly complex environments it is unlikely that any single organisation will possess, or wish to possess, all the necessary skills and technological collateral to meet the broad
enterprise-wide needs of its customers. To develop a solution usually demands sourcing and integrating both internally and externally supplied components into the solution. It is therefore necessary that effective and enduring relationships are established with partner firms, who possess a strong knowledge and capability base in the different components. In this network, the solutions innovator adopts the role of a trusted focal integrator who identifies and develops the ‘solution’ by integrating the components such that all the partners in the network benefit. A strong project management competence is needed here!

**Integration competence**

To develop solutions means that the company must be able to integrate the components seamlessly and efficiently so as to deliver high value. This demands an integration capability to put together the different components to compile a solution. However, the expertise required is not only in technical integration of components but also an ability to identify valuable business, process and organisational integration opportunities. This requires the solutions innovator to first have an appropriate network of partners and second, has the ability to manage the relationships to facilitate integration. Underpinning this, of course, is trust and the management of a complex web of partner relationships.

It is clear that an organisation adopting a solutions focus needs to be able to articulate its solution offerings clearly and ensure the components that they comprise can be provided. Consequently, the competence profile of the solutions-focussed company sees a progressive move away from a strong technical competence to one which is more balanced with market/business knowledge, partnership and integration competencies. Figure 5.26 illustrates the move required to become a solutions innovator.

It is important to note that although we have discussed solutions innovation in seemingly discrete block components (product components, service, hardware, software, etc.), the solutions concept is actually quite generic. It extends to complex products, and even in some cases to what look on the surface like simple products. For instance, often it is the case that complex products, such as drugs, are viewed as simple product entities by customers. However, their development frequently involves the coming together of several different component technologies and capabilities, i.e. the product is actually made up of sub-components.

**FIGURE 5.26 Organisational competence of a solutions provider**

*Source: Shepherd and Ahmed, 2000*
which a single firm alone may not possess. This is particularly the case in the new drug
development sector, which is now experiencing a convergence between nanotechnology,
bio-science with pharmaceutical development. Such ‘complex products’ are actually made
up from sub-component elements that must come together to produce a seamless product
solution. Additionally, products that one may think of as simple, are also being examined
and innovated from a solutions perspective. Take, for example, toothpaste. It is no longer
developed as a simple tooth-cleansing paste, but is formulated as a bacterial wash for the
mouth and tongue. Nike is a great example of solutions positioning. Nike is not just design-
ing shoes for performance but it is now beginning to consider bundling an athletics solution
by providing sports coaches to its customer geared to develop the customer skills in the
specific type of Nike shoe they purchase.

In this section we have presented an overview of the challenges facing traditional, ‘prod-
uct’-focused companies in a world of rapidly changing technologies, increasing product
commoditisation and more sophisticated customer needs. A number of world-class com-
panies recognising that their traditional business is under threat are adopting a solutions-
focused business model to sustain their long-term profit and growth aspirations. The
solutions model encourages companies to integrate component products (or component
parts of a product) and services in a manner that allows them to meet the complex needs of
their customers. Such a strategic change requires a significant overhaul in the company’s
NPD frameworks. An adjustment in the skills mix and organisation structure is often
demanded to execute solutions innovation effectively. Solutions innovators must develop
new practices and frameworks to exploit ‘solutions’ opportunities. Moreover, management
in these environments need more and better quality information to guide their decision
making as well as track performance. This is not a trivial, or simple, thing to achieve.

The challenges we have defined specifically for solutions innovators are the general
challenges of network innovation. We have used the solutions approach to highlight the
organisational demands that must be tackled by companies wishing move to a network sys-
tem of innovation. The network approach is based on collaborative links and relationships.
Chesborough (2003) conceptualises this shift to links and relationships as ‘open innovation’.
In the developing the solutions model we have highlighted not just the challenges but
also the reasons for the shift toward network systems of innovation. Becoming a solutions
innovator specifically, and network innovator broadly, demands significant organisational
shift. Companies that attempt this are engaging in an act of strategic and process innovation.
Organisational innovation is required to develop the new competencies to become a solu-
tions innovator. The evolution to a network (or solutions-focused) business model is a
high-risk and complex strategy, but in today’s rapidly changing economic and technological
climate there seems little alternative.

ILLUSTRATION

From technology to functionalities: Rhodia’s partnership
approach to innovate solutions

R&D partnership between speciality chemical companies and their customers are relatively common-
place in the development of new products. Several European chemical companies are taking this fur-
ther and extending product development to include not only suppliers and customers, but also other
players in the chain, such as retailers and designers in the home and personal care markets.
With a current allocation of around 20 per cent of its R&D budget to such broad-based research partnerships, Rhodia considers itself to be pioneering a new way of conducting research and development in the chemicals sector.

‘This is truly a revolution in the approach to new product development’, says Jean-Julien Baronnet, Rhodia’s group executive vice-president responsible for developing the new partnership business model.

‘Companies in sectors such as detergents, automobiles and food are moving away from a culture of secrecy in research into one involving strategic alliances’, he adds. ‘The future of R&D now lies in these sort of alliances. Trying to develop products alone is wishful thinking. The discovery of new products has become more and more complex because it involves so many different competences in addition to chemicals.’

In October 2002, Mr Baronnet, speaking at the World Detergents Conference in Montreux, Switzerland, stated that when tackling new product development, companies like his own are beginning to think more in terms of functionalities than technologies.

‘Our organization is market- and customer-oriented, so that we may have an intimate understanding of market trends and our customers’ expectations’, he explains. ‘This enables us to identify unmet customer needs. These needs are translated in terms of functionalities, and we determine what technologies and expertise are necessary to satisfy them.’

Functionalities in detergents include surface modification for easy cleaning, surface adhesion for textile fabric care and controlled release for time-controlled discharge of perfumes.

‘A major problem with perfumes in detergents is that 80 to 90 per cent of them are destroyed in the wash, yet they can account for around 30 per cent of the cost of the formulation’, Mr Baronnet notes. ‘The solution to the problem in terms of functionality is controlled release, which can help to reduce the destruction level down to 40 per cent and generate huge savings. But a control release system can involve three to four complementary technologies in areas like latex, polymers, [and] minerals such as silica and surfactants.’

Like technologies, similar functionalities can be applied across a range of markets. Rhodia is using surface modification in sectors such as fabric care, hygiene and automotive.

‘Our polyamide fibers division is working on the surface modification of fibres so they can capture smells like dog odours in cars’, says Mr Baronnet. ‘We are using surface modification of fibres to eliminate stains, while we also see opportunities for applications in areas like babies’ tissues.’

Around half of Rhodia’s R&D expenditure is allocated to one-to-one co-operation projects with individual customers, which are based on the company’s system of cross-fertilisation of technologies. Over the last two years, Rhodia has pursued a strategy of cross-linking its own technologies to help build close R&D partnerships with customers. In these, Rhodia businesses that have helped launch the new strategy, research partnerships have boosted average returns on capital employed to around 15 per cent, roughly a fourfold increase. The partnerships have been such a success that the company is rolling out the concept across the company and extending the scope of the alliances beyond direct customers.

‘We are bringing together companies which are complementary to each other’, explains Mr Baronnet. ‘In the field of surface modification, for example, we would want to get around the table a textile manufacturer, our own polyamide and detergents businesses, a soaper, a retailer and a designer.’

The company is already helping to develop clothes using fibres with antibacterial and anti-odour properties for Benetton, the retail chain.

‘If necessary, we will bring into these alliances competitors who are strong in a specific technology relevant to a functionality we are working on’, Mr Baronnet says. ‘The important thing will be that we will not be in competition with these chemical companies in the same markets with the same functionality.’

Rhodia is finding that in sectors such as detergents, these broader alliances tend to comprise three to four companies. In its automotive activity, the partners number five or more.

‘What we are helping to develop are virtual companies whose members have the same objective of satisfying unmet consumer needs by working together on the same research programs’, Mr Baronnet explains.

(Source: Based on Milmo, 2002)
**Conclusions**

In this chapter we examined how innovation management processes have evolved into their current state of being. This is instructive in that it highlights a trajectory of continuous improvement in the approaches and it emphasises the need to build upon the current legacy of innovation systems. The effectiveness of the approaches is very much contingent upon the specific context a company faces. Unquestioned adoption of frameworks and associated tools is likely to result in failure. Success requires careful understanding of the specific constraints and opportunities both internal and external to the organisation, and selection and adaptation of an innovation framework that capitalises on this context.

In elaborating the generic structured development model we defined the fundamental activities and structures required for a modern product development system. We went on to highlight the iterative learning and the solutions model as two formats that potentially define the trajectory of development for modern innovation practice. The iterative learning model focusses upon continuous learning more thoroughly than earlier innovation processes. It is also driven by a stronger focus on incorporating value for a wider set of stakeholders than previously, i.e. using more than just shareholders as a yardstick of success and decision making. The solutions model focusses on the challenges facing management of innovation as environments become more complex and end customer needs become more sophisticated. The solutions model is a specific illustration of the shift toward network-based innovation. It shows that the current structured product development methods are inadequate in the face of new environmental challenges. And to move from product-centric innovation to solution-centric will require companies to undertake strategic innovation in the process of innovation itself. Perhaps taken individually these models represent moderate improvements to current understanding of the innovation process. Taken together, however, the models are representative of the evolutionary trajectory for the new generation of innovation management processes.

**QUESTIONS**

1. What are the six major stages through which innovation process management systems have evolved? Define the pros and cons for each approach.
2. What are the four basic components that constitute a generic NPD framework?
3. What are the advantages of implementing a structured product development (SDP) model? What are potential limitations or problems of this approach?
4. Explain the reasons behind the Japanese ability to parallel process new product development activities. Why do some western companies find it difficult to emulate this model? How have western companies been able to come to grips with the parallel processing model of development?
5. How do NPD frameworks differ between a product/service-focused business, and one that is positioned as a network innovator or solutions provider?
6. Define the key organisational challenges in becoming a network innovator.
7. What dynamics are driving the shift towards network innovation generally, and toward solutions innovation specifically?
When Molton Brown chief executive Sara Halton wanted to inject fresh life into the 34-year-old brand, she didn’t just talk to the people in new product development. She set up an advisory board — calling in Hip Hotel founder Herbert J.M. Ypma, interior decorator Andrew Martin and horticulturist Guy Barter, and six other experts. ‘I thought it would help us to think differently’, Halton says. ‘Ideas come out of the most surprising places sometimes.’

This is a new way of thinking about beauty product development. Traditionally, a company would see a gap in the market and talk to its laboratories or create a product in response to a competitor’s launch. But lately, the approach has been quite different. Nivea, for example, has just set up a discussion group with Stephen Bayley, creator of the Design Museum, in the chair. Its aim is to answer this question: ‘what is beauty?’ ‘Creating new products is not the reason for the group’, says Ann-Louise Holland, PR manager for Nivea’s parent company, Bierefsor UK. However, ‘if light bulbs for new products come out of it, we’ll pick up on them.’

Five years previously, Chris Sanderson at the Future Laboratory, a trend-forecasting strategic consultancy, received a call from Procter & Gamble. ‘We were commissioned by them to look into the concept of light, without knowing why’, Sanderson says. The outcome was The Book of Light, a report that offered insights into how the cosmetics market was set to change over the coming decade. And the result in product terms is rumoured to be the bestselling Olay Regenerist range.

Then there’s the Mind Gym, a corporate consultancy famed for coming up with the concept of the stuffed crust pizza during one of their workshops, who were approached by GlaxoSmithKline to run a ‘Generating Creative Sparks’ workshop with its oral hygiene team.

‘It’s a cornucopia of stimuli to the senses’, explains Octavius Black, global managing director of the Mind Gym and co-author of The Mind Gym: Wake Your Mind Up. One exercise, for example, involves objects such as teddy bears or rubber being proffered with the objective to create ideas in a specific field.

According to Sarah Leonard, vice president of leadership and organisation for GlaxoSmithKline, ‘in just 90 minutes, the business generated over 60 innovative concepts for new product development, of which 30 were then taken and further progressed.’ One new, top-secret toothpaste is being launched on the back of the workshop.

It’s not just idea generation that is being revolutionised, though; these days the big beauty giants are creating products using more esoteric sources.

For example, the technology used to develop protective clothing in Japan has been modified for use in skincare. It takes the form of an ingredient called Diakalyte in an anti-ageing product by L’Oréal’s Biotherm, called Source Thérapie Superactiv serum.

‘L’Oréal has a worldwide open innovation process that looks for any new technologies and concepts mastered in other industries that could be of interest to the cosmetics industry’, says Patricia Pineau, L’Oréal’s director of scientific communications. ‘We took the technology from the waterproof fabric and translated it to work for a skin cream. We wanted to preserve skin transparency as well as increase the diffusion of light. In other words, create the optical effect of a skin surface that is at once smooth, transparent and matt.’

The food industry, too, is proving fertile territory for the beauty industry. Clinique’s Supermoisture make-up is made using a machine similar to that traditionally used in ice-cream vans. ‘Our textural prototype to research and development was yoghurt’, explains Scott Miselnicky, Clinique’s executive director of worldwide make-up product development. Clinique was interested in the ice-cream technology ‘for the reason that it changes the chemical properties of the emulsion and comes out as a mousse.’

In fact, changing the intellectual properties of the beauty industry itself is what this is really all about. ‘During our first meeting [with the advisory board], the conversation ranged from elephant polo
to organic food’, recalls Molton Brown’s Sara Halton. ‘It was like being at a very interesting dinner party.’


QUESTIONS

1. To what extent does this case study justify being innovative in an organisation’s approach to innovation?
2. Analyse and categorise the different approaches that are described.
3. Consider another industry very different from skincare and suggest ways in which they could benefit from looking at that industry from outside the box.

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