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DESIGN MANAGEMENT

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ABSTRACT
There are many, sometimes conflicting definitions of both "design" and "management". Each is an interplay between physical action in the real world and the mental picture the designer/manager has of that activity. Indeed they have a lot in common, but because of their separate history and terminology, that common ground is lost in a fog of conflicting concepts. When you try to combine them into a single process, "design management", it becomes very difficult to conceive an adequate mental model, which encompasses both parts. This paper will explore this interplay in more detail to find the management knowledge and understanding content essential for designers and design courses.

Keywords: Design management, innovation, organization.

1 INTRODUCTION

A large part of the design task is organizational. It begins with an exploration of the need, which you are trying to meet. Who is the customer, who will finally judge whether you have succeeded? Is it the user, or the purchaser? What are the real needs they are want to satisfy? Who is available to perform the task? Do they collectively have the right knowledge and understanding for the task? How much time and money is available? Who will make the product and how will it be made? These questions, and more, are considerations outside the main requirement of actually designing the product, yet are essential for a successful outcome. These are the tasks of the design manager. My aim is to explore the concepts of design and management to find how they interrelate.

2 WHAT IS MANAGEMENT?

Management is the art and skill, using knowledge and experience, leadership and enthusiasm, of setting goals, planning, resourcing, organising, and monitoring the achievement of an objective, within acceptable limits of cost, risk and time.

Sir Hugh Ford

Modern management thinking began with Adam Smith in the 18th Century [1]. Although his main illustration of work organization was the manufacture of pins, his fundamental message was economic. Management theory since that time has concentrated on the organisation of business with profit as the measure of success. Management is often spoken of as if it were a single definable topic. In fact you can't look at management, beyond a superficial level, without qualifying it as to type and application. Management is a range of similar but separately identifiable tasks, linked loosely by a common theme of organisation.

We can characterise these tasks in three basic ways:

1. **The control of a fixed, or very slowly evolving organisation, set up to carry out a repeated series of definable tasks.** This typically includes most administrative and financial management and often requires a bureaucratic system to ensure that a long series of individual tasks are carried out in accordance with a set pattern of standards. A bureaucracy can be a very effective way of managing such repetitive tasks even-handedly, provided you avoid the inherent tendency for the system to dominate the tasks it administers. Such systems are usually characterised by a set of rules for dealing with all but the most extreme situations. A record of past actions often provides precedence for the interpretation of the rules and, if necessary, the formulation of new rules. Most civil service, legal, and banking tasks typically fall into this category.

   Bureaucracies often lack flexibility but are tolerant of small errors since each case is dealt with as a separate entity with little overall effect on the system. This provides a high sense of security for those staff involved in it. When, in time, large-scale change becomes necessary, it is likely to be

traumatic for both the organisation and the staff and is often resisted. This type of management can be characterised as **"Policy, Procedures, and Precedence".**

2. **Managing a system where parts of the organisation may change occasionally, but the majority remains fixed for long periods.** The system is also expected to have a long-term future gradually evolving as its role changes. This is typified by large scale manufacturing and most business and sales management, where a number of lines of work may be proceeding together, but each will be replaced in time by others of a similar nature without fundamentally changing the overall organisation. This type of management can accept changes which do not threaten the integrity of the system, but cannot adapt easily to large scale changes and may slowly become outdated. This type of management can be characterised as **"System and Scheduling".**
3. **The organisation of a change, which has a definable conclusion when the system to carry out the task will cease to have a role.** This is, in broad terms, project management, where there is a specific objective to be achieved. It includes Design Management and even the task of setting up, or changing, management systems for the other two types. (A major example is the rebuilding of Japanese industry after World War 2, guided by the economist W E Deming [4]. His 14 principles have aspects frequently advocated for design management. [See Appendix.])

   A project is often prone to cancellation or external interference and thus has lower security for its staff, further compounded as it nears completion by the inevitable "end of project" insecurity, when staff are moved on and the team breaks up. Staff usually have a far higher sense of ownership and achievement which can compensate for this insecurity. Typically communications play a vital role in completing the task but often the final result is the only record kept. Staff need imagination and adaptability to cope with this sort of task. There is usually a high level of checking and analysis to verify decisions and eliminate errors as far as possible. This type of management can be characterised as **"Communication, Concept, Choice of Options, and Cross-checking.**

Two or even all three of these management types may be found within a single organization. Administrative tasks such as pay, accounting, etc. will be type 1 tasks. Tasks carried out by marketing, personnel, etc. will be type 2. Organizations with a significant forward planning activity will have type 3. With the growing emphasis on business and finance in the last century, it can be seen that, as an organization matures, management thinking tends to move from the more entrepreneurial type 3, through type 2, into the more conservative type 1. As this happens, the organization becomes less flexible, and struggles to adapt to a changing world, being more interested in cutting costs, than in investing in new activities. Type 3 management carries a higher risk of failure, but also has the greatest prospect for opening up new areas of activity for the organization. (This discussion is based on my teaching notes for a CPA Management Short Course for the OU in summer 1992.)

3 WHAT IS DESIGN?

There are many ways to answer that question, but suppose we try a similar breakdown to the one above. Modern design thinking evolved slowly as the products of the industrial revolution became more complex relying on design teams rather than the flair of one imagination, helped by a range of craft support. The two world wars each fostered step changes in the organization of design and manufacturing, which was then carried through to satisfy the post-war needs of an aspiring population. Developments since then have been summarized in the ACED report [2] and papers such as Evbuomwan [3]. Design theory concentrates on the efficient organization of practical concepts, with customer satisfaction as the measure of success.

Design is often spoken of as if it were a single definable topic. In fact you can't look at design, beyond a superficial level, without qualifying it as to type and application. Design is a range of similar but separately identifiable tasks, linked loosely by a common theme of purposeful creativity.

Again we can characterise these tasks in three basic ways:

A. **The routine arrangement of standard parts into a configuration which matches the immediate need.** Examples include: the design of a kitchen layout, using standard modules from a fixed range, to fit the space available; and the "customization" of a new car using the options available from the manufacturer. Usually some form of catalogue lists the options and viable combinations and a vast range of possibilities can be produced from a relatively limited set. (There are over 4 million variations of the Ford Transit van.) This type of design follows on from an original design produced with simple fixed component interfaces in mind.

If an individual combination does not work as well as expected, it does not affect any other project. Occasionally further options are made available, if there seems to be a market demand. Since the arrangement of parts depends on common interfaces for the design to work, any proposals to improve the interface will be resisted, since this may render earlier versions obsolete. This type of design can be characterised as **"Modular, Limited and Derivative."**

B. **The adaption of a known theme or technology to new circumstances.** This can range from the adoption of a common recognizable style for a related range of products (e.g. street signage) to the performance development of a functional product (e.g. the Rolls-Royce Trent series of engines, now considerably more powerful than the original design, with few parts in common). The majority of the design activity falls within this area. For most design challenges, current known technologies can satisfy the functional needs and there are comparable products to help set the human interfaces. Modelling and functional analysis capability is available and there may be standards to guide good practice and satisfy health and safety issues. This gives the designer the security of knowing that a solution is likely to succeed even if it stretches the boundaries of what has gone before. This type of design can be characterised as **"Adaptation and Development"**

C. **The development of a novel form of product where any previous design solution will not suit.** This usually happens when a completely new solution to a previously unresolved or unexplored situation is required, where a current product type cannot be developed further, or when a technological change opens up new design options. When televisions first became more generally available, no-one knew what they were supposed to look like. The introduction of carbon fibre reinforced materials has changed the design of sports equipment, medical prosthetics, aircraft and much more. Type C design carries a high risk of failure, but also has the greatest prospect for opening up new fields of exploration. This type of design can be characterised as **"Novelty and Innovation"**

The size, costs and complexity of the product are unrelated to its position on this spectrum. The costs of the early planning stages are usually only a small proportion of the total and yet most of the remaining costs of the rest of the project are determined then, directly or indirectly. Hence it is a wise investment to make the effort to get these early stages right.

A single complex product may contain two or even all three types of design. It is usually convenient, and economic, to include some standard, "off-the-shelf" components in a design (type A), from fasteners and connectors to larger sub-assemblies. Even in the most novel products, most of the solution is available from existing experience (type B). Rarely, a totally new concept provides a feature which leads to a successful conclusion (type C), even though the rest of the design comes from the other types. Sometimes a new concept (a material or mechanism) actually makes it possible to produce a product not seen before, which opens up a new market. That is innovation.

4 DESIGN MANAGEMENT

- *Design is a process for deciding what to do to achieve a particular objective*
- *Management is a process for deciding what to do to achieve a particular objective*
- *Design Management is not as simple as that*

Colin Ledsome, 1991

There are two aspects of design management: the management of a specific design project; and the management of the whole company design programme allocating human and physical resources between numbers of projects.

Designers are by nature independent thinkers and people aspects of project management can take on a "herding cats" nature. As is usually the case, the best managers are those with experience in the practice, who know when to stay out of the way, and when to concentrate minds on the goal. This is a type 3 management activity of a high order.

Managing the design activity of an organization is a type 2 activity requiring foresight and planning to ensure that each project proceeds at an appropriate pace and each team retains the necessary coherence and continuity of purpose.

The transitory nature of a design project means that historically the learning and experience gained from the project often only remained with the participants. More recently, steps have been taken to retain a more comprehensive record of the design decision process, particularly those options considered but not taken forward, for future use.

For further guidance on design management see BS 7000 Part 2 [6].

5 EDUCATIONAL ASPECTS

Management or Business Schools tend to concentrate on type 1 management with business at its core. Most design related courses use business schools to provide their required "management" teaching, yet probably do not relate it to the organizational and decision making aspects of design taught as design methods. In 34 years of degree accreditation experience, I have found that most design and engineering students find type 1 management tedious (particularly if it includes bookkeeping), yet will enjoy type 3, which they can immediately apply in their projects. In industry, the major challenges of design management fall into type 3. In courses I would suggest that more effort be put into teaching management as an aspect of design, with the main emphasis on types 2 & 3.

Students often have difficulties with the team aspects of design management. They have been used to being assessed as individuals through their early schooling, so team thinking and the delegation of tasks and responsibilities can be daunting. A design team leader has to transmit their concepts for the product to the group, yet remain open to constructive suggestions. This is a situation where all members of the team can learn. Pragmatic compromise is more likely to provide a satisfactory solution, than the blind pursuit of an unobtainable ideal. Design projects should be formulated to provide opportunities for students to explore these new management concepts, and perhaps struggle a little, before they have to do it in an industrial setting. One approach, which has had some success, can be seen in the CDIO methods [7].

While more general management topics could continue to be taught by business schools or other agencies, design management should probably be best taught alongside design methods. Useful texts are already available, for example [8] & [9].

6 CONCLUSIONS

I have deliberately adopted the same descriptive pattern for both management and design to bring out their similarities. Even so it should be clear that the two topics are closely related. There is an opportunity, for each to learn from the other. (The work of Deming, mentioned earlier, is encapsulated in his 14 rules, listed in the Appendix. It has the clarity of practical purpose and empathetic inclusivity with the practitioners, often found in the best design methods.) The management of design is probably the greatest challenge a manager can take on. Both engineers and product designers spend most of their time in teams, with many contacts in other groups. The earlier they can come to terms with the challenges and rewards this provides, the better they will be.

REFERENCES

[1] Smith, A., *Wealth of Nations*, 1776.

[2] *Attaining Competence in Engineering Design*, ACED, Design Council, 1991

[3] Evbuomwan N. F. O. et al, A *Survey of Design Philosophies, Models, Methods and Systems*, Proc Inst Mech Engs Vol 210. 1996

[4] Deming W. E., *Out of the Crisis*, MIT Press, 2000 (See Appendix below).

[5] *BS 8885 Information Management in the Product Life Cycle*, in development.

[6**]** *BS 7000 Design Management Systems – Part 2: Guide to Managing the Design of Manufactured Products*, 2015.

[7] Crawley, E.F., Malmqvist, J., Ostlund, S., Brodeur, D., *Rethinking Engineering Education; The CDIO Approach*, 2007.

[8] Shtub, Bard and Globerson, *Project Management Engineering, Technology and Implementation*, Prentice Hall International, 1994.

[9] Payne, Chelsom & Reavill, *Management for Engineers*; Wiley 1996.

APPENDIX

W. Edwards Deming offered 14 key principles for management to follow for significantly improving the effectiveness of a business or organization. Many of the principles are philosophical. Others are more programmatic. All are transformative in nature. The points were first presented in his book *Out of the Crisis.* Below is the condensation of the 14 Points for Management as they appeared in the book.

1. Create constancy of purpose toward improvement of product and service, with the aim to become competitive and to stay in business, and to provide jobs.

2. Adopt the new philosophy. We are in a new economic age. Western management must awaken to the challenge, must learn their responsibilities, and take on leadership for change.

3. Cease dependence on inspection to achieve quality. Eliminate the need for inspection on a mass basis by building quality into the product in the first place.

4. End the practice of awarding business on the basis of price tag. Instead, minimize total cost. Move toward a single supplier for any one item, on a long-term relationship of loyalty and trust.

5. Improve constantly and forever the system of production and service, to improve quality and productivity, and thus constantly decrease costs.

6. Institute training on the job.

7. Institute leadership (see Point 12). The aim of supervision should be to help people and machines and gadgets to do a better job. Supervision of management is in need of overhaul, as well as supervision of production workers.

8. Drive out fear, so that everyone may work effectively for the company.

9. Break down barriers between departments. People in research, design, sales, and production must work as a team, to foresee problems of production and in use that may be encountered with the product or service.

10. Eliminate slogans, exhortations, and targets for the work force asking for zero defects and new levels of productivity. Such exhortations only create adversarial relationships, as the bulk of the causes of low quality and low productivity belong to the system and thus lie beyond the power of the work force.

- Eliminate work standards (quotas) on the factory floor. Substitute leadership.
- Eliminate management by objective. Eliminate management by numbers, numerical goals. Substitute leadership.

11. Remove barriers that rob the hourly worker of his right to pride of workmanship. The responsibility of supervisors must be changed from sheer numbers to quality.

12. Remove barriers that rob people in management and in engineering of their right to pride of workmanship. This means, inter alia, abolishment of the annual or merit rating and of management by objective.

13. Institute a vigorous program of education and self-improvement.

14. Put everybody in the company to work to accomplish the transformation. The transformation is everybody's job.

Taken from the website of The Deming Institute: www.deming.org