Manufacturing Engineering Tripos Part II
Paper 2 2008
Examiner: Dr Elizabeth Garnsey

Question 1: (Dr James Moultrie)

a) Describe the relationship between product and market lifecycles and outline the limitations of the lifecycle concept as a marketing tool. [20%]

A successful multinational manufacturer of consumer goods has recently employed a new Product Manager, who has expertise in an industrial goods sector.

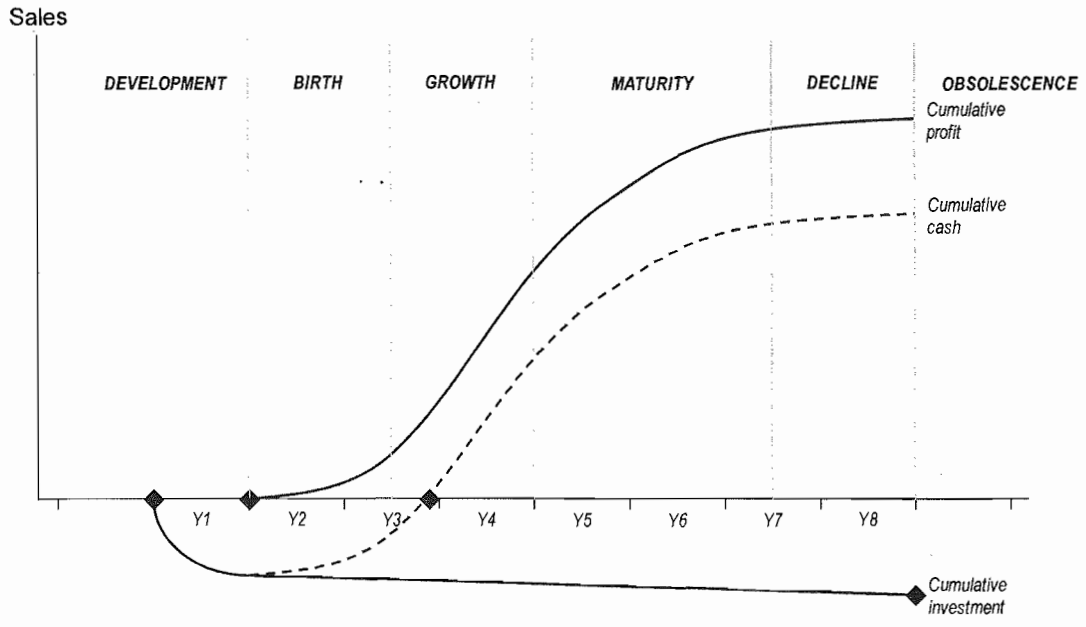
b) Outline the roles and responsibilities of the Product Manager in this organisation and indicate how these might differ from his previous role. [30%]

The Product Manager has taken responsibility for a range of products that have historically been technically superior to the competition. However, a competitor has recently launched a new-high technology product and as a result, sales have begun to fall.

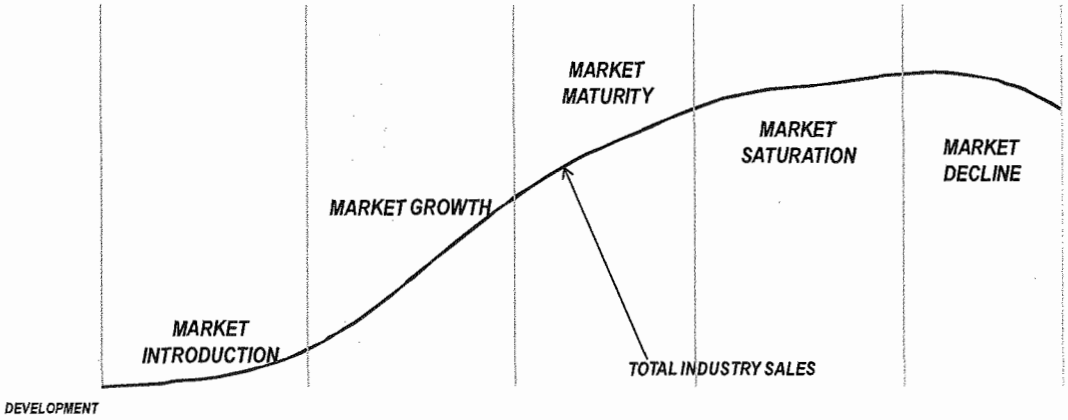
c) Prepare a short report for the Managing Director, with recommendations for how the business might respond to this competitive threat. Where appropriate, make reference to relevant theoretical models and illustrative examples. [50%]

Answer:

a) Product lifecycle: represents the stages of 'growth and decline' of a product offering from a company. The product lifecycle will typically go through a series of recognised stages as indicated below:



Product lifecycle



Market lifecycle

Market lifecycle: the market lifecycle is clearly related to the product lifecycle, but might take into account different generations of product. E.g. the product lifecycle for an individual mobile phone might be six months. The market lifecycle for 'mobile phones' is still growing and will take into account many individual phones. The market lifecycle is created by buyer demand. Also related is the technology adoption cycle (bell curve).

At the birth stage, customers are innovators. Early in the growth phase are the early adopters followed by the early majority. In the maturity phase are the late majority, followed by the laggards.

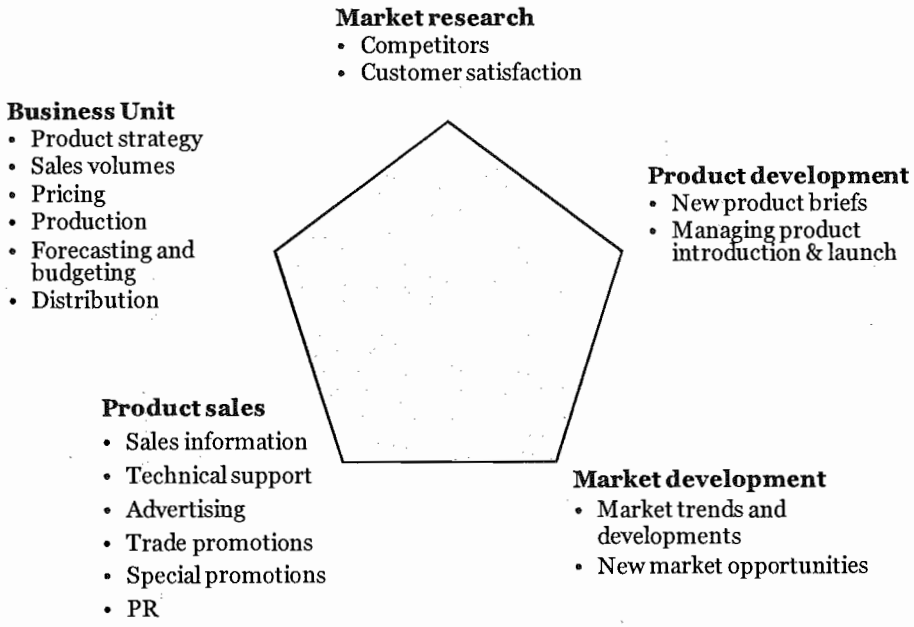
Many of the same managerial issues apply for both lifecycles and generic issues can be considered at each phase. These include both who the potential customer is, what the competitive actions might be and also what communications or development strategies might be appropriate.

The key limitation with the lifecycle concept is difficulty in establishing the stage of the lifecycle that a product is in, and whether this is as a result of internal company actions or a factor of the external competitive environment. It is difficult therefore to extrapolate any reliable trends from this data. Students should recognise that they can influence the lifecycle and that it is not necessarily independent from the actions that the company takes. Strategy is both a cause and result of the PLC
Thus, used over simplistically, the PLC data can be dangerous. Used cautiously, the data might point towards potential actions. Thus, key questions that might be asked are:

- Which stage am I in?
- When does a product move between stages?
- How to forecast sales level, length of each stage, and shape of PLC
- How to predict the trajectory?
- Am I really influencing the trajectory?
- Independence of the trajectory from my actions?

b) The product manager's primary role is bottom line responsibility for a product, brand or a range of products. However, the emphasis of this role will be different in different types of organisation. As a brand manager in an FMCG company, the emphasis will be towards communication, sales, pricing, market research and distribution management. In an industrial company, the product manager will have a stronger technical involvement in both product development and also technical sales. The generic product

management roles are indicated below. Product managers in small technology firms – with either a sales alignment or a product development alignment. Here the product manager is more information gatherer and provider to enable decision making at a senior level. Students might draw on examples from guest lecturers here.



c) Here, students should consider the key marketing concepts from the module (along with examples). This should include: 4Ps, PLC, SWOT analysis, Porters Value Chain, Porters 5 forces, BCG matrix, portfolio management, market segmentation and positioning, etc. From a BCG perspective, the product has become a question mark or maybe a dog. They should present some strategic options – these might include:

i) Product development: with a distinction between a radical product development to compete with the new technology head on – vs a 'face-lift' to encourage competition along a different dimension.

ii) Brand strategy: to focus less on the individual product and more on the brand values associated with it, to build customer awareness and interest in the brand. This could be through celebrity endorsement, through re-packaging, through improved services etc. However, the product must be consistent with the brand values being promoted.

iii) Product/service benefits: to emphasise the non-technical benefits of the product and potentially focus on service / customer service related issues. Thus, to change the core benefits being offered – away from solely performance.

iv) Promotion: sales may be falling due to a lack of customer awareness in general, or awareness of unique features not related to technical performance. However, this type of strategy can only be short term.

v) Pricing strategy: simply reduce the price, in conjunction with appropriate promotion and distribution – there is a danger that this damages the brand or reduces profitability

Ultimately, the only long term solution is product development. All other solutions perhaps provide a short term response.

Question 2: (Dr. Ken Platts)

How do strategies form in organisations?

Answer this question with reference to Mintzberg's writings on strategy. Illustrate your answer with suitable examples.

Answer:

This question requires students to synthesise the different models and perspectives of strategy. Mintzberg's writings provide a suitable structure for this. A good answer would cover discussion of the following:

- intended and realised strategy
- deliberate and emergent strategy

(Minztberg and Waters diagram would be useful here)

- Mintzberg's perspectives on strategy

Strategy as Plan

The traditional view - top down
Developed consciously, then implemented
Result of rational and analytical process
The preserve of 'the planning department'
Predicated on assumptions of predictable environments and control

Strategy as Ploy

A possible subset of Plan
A manoeuvre threatening action (often with little intention of implementing)
'Game' playing
Usually to promote a particular reaction (behaviour) from another party

Strategy as Position

The relationship between organisations and their environments
Strengths, Weaknesses, Opportunities and Threats
Michael Porter's 5 force Model

Strategy as Perspective

Internally determined
Organisation culture, ideology, character
Shared by members of the organisation
Determines norms and values

Strategy as Pattern

A pattern in a stream of actions
Consistency in behaviour, *whether intended or not*
A 'Plan' may be part, but in most cases only part of a strategy
Unplanned actions and events can connect into strategic themes

The better, or more widely read, students might synthesise the above into the strategies identified by Mintzberg and Waters (see below). (Students were asked to read this paper.) The really good students might discuss issues of strategic learning as a way of reconciling the deliberate and emergent perspectives.

Question 3: (Mr David Probert)

Discuss what, of educational value, can be gained from planned industrial visits in the context of a manufacturing engineering course. How should visits be organised so that maximum value is derived from them?

Illustrate your answer drawing on your experience of industrial visits and study tour preparation. [100%]

Answer:
Students should draw on their own experience of visits, and from material and exercises provided to ensure that factory visits result in useful learning. This could include:

- MET1 visits that cover the different sectors in manufacturing industry (automotive, aerospace, FMGC, etc) and different organisation of manufacturing (batch, process, job shop etc)
- Other aspects covered include: lean manufacturing, good or sub-optimal manufacturing practices, performance measurement, inventory management, workplace organisation, health and safety, corporate and social responsibility, climate and work culture
- MET2 visits which link to particular themes in modules: assembly exercises, process technologies, market conditions etc
- The MET2 study tour which enables specific themes to be investigated and researched, for example emerging manufacturing economies or environmentally sustainable technologies in a particular part of the world

Good students should be able to discuss the preparation and briefing that precedes a visit in order to identify the particular learning points of interest. This includes preparing the visit in collaboration with the host company, and setting up a guided tour of the facilities. A question and answer session with local managers is also used as a means to extract additional insights and value from the visit. Debriefing, reporting and presentation may be organised after the visit in order to consolidate and communicate the learning.

Good students will be able to illustrate their answers by describing aspects of the factory organisation they have observed, and key lessons from particular visits.

Question 4: (Mr David Probert)

(a) Explain what is meant by the following concepts, illustrating your answer with examples from practice:

(i) the technology 's'curve

(ii) managing the 'fuzzy front end' of innovation

(iii) technology roadmapping [30%]

(b) Describe the activities embodied in technology management processes, such as those of the 'ISAEP' process model. Discuss how the three concepts in part (a) could be integrated with technology management processes, as the basis for a technology management system in a manufacturing business. [40%]

(c) Discuss the role of the Chief Technology Officer (CTO) in establishing such a system, and how the role might differ between large and small firms. [30%]

Answer:

(a)

(i) The technology 's' curve is a graph which plots the development of a given performance characteristic of a technology against effort or cost given to the development of the technology. Time is sometimes used as a substitute for effort/cost as this can be difficult to measure if many different people and organisations have been involved in the development of the technology.

(ii) The 'fuzzy front end' of innovation is the period at the start of a development project, when the project could have started, but has not yet been formally approved. This period is characterised by the exploration of many alternative ideas, uncertainty as to which is the best option to pursue, and the progressive elimination of non-viable possibilities.

(iii) Technology roadmapping (TRM) is a graphical method of representing technology, product/service/system and market developments against a time axis. The method supports the development of technology strategy and business planning in an organisation or group of organisations, linking technical and commercial viewpoints.

TRM has been used for a wide variety of purposes, but originates in product/technology planning. It is a powerful consensus-building technique that combines technology push and market-pull, and which develops knowledge sharing around an opportunity. It has also been used at industrial sector level and national level in order to facilitate foresight studies. Experience shows that the technique can be used to address a very wide variety of business and organisational issues, as long as the architecture of the roadmap (the levels of the vertical axis and the timescale) are customised to suit the context and the issue.

(b) Technology management processes of the 'ISAEP' process model (as covered in the teaching module), and embodied activities, are:

- Identification (exploring the environment for possible technologies)
- Selection (choosing which technologies to make use of)
- Acquisition (bringing the chosen technology into the business activities of the firm)
- Exploitation (making use of the technology to produce revenue)
- Protection (ensuring that the value of the technology is preserved)

This process model enables the activities of individuals in a firm to be organised in a systematic way such that technological resources are most effectively managed – and helps to ensure a comprehensive approach.

Good students should be able to give many examples of activities carried out by individuals and groups in the firm that relate to these processes.

The technology 's' curve is useful in the context of managing technology over its lifecycle, and plays a particular role in supporting identification, selection and exploitation activities.

The fuzzy front end is the period during which identification activities are at their most intense and selection criteria need to be defined.

Technology roadmapping is a powerful integrating technique which draws on all of the ISAEP processes, and links to the other key business processes as well (strategy development, innovation and operations). Protection issues need to be considered in order to make the case for the exploitation of a selected technology, as depicted on the roadmap.

(c) The Chief Technology Officer usually has responsibility to ensure the technology and innovation management systems of the business are working effectively. In practice, this role (or at least the title) may not exist in every firm. The responsibilities associated with the role will then need to be distributed to other senior managers in order that these activities are not neglected. These activities can be carried out by a combination of the CEO, the Technology Director, the Manufacturing Director, R&D Managers, Product Development Managers, etc.

By making use of the ISAEP process model, and other associated technology and innovation management tools and techniques (such as 's' curve analysis, tracking ideas through the fuzzy front end, and applying technology roadmapping), the CTO, or other relevant senior managers, can make sure that technological considerations are being fully integrated into business decision making.

In large firms the CTO role may have cross-business unit responsibility, in order to ensure technology synergies are fully exploited. In a small business, the role is more likely to be concerned with specific individual technologies which are central to the firm's business.

Question 5: (Dr Elizabeth Garnsey)

A company producing precision instrumentation is growing rapidly and facing problems of delay and quality control. Experienced production managers favour a move to lean production (LP) to address these problems, but the HR manager has convinced the CEO that it will be impossible to retain their loyal workforce if they introduce task fragmentation and standardisation. Prepare a briefing document for the CEO setting out why, appropriately conceived, LP prioritizes worker involvement and commitment and under what conditions HR practices and work organization can be combined to ensure favourable results for both HR and overall performance. [100%]

Answer:

This question calls for the ability to draw together material from lean work organization lectures and on the scaling up problems of young firms into a well structured answer. Specific marks are not set for sub-questions to allow students scope for originality in addressing the question and organising their answer.

An integrating theme could be the distinction between Fordism (which the HR manager is confusing with LP) and the principles of lean production. These are to eliminate waste, maximise value, ensure continuous flow right through from suppliers and involve a committed workforce in continual improvement.

Typical problems of scaling up production in a new technology based firm could be related to failure to achieve these objectives. The students should explain why a change in work organization from current arrangements to lean production can improve productivity and quality as a company scales up output and how the higher administrative costs of LP will be recouped. They should also identify key differences between Lean thinking as applied to tasks and the distinction between Thinking and Doing advocated by Taylor and embodied in Scientific Management and Fordism. Lean principles, unlike Fordism, prioritizes worker involvement and high workforce commitment and HR practices to ensure this should be explained.

As well as making the above points, a good answer could recognize an alternative to LP for small scale activity in the form of flexible specialization for niche customers: creating unique (e.g. fashion) products or customised products for special customers. Here small scale activity on a disaggregated basis is integrated by the firm in question, which builds on the competence of specialist partners – an example could be Benetton. But they would point out that this solution is not appropriate for volume production of precision engineering equipment.

The answer should show in more detail why the lab automation company that is aiming to move beyond niche production to achieve integrated scaled up manufacture would be well advised to introduce LP for quality and productivity, in order to avoid human error effects (for which formulae were provided in the lectures). There would be extra marks for pointing out that stressful conditions can be mitigated by reducing resources in response to, rather than in anticipation of, productivity increases, by introducing technical changes such as total preventative maintenance, by worker participation in improving tools and task organization, and by provision of employment security.

A first class answer would be able to bring the literature on lean production and on scaling up small tech based firms together in a coherent way, providing a well structured answer, illustrating points made by the use of case study examples presented on the module or reading, and from experience.

An upper second would show some grasp of what the two sets of issues have in common but would lack coherence and miss some of the key empirical points. A coherent account of scale up problems of young enterprises could contribute 1/3 of marks so long as the issues are set in context and not reproduced by rote.

Weaker answers would simply reproduce material from slides and reading without understanding the HR dynamics of scaling up a company. Third class or lower answer would be unfamiliar with the materials covered in class and would produce generalities without detailed evidence or coherent arguments.

Question 6: (Dr Elizabeth Garnsey)

Companies often use Joint Ventures or Acquisition as innovation strategies. Compare and contrast the human resource management issues that need to be addressed in Joint Ventures and in implementing an acquisition. [100%]

Answer:

This question is based on combining material from the lecture and workshop on partnerships and alliances with the lecture/workshop on acquisition. The open nature of the question allows scope for rewarding students who devise a conceptual framework that allows them to integrate material relating to both alliance and acquisitions, and to draw on workshops and readings to illustrate and elucidate common themes.

Answers should recognize that there are common issues under both forms of change affecting HR management: there is a need to align structures, cultures, integrate teams, retain and develop skills and, above all, to align individual and organisational goals under both forms of governance. In both cases workers would encounter unfamiliar ways of working. Teams and individuals from the two original companies would have to learn to work together by making concessions to each other and showing mutual respect for skills and values. This could result in innovative developments through combining competence of the two teams.

Under JVs, relationship building is particularly essential since command and control is not possible. Agreed methods could be negotiated in a joint venture to the benefit of both parties, but the duration of the joint venture may be in question, reducing incentives to accommodate differences. Examples should be provided from case studies.

An acquisition can use command and control, but this is likely to demotivate and lead to problems of staff retention. An acquisition is more likely to impose work organization changes, and thus to lose less time in trying to accommodate differences, depending on the type of acquisition introduced. If the companies are closely integrated there is more need to align reward strategies than if autonomy is allowed to the acquired unit.

The more enduring nature of an acquisition would provide greater certainty than is available in often short term joint ventures. That the acquiring firm is in danger of losing staff who are disaffected by loss of their leadership and changes in management methods should be illustrated from case studies. This is particularly serious if people are the main asset of the company acquired. Differences in reward and recognition need to be addressed. Thus the answer should point out that the building of relationships and trust is necessary under both types of governance; they could refer to the vicious cycle of mistrust covered in the lecture.

A first class answer would provide common themes, and offer a framework for analysing the two variants of change in governance. Examples would be given to bring the themes to life.

An upper second answer would show knowledge of management of change issues under the two systems of governance, but would fail to include some of the key points and lack analytical edge.

Weaker answers would fail to identify integrating themes and be unable to provide examples and instances. A third class answer would fail to make effective use of any of the relevant material presented in the module and present generalities or irrelevant evidence.