

INCREASING COMPETITIVENESS THROUGH THE APPLICATION OF PRODUCT DESIGN AS A KNOWLEDGE CREATION MANAGEMENT TOOL

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ABSTRACT

The business environment is becoming more and more competitive as a result of an increasingly globalised economy and the resultant increase in customer expectations. In response, companies are increasing their competitiveness through knowledge management. Although business managers could use design as knowledge creation management, they are not using it as widely as they might as a result of a poor understanding of the contribution of design. This raises the question of how the understanding of design can be improved. A conceptual framework was drawn up, which could assist managers to acquire a sufficient understanding of design. This framework also indicated how design could be both a user and producer of knowledge and, thus, could contribute to a continuous competitive advantage. A curriculum was developed which could provide managers with an effective understanding of design in order to increase a company's competitiveness by managing design as part of the knowledge creation management of a company.

INTRODUCTION

As early as 1980, De Geus (1980: 17) mentioned that "Over the long term, the only sustainable competitive advantage may be an organisation's ability to learn faster than its competition." Today this remark is taken as referring to the creation of new knowledge as part of a knowledge management strategy.

This paper will indicate that competitiveness can be improved by using new product design as a knowledge creation management tool. The business environment is becoming more competitive as a result of the globalised economy. Design can contribute to the competitiveness of a business by contributing to innovation and, in so doing, to knowledge creation. The traditional design process will be depicted as both a user and producer of knowledge. After comprehensive research, recommendations are made on how business managers can acquire a sufficient understanding of product design in order to use these processes as a knowledge creation management tool.

THEORETICAL BACKGROUND

Competition is Increasing Customer Expectations

Two main factors in the marketplace have increased customer expectations and highlight the importance of achieving a competitive edge for leading companies. These are the effects of globalisation and a slowdown in the world economy.

Globalisation is characterised by the fact that distance and national borders no longer matter, the ease with which business with customers across the globe can take place and that the nation, state and geography are no longer relevant for economic success (Loots, 2001: 2–3). The information technology revolution sped up communication around the world, and with it came deregulation and the elimination of trade barriers. Competition increased as companies started to compete with one another across the globe. For the customer, increased competition means increased offerings, both quantitatively and qualitatively.

Competition between companies has also increased due to a slowdown in the world economy. Apart from the most recent global economic crisis in 2008/9, the slow world economy can be traced back to a few dominant events in the USA a few years ago. In April 2000 the Nasdaq lost a third of its value and in March 2001 a recession began. Six months after that, two planes hit the World Trade Centre and another crashed into the Pentagon. Although this recession technically ended in late 2001, the aftereffects continued to plague the economy (Norris, 2003).

In the European Union, the average per capita economic growth dropped steadily from 2.6 per cent annually in the 1970s to just 1.7 per cent in the 1990s. At the same time Britain reported that its economy had grown at the most sluggish pace in 10 years. In addition, the German economy shrank at the end of 2002 (Leonhardt, 2003). Towards the end of 2008 the world economy slowed down so much that the worst economic crisis since 1933 is feared.

As a result of globalisation (more offerings) and slow economic growth (fewer customers), competition has increased between companies, which leads to increased offerings, and thus providing customers with increased options. These increased choices raise customers' expectations and make them more demanding. Customers have become spoilt for choice. As a result, the continuous development of products has become essential for companies to survive.

Competitive Advantage Needed

A business can compete successfully only if the continuous development of products can lead to a competitive advantage. The best competitive advantage is a temporary monopoly created when the product offering adds unique value to a specific set of customers. Unless the firm is in a monopoly position, competition will force it to engage in ruthless price wars resulting in zero profits. To create a temporary monopoly, the company needs to be different. The product offering must add value in a way that nobody else can (Holmberg & Riddestrale, 2000: 35). A sustainable competitive advantage for most companies is thus based on continuous innovation.

Innovation, according to the SOED (1993: 1373) comes from the Latin *novare* meaning to *make new*, which comes from the root *novus* meaning *new*. An innovation is described as *the introduction of something new; or the alteration of something established*. Merriam-Webster (2001: 736) concurs with this definition as it describes innovate as to *renew; to introduce new methods*. Management authors such as Stoner et al. (1995: 426) describe creativity as the translation of a new idea into a new company (Apple computers), a new product (Sony Walkman), a new service (Federal Express's overnight delivery), a new process (one queue for multiple services at a bank) or a new method of production (computer-aided design and manufacturing).

A definition of innovation, in terms of product design, is provided by Walsh et al. (1992: 16). Innovation is used to describe the whole activity from invention (the discovery of the new device, product, process or system) to the point of first commercial or social use. Such a description includes all the various activities involved in converting a new idea, invention or discovery into a novel product or industrial process in commercial or social use. The innovation design process according to Roy and Potter (1990: 33) includes the technical, design, production, financial and marketing steps necessary for the first commercial sales of a new (or improved) manufactured product or the first commercial use of a new (or improved) manufacturing process.

To be able to innovate permanently, knowledge is paramount. Knowledge management is one of the key constituents in the management process. Whoever has the greatest insight in innovation and better skills in applying this insight will be more successful than the competition.

Knowledge Management as Competitive Advantage

Knowledge management has risen to prominence in most organisations mainly as a result of the nature of the globalised economy and the loss of expertise through corporate downsizing, outsourcing and staff reductions in the West in the 1980s. Companies rediscovered in the 1990s that employees have skills and knowledge that are not readily available to (or captured by) the organisation. Organisations that downsized found that they had lost much of their organisational memory or intellectual capital. Rather than innovating, firms found themselves reinventing the wheel and repeating the mistakes of the past (Little et al., 2002: 299). In many cases people who had been made redundant had to be rehired, often as consultants, because their knowledge was found to be irreplaceable (Quintas, 2002: 5).

The rationale and background of knowledge management is that an organisation that increases its knowledge, can increase its competitiveness. Quintas (2002: 11) states that the key relationship between knowledge and competitive advantage lies in the potential for knowledge creation to lead to innovation, which, in turn, provides the basis for competitive advantage. According to Keys and Fulmer (1998: 7) other competitive advantages, such as capital resources, technical innovation, or even management talent, can be made obsolete by a competitor who reads the changing environment and learns in a more appropriate manner.

New Product Design as Knowledge Creation Management

This section highlights the role that product design can and does play in innovation and in the new knowledge-based economy. Knowledge was traditionally generated by research and development but in the new economy research, design and development are required as design adds innovation. In the process design uses knowledge and produces knowledge.

Design uses knowledge by integrating knowledge from other disciplines. This integration is done through research of existing knowledge. To design an object requires a great deal of technical and instrumental knowledge, much of which originates in other discipline areas. When, for example, a new coffee machine is required, the designer must have a workable understanding of, for example, plastics (for the outer shell), the process of making coffee, heating requirements, etc. This research can happen outside as well as inside the company. An example of design drawing from the pool of the company knowledge is the practice by 3M. One of 3M's accepted norms is that products belong to divisions but technologies belong to the company. The company encourages people to work collectively to shared goals and values. They can share resources, including knowledge (Ghosal, Bartlett & Moran, 2000: 127).

Knowledge is drawn from various sources in order to increase the quality of the design solution. According to Snoek and Hekkert (1999: 168), the total amount of knowledge related to a certain design problem, including both the initial state of knowledge and the goal state of the problem, as well as a set of operators that can produce new states of knowledge from existing states of knowledge, is metaphorically called the *solution space*. The solution space of a design problem involves knowledge from a variety of domains. The complexity of most design problems requires gathering of additional information, either from domains closely related to the problem at hand or even from domains that have not been related to this particular problem before. Thus, the final solution space expands from the initial solution space. Productive thinking, i.e. restructuring the information in the final solution space, will lead to a creative solution to the design problem (Snoek & Hekkert, 1999: 168).

Using and producing knowledge in design can never be separated, as they are intertwined and often have a cause–result relationship. Design can produce knowledge when designers contribute their knowledge to an organisation. Designers can create knowledge by the generation of concepts,

the critical evaluation of existing products or idea generation. Designers can also turn the most appropriate concepts into product ideas and ultimately into viable products. Sanchez and Mahoney (1999: 68), for example, indicate how the new product information structure is an output of the design process and thus represents knowledge creation.

By generating knowledge, design can contribute to a sustainable competitive advantage. Holmberg and Ridderstrale (2000: 34) argue that future success of companies is dependent on the development of conditions that facilitate the continuous (re)creation of customer value or, put differently, continuous innovation. For companies to compete successfully, a system of continuous innovation is, therefore, essential. Such a system can be the holistic design process.

Holistic Design (Conceptual Model)

This section proposes a conceptual model of a holistic design process, which companies can apply in order to use and produce knowledge in their quest to be competitive.

Start of the design process

The design process starts with acquiring knowledge on various aspects in preparation for the actual design process. Any design starts with a design **brief**. The brief usually, but not always, derives from **market research**. (See Figure 1.)

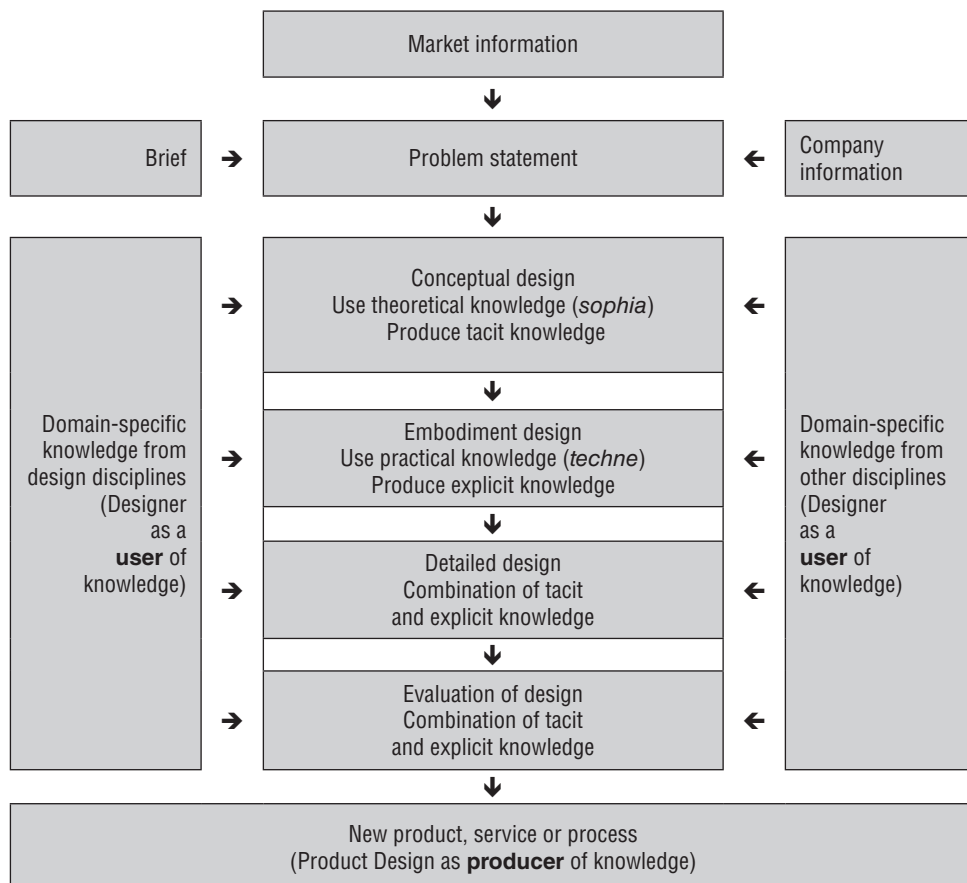


Figure 1: Product Design as a Knowledge Creation Management Tool (conceptual model)

There is a natural interaction between the designer and the market. The origin of a product can be either based on market information or in the creativity of the designer. On the one hand the designer could follow the market by reacting to market information and deliver a product for which there is known demand. This usually leads to incremental or continuous development and involves less risk. On the other hand the designer could lead the market by anticipating future trends and deliver a product for unmet or as yet unknown consumer needs. This usually leads to radical or discontinuous development and involves a higher degree of risk taking. The difference between these approaches relates to the push and pull marketing approaches. Theoretically the answer is not an either/or but both. The ideal new product should satisfy a known need in the market and, at the same time, be radically new.

Apart from the brief and market information, the designer should be *au fait* with certain **company information**. It is important that the designer comprehend the relationship of the new product to the rest of the company. The designer should understand the strategic direction of the company, knowing which aspects are fixed (e.g. the main purpose of the product) and which are open to creative design.

When research on the above is completed, it can be condensed into **problem statement**. (See Figure 1.) An example of a problem statement could be: Design an upmarket timepiece for young adults that could be produced by any subcontractor, but would sell for less than R1 000.

The design process

With all the preparations done, the problem can be addressed through the following four processes. The designer will use or increase his/her domain-specific knowledge of the design process to guide the process and make sure that it arrives at the desired end – a new product, service or process. The designer will also use or increase his/her domain-specific knowledge on non-design disciplines (Friedman 200a, 200b and Young, 2001). The design process will proceed as follows:

- Conceptual design: The stage in which alternative solutions and design variants for solving the problem are generated and selected for further development. This process includes the knowledge-creation process. In this process the designer uses theoretical knowledge or *sophia* (theory driven knowledge) and generates mainly tacit knowledge as the conceptualisation will happen in the mind of the designer.
- Embodiment of design: The stage in which one or more design concepts are translated into layout drawings and/or prototypes or full-scale mock-ups. In this process the designer uses skills or practical knowledge also known as *techné* (skills-driven practice) and generates explicit knowledge, as the tacit knowledge of the previous process is being formalised and expressed.
- Detailed design: The stage in which the chosen design from the embodiment stage is developed and optimised in detail. Tacit and explicit knowledge are combined and further knowledge is created when the material is specified and the design engineered for ease of manufacture and maintenance. Detailed working drawings and specification or computerised instructions are drawn up.
- Evaluation of design: It is imperative that designs are evaluated. Not only is the outcome of the design process evaluated against explicit knowledge (e.g. brief or company's mission statement), but they are also evaluated against tacit knowledge (e.g. the opinion of the designer or manager). If the outcome is not satisfactory, it is back to the conceptual design stage.

Outcome of the design process

The outcome of the design process is a new product, service or process. Knowledge is produced in the process that can be incorporated into the strategic and functional management of the company.

RESEARCH

It has been established that design can contribute to the competitiveness of a business. The design input, like any other in a business, needs to be managed. Design management refers to the process through which design is integrated into the rest of a company's business functions. Unfortunately business managers do not use design as widely as they might as a result of a poor understanding of the contribution of design. This raises the question of how the understanding of design can be improved.

Only a few companies have incorporated design in their businesses, notwithstanding the advances of design management and the fact that the benefits of design are the subject of many publications. As these companies are the exception rather than the rule, it is an indication that design is not recognised sufficiently. Some of the reasons lie in the perceived risk of design, an inability by senior personnel to manage the design process and a different approach by designers and marketers towards executing their respective responsibilities. The reasons centre around a mutual misunderstanding between designers and other staff members, built on what seems like a lack of sufficient knowledge of one another's contribution to the benefit of the company.

As a result, it was investigated what managers should understand about product design in order to use it as a source of knowledge creation. This investigation was done through a questionnaire survey and two focus group discussions (Groenewald, 2009).

Questionnaire Survey

A questionnaire survey was applied in order to find out what designers say managers should know about design. Section One outlined the background information and represented a wide spectrum of respondents from 22 countries. The results can be interpreted with confidence, although caution is advised against generalisation. According to Section Two respondents felt that it was important for managers to know the role that the design application could play in business solutions, case histories and the competitive advantage. The difference between design disciplines and which design discipline is best suited to solve a problem, were not indicated as important.

Section Three indicated the importance of managers to be aware of the integration of design with business. In more detail, they were:

- Design should be included as early in the development process as possible.
- Design is an integrated team effort between company, employees and designers.
- Design information should be integrated with the workflow process of the company, which includes (placed in order of support) marketing, manufacturing, service delivery, finances and human resources.

Section Four centred on the importance of managers knowing about the design process. In general, the issues early on in the design process (for example the psychology of creativity) did not receive much support, with the writing of a creative brief, a significant exception. The importance of design as a multidisciplinary approach received the strongest support, while the respondents also felt that it was important for managers to understand the presentation of a design and the implementation of a design, as well as the short-term effectiveness and long-term significance.

Section Five centred further on the importance of managers being knowledgeable about the presentation of the design application. A very strong negative correlation indicated that respondents felt that the more technical the information in the design presentation, the less important they were for managers to know about. The respondents felt that it is important for managers to know about (in order of support) the proposed alternative reality the designer was presenting, popularised drawings, written report(s) accompanying the design and working drawings.

Section Six centred on the importance of managers knowing about the implementation of the design application. The respondents felt that it was important for managers to understand all four items listed. The items were (in order of support): The design application was to be implemented as

an integral part of the overall business strategy, the implementation of the design application could be a long-term process, the implementation of a design application could involve many experts from other fields and the manager should be involved on an ongoing basis in the implementation of the design application.

Section Seven centred on the importance for managers to understand the risk analysis when dealing with design. The respondents felt that all four items listed were important for managers to know. The items were (in order of support): Integrating a design application is a calculated risk, the designer cannot guarantee an increase in sales, proper research can lower the risk and the designer carries part of the risk.

In summary, the questionnaire managed to distinguish in a statistically significant manner between certain items that were indicated by designers as important for managers to understand and other items that designers felt were unimportant. In general, the items that were design-specific, such as conceptualisation and the psychology of creativity, were indicated as unimportant and the items close to managing a business, such as the writing of a creative brief and the risk factors, were indicated as important for managers to understand. The items that were indicated as important are included in the proposed curriculum for managers to learn about the design discipline.

Focus Group Discussions

Two focus group discussions agreed in the main with the results of the questionnaire survey. A focus group with product designers agreed in general with the results of the questionnaire survey, with the exception of Section Four. The group felt that managers should understand the whole design process. Another aspect of importance was that the manager should trust the designer. The group also made suggestions for a number of topics that should be included in a curriculum about design awareness for management students. The focus group with marketing managers also agreed that the marketing manager should be involved in the whole design process, although the level of involvement during the conceptual design phase is minimal. They felt that it is important for the marketing manager to have an understanding of this phase but he/she only becomes involved when there are problems or deviations. The marketing managers stressed the importance of clear communication during the whole design process.

It can therefore be concluded that the questionnaire survey and both focus groups indicated that managers need to have a general understanding of the design process but they do not need to understand the design discipline in detail. As a result the whole design process should be included in a curriculum, but not in detail. A curriculum should include an overview of the design process providing managers with a holistic view of the design process.

Managers are not Taught about New Product Design

With an established selection of what managers need to understand, it is important to ascertain whether this content forms part of their education at tertiary institutions, especially in South Africa. The next step was thus to investigate whether future managers are educated by tertiary institutions to use product design to increase competitiveness.

Information was received from 13 universities on the subject nomenclature in management, marketing and entrepreneurship offerings. At none of the universities was there any reference to creativity or innovation as an official name of a subject. At seven of the 13 universities (or 54%), there was no mention of creativity or innovation at all, not even as part of a subject. At six of the 13 universities (or 46%), there was some mention of creativity or innovation as part of a subject but this is not strong enough to be included in the official name of the subject. At the management faculties/departments of the universities of technology (former technikons) there was no reference to creativity or innovation in the official name of a subject. The design discipline was not mentioned anywhere at either the universities or universities of technology.

Based on the information received, it can be concluded that the offerings to management students at South African universities or universities of technology do not put much emphasis on creativity or innovation, while the design discipline is totally ignored. A cautionary note should, however, be added, as this conclusion was reached through the information supplied by the tertiary institutions, which consisted of only the subject names. More in-depth research is thus recommended.

The Framework Could Work

Design projects of 18 fourth-year design students were analysed according to the proposed framework. All 18 projects indicated clearly how the product design process used and produced knowledge. The framework was thus successfully tested as a means to assist managers to acquire a sufficient understanding of product design.

CONCLUSIONS

It was firstly concluded that evidence in the literature does exist that product design can improve competitiveness in a business, but that it is not always used as widely as it could be. Traditional approaches to integrate product design with the decision making of a business has only had limited success. A new approach is therefore necessary. Such an approach can be found in the use of product design as a knowledge management creation tool in order to increase competitiveness. This, however, requires that business managers should have a certain understanding of product design. A framework was developed that will assist managers to acquire such an understanding. It was then established that managers should have an overall understanding of the design process, but not necessarily an in-depth understanding of the design discipline. Unfortunately future business managers are not educated at South African tertiary institutions to understand enough about product design in order to use it to increase competitiveness. A proposed framework that could assist managers to acquire such an understanding was successfully tested in practice. This finding leads to the recommendations in the next paragraph.

RECOMMENDATIONS

This study would like to make two recommendations: How design can be integrated with business management and a curriculum that can provide business managers with a sufficient understanding of product design in order to manage the integration.

Firstly, it is recommended that design becomes part of a business and is managed on the same basis as any other business function such as marketing, finances or human resources. Sometimes these functions are managed by specialists, for example, when a marketing manager holds a qualification in marketing. The same can happen with the design function, where a qualified designer can be responsible for the design function.

The problem is more acute at the general management level. For general managers (or directors or chief executive officers, etcetera) to manage a business with its specific functions, they need to have a sufficient understanding of the most important issues and the vocabulary of each individual function. This is at the heart of many management training programmes, such as the MBA. *Similarly, general managers must have a sufficient understanding of the most important issues of design and its vocabulary.*

- On a practical level, someone needs to be able to manage the design process on the same basis as he/she would manage any other business process. This can be referred to as *operational design management*.
- On a functional level, someone needs to be able to manage a design department, whether in-house, outsourced or a combination. This level can be referred to as *functional design management*.

- On a more analytical level, someone needs to be able to manage design as a strategic resource as part of the decision-making process, on the same basis as he/she would all the other strategic resources. This can be referred to as *strategic design management*. Design should be a holistic part of the process of formulating, implementing, and evaluating cross-functional decisions that enables an organisation to achieve its objectives, and should be applied like any other resource.

In order to be competitive in the globalised economy, with outsourced functions and networked organisations, *managers tend to manage competencies; they do not necessarily possess them*. The general manager may be the best human resources manager, but if he/she attends to all the human resource issues, it is most likely that he/she will neglect his/her role as general manager. That role is primarily to pay attention to the strategic management of the organisation. Specialists are appointed, or often contracted in, to devote all their attention to a specific function of the business. In a similar way, designers must be appointed, or contracted in, to pay all their attention to the design function of the business. They will be the innovation specialists in the same manner as the company makes use of marketing, finances, human resources and production specialists. In order to increase competitiveness, good managers are people who have a sufficient understanding of all the specialist business functions which enables them to synergistically coordinate them. Against this background, a curriculum on design for managers is proposed.

Secondly, a curriculum is recommended which could provide managers with sufficient understanding to manage design as they would manage any other business function. The curriculum is divided into project design management, functional design management and strategic design management.

The outcomes of the curriculum can be formulated as follows:

After studying project design management, a student should be able to:

- Describe the role of design in business.
- Describe the design process.
- Write a creative brief.
- Understand a design presentation.
- Implement a design application.

After studying functional design management, a student should be able to:

- Integrate design in a company's management structure.
- Effectively source design.
- Manage the design linkage/interface.
- Overcome barriers to the integration of design.
- Manage designers.

After studying strategic design management, a student should be able to:

- Describe the importance of the strategic role of design.
- Write a strategic brief.
- Use design as a source of sustainable competitive advantage.
- Minimise the risk of implementing a design.

Managers can obtain a functional knowledge of product design by following the proposed curriculum. How such a curriculum fits conceptually in the business management theory, is graphically portrayed in Figure 6.2. Globalisation impacts on individual companies in many ways. Some of these factors are political, technological, cultural, socio-economic, legislative and environmental. The managerial ethos and increased competition further impact on individual companies. All these factors have an influence on the profitability of the company. Profitability can be increased by product design and knowledge management, and can be still further increased by using product design as knowledge creation management. Such an increase in profitability is, however, conditional on the fact that managers have a functional understanding of the product design process.

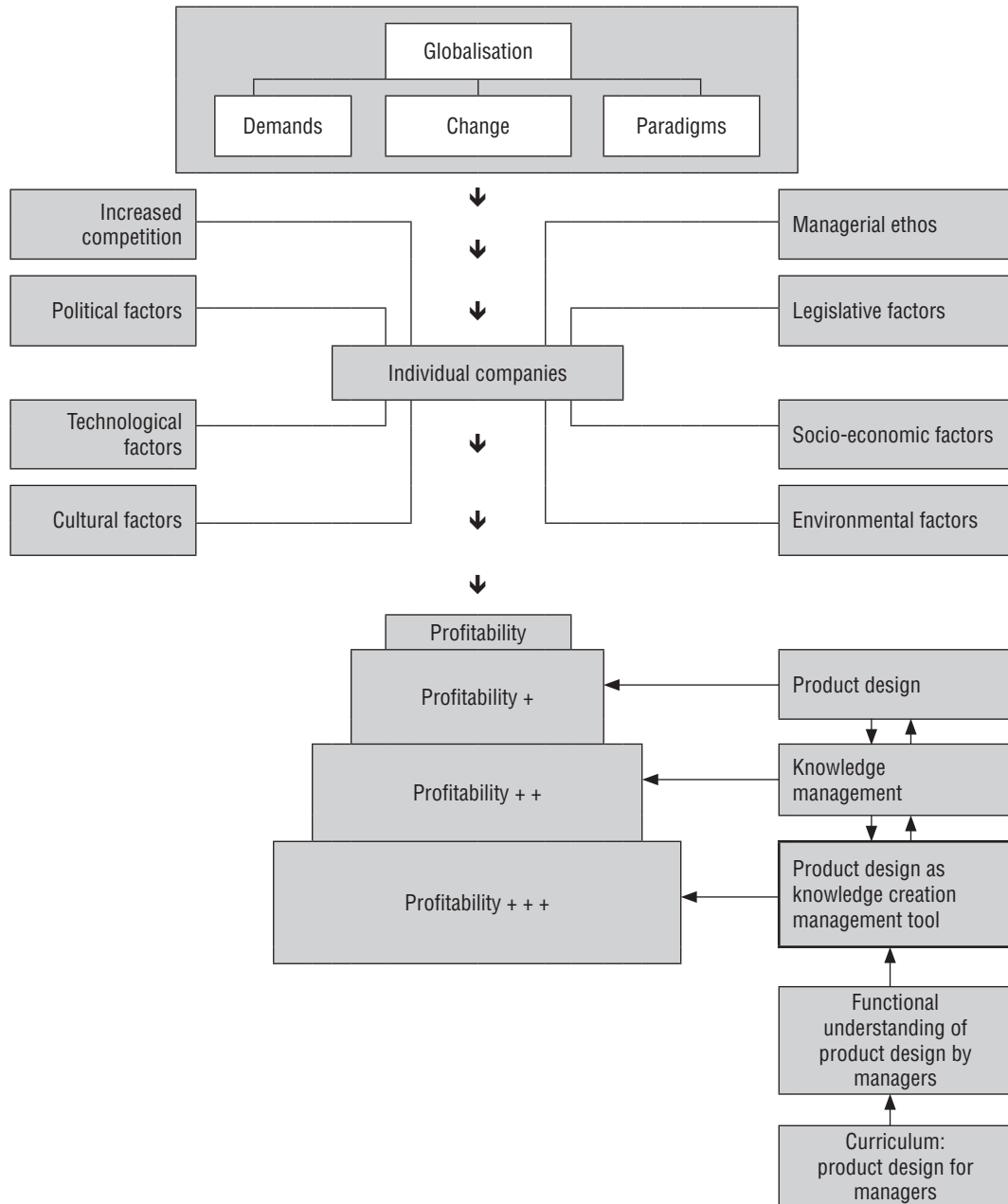


Figure 6.2: Summary of the need for a curriculum on product design for managers

SUMMARY

This paper indicated that evidence in the literature suggested that managers could use product design to improve competitiveness. Unfortunately business managers do not use design as widely as they might as a result of a poor understanding of the contribution of design. This raises the question of how the understanding of design can be improved. As a result of a questionnaire survey, a selection

of items for managers to know about design was drawn up. Two focus group discussions agreed in the main with these findings, but also made smaller adjustments. A conceptual framework was drawn up which could assist managers to acquire a sufficient understanding of design. This framework also indicated how design could be both a user and producer of knowledge and thus could contribute to a continuous competitive advantage.

Further investigation showed that in the education of business managers, creativity and innovation did not receive sufficient attention. In response a curriculum was developed which could provide managers with an effective understanding of design in order to increase a company's competitiveness by managing design as part of the knowledge creation management of a company.

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