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Considering value during early project development: a product case study

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Abstract

There is insufficient recognition of the important role that value management has within projects. In the global economy it is difficult to compete, or be viable, if you don't have high functionality and low cost in the product, or service, to be delivered. A part case study (Hamilton A. Managing for value. Dublin: Oak Tree Press, 1999.) of a project to develop a product, used in low voltage distribution systems, is taken to support the case for a better understanding in integrating value management within the management of projects. Certain tools from value management are presented which when used in the early stages of project development can result in securing the deliverable that will best satisfy the pre-determined requirements. © 2001 Elsevier Science Ltd. All rights reserved.

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1. What is value?

In the early days of developing what became known as the value approach, it was found that substituted materials had unique physical properties that could enhance a product if the design was changed to take advantage of those properties [1]. This was then expanded into components and elements with the discovery that the performance of the materials and the final product could be improved while at the same time reducing cost, providing the intended function of the elements and the product was fully understood. The trick was separating the function — *what* something must do — from activity — *how* something must do it. It was considered that value was therefore the fundamental relationship between function and cost. Function being loosely defined as *that which makes a product perform in accordance with requirements and will sell.*

The principal value types are [2]:

1. *price value* (price) the price charged for a product;
2. *cost value* (cost) the process cost of performing the function(s) reliably;
3. *esteem value* (want) the measure of the functions of the 'something' that are required to please;
4. *exchange value* (worth) the amount of current resources for which a product can be traded; and
5. *utility value* (need) the measure of functions required to make the 'something' perform to requirements.

When considering the value of an item, our sense of value will depend on whether we are the buyer or seller.

$$\text{Value as viewed by the seller : value} = \frac{\text{function}}{\text{cost}}$$

$$\text{Value as viewed by the buyer : value} = \frac{\text{benefits}}{\text{price}}$$

From these relationships it can be seen that value can be increased by favourably influencing function or benefits, and favourably reducing cost or lowering the price, if you are a seller or buyer, respectively. From the seller's viewpoint, value increases when the functionality is enhanced and/or the cost to produce has decreased. However, when competing in the world of product delivery, such as, the electrical cut-out described in this paper, value will be increased when the satisfaction of the buyer's need is augmented and the price, or what the buyer has to pay, is diminished.

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2. Creating value — a continuous process

Value is often mistaken as just a new way of measuring financial performance. Value should drive a company in the way it develops its strategy, aligns its processes and provides incentives for its staff. Without this fully integrated approach, the benefits of managing for value will be diluted. If society prefers certain values, then it logically follows that astute organisations should want to develop those values [3]. Logic, however, does not always rule. In a strict sense, an organisation cannot develop values the way it does a product, because values do not lend themselves to a series of steps that culminate in success. Instead, personnel evolve values, and when a critical mass of individuals share the same ones, then they automatically become corporate values. Values take hold in an organisation when actions consistently indicate some level of belief in a particular standard [4].

The philosophy and techniques of value management provide a structured approach to the examination and development of a product (or project or service or process) that will increase the likelihood of achieving the predetermined requirements at optimum value for money. The value management methodology uses problem-solving techniques in a structured framework to ensure that the end deliverable or outcome will correspond to the requirements [5]. Utilising the processes of value management will increase the correct interpretation of the requirements and the avoidance of much, if not all, waste in developing a product. Using value management will also save significant amounts of money and provide other tangible benefits by analysing function — *not what something is but what something does* [6]. To be successful, value management must be a continuous process. It is axiomatic that value management becomes a core knowledge area to the performing organisation involved in managing projects.

There are at least three value management approaches [7]. The types are referred to as continuous approach; expert review; and external review.

3. Value planning

The value process is defined [8] as the overall sequence of actions that lead to the achievement of value. Value management (VM) is defined [9] as a systematic and creative procedure operating on the relevant aspects of the value process through the life of a project or product. Value planning (VP) is synonymous with value management but deals with the value process as applied to only *the inception and conception* (early life cycle stages) of a new product [9]. Therefore, through the use of VP in the early formative stages, when a seller is contemplating the development of a new product, the process will help to identify, clearly and explicitly, the product's raison d'être and what the company's reaction to such a requirement should be. By identifying and defining the needs of a new product, or a potential buyer requirement, the seller will be in a position to determine 'intent to provide' and whether or not this is an opportunity that the seller's organisation wishes to proceed with.

For VP to be implemented, the seller needs to identify the potential business opportunity, what the technological trends are for such an opportunity, and if there are likely to be any associated political influences. From this identification of need, the company will be able to compare with their strategic objectives, relate the near future match, or otherwise, with their current business, and set the opportunity as a high or low priority within the company's goals and objectives.

The outputs from VP should include but not be limited to:

1. analysis of market and business options;
2. shared vision and consensus on strategic objectives;
3. a set of evaluation criteria for new products;
4. investment criteria and alignment with budgets.

To describe the use of some of the techniques that can be used in VP, the following is a recent example.

4. Product need — the project

Before a product becomes a product it is best to consider it as a project and treat it with the full application of the project management process. A subset of this process must be VP.

The product of this case study is an electrical device: a heavy duty cut-out that is used in low voltage distribution systems for large customers such as retail stores, factories, residential apartment blocks, etc. where protection is needed at the point of supply to the customer's main switch board. Energy suppliers have codes of practice that indicate space requirements, installation procedure, etc. for such cut-outs.

Based on customer opinions and statements levelled at the British Isles' sole supplier of cut-outs to Ireland, it was generally felt that the Irish electrical manufacturing industry had not adequately responded to the need. Company G, which is a manufacturer of electrical components located in Ireland, identified that there was a customer demand which it felt it could respond to by producing a saleable and profitable product. The product, if manufactured and made available for sale in Ireland, would likely displace the current imported UK product, and could be a serious contender for achieving a share of the UK market.

5. Strategic value plan

Company G decided that it would pursue the development of a new product by assembling internal and external stakeholders over a period of a few months, and that two value exercises under their management would be held. The stakeholders included a value manager, marketing personnel, plastics manufacturing specialist, industrial engineer, toolmakers, R&D fitter, all from Company G, and distribution engineers from Ireland's power utility organisation — a prime customer. No one, with the exception of the value manager, had any real knowledge of value management; two individuals were aware of it but by name only.

The initial plan to hold two continuous VP exercises had to be adjusted due to resource availability; this was replaced by a series of short exercises, but still held over two distinct time periods. It was the seller's decision to set the higher order function — the requirement — as 'to provide a viable customer-oriented product'. During the first time period, the team brainstormed a listing of some 18 criteria that were considered would support the product requirement. Determining these criteria, their relationship within a product structure, and their relative importance, were the subjects of the first time period. The second time period dealt with the identification of appropriate prototype designs.

The process consisted of brainstorming to determine seller and product criteria. The value team identified 18 key 'wants' and 'needs'. These items were added to or modified during the next step, which was the development of a value tree. A value tree is similar to a functional analysis system technique (FAST) diagram, in that it asks and responds to *how*? and *why*? questions [10,11]. However, its purpose is to help agree a structure of goals, objectives and criteria that will support the achievement of the overriding purpose. Value trees are useful techniques that can be used at any time in the process when structure to a product, component, or element is required.

The starting point at the left side of the tree is the 'overriding purpose', as in the FAST diagram, although in that technique it is referred to as the higher order function. The goals are the first-order support of the overriding purpose, the objectives are the support to the goals, and, if extended further, the criteria (attributes) are what supports achievement of the objectives.

Fig. 1 shows two value trees, (a) being the team's first attempt, and (b) the team's revised attempt at creating a structure to respond to their agreed overriding purpose, 'to provide a viable customer-oriented product'. In this case, of course, it was obvious to those involved that the 'customer product' under consideration was a heavy-duty cut-out. The four goals and the 12 criteria of the revised value tree (b) show the agreed structure to proceed with in the further analysis of conceptualising the product.

Each of the criteria was assigned an *alpha* (alphabetic letter) as an easy means of identification (A–L inclusive). From a further brainstorming session with all the stakeholders involved, the criteria-weighting technique was then used to weight the criteria [12]. The result of that workshop is shown in Fig. 2.

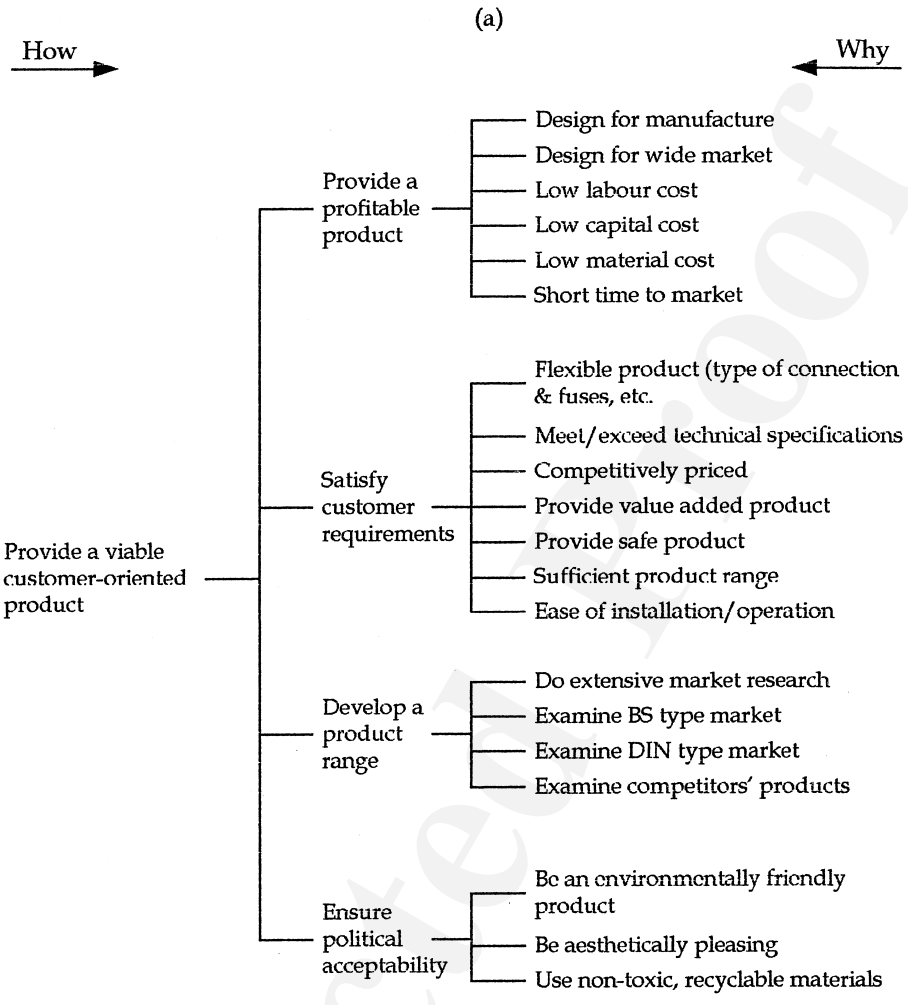
Before commencing the brainstorming, the team felt that criteria J, although important to Company G's product plans, had more to do with overall business strategy and less to do with this particular product. Criteria J was therefore eliminated.

The comparison of how the stakeholders judged each criteria against all other criteria is shown in the upper matrix. The lower matrix is a summation table of the raw scores for each criteria and the conversion of that score into a weight. In this case, each criteria's weight when accumulated will equal 1.00, but 100 could also have been used. As can be seen, 'meet/exceed specification', 'environmentally friendly', and 'easy installation/operation' were the top three and accounted for just over 50% of the total weight.

With the criteria and their relationships, importance, etc. established, the value team undertook further brainstorming to create products that would respond to the criteria. At the same time, investigations were taking place into certain criteria. For instance, the 'short time to market' criteria meant searching for other processes that would offer an alternative to the normal Company G method of *injection moulding*. Normal periods for producing and testing an injection mould would be 14–16 weeks. Searches indicated that *pressure-forming* tools, available from a company in Ireland, could be produced in 4–6 weeks. Pressure-forming tools have a further advantage of being easily changed or modified. This is not a facility normally available to injection moulding tools.

The investigative work was useful in allowing the team to produce three prototype designs, denoted as A, B and C. A sketch of an early prototype design is shown in Fig. 3. The prototype designs were the result of the team having generated over 87 ideas that could be used in satisfying the criteria, and objectives (and hence, the overriding purpose). The ideas were grouped and as a result of this grouping, there was three natural scheme ideas or prototypes.

Prototype A was for a unit housing manufactured from high strength, flame-retardant plastic material with a one-piece body (three phases and a neutral), removable cover, and detachable cable crutch cover. The current carrying components within the housing should be mounted on a removable plate made from UL-94 V0 rated high heat plastic material. Similar plastic shrouds would act as inter-phase barriers. The unit would be designed to accept Company G's fuse carriers. B differed from A in that the base of the unit housing was heavier to accommodate the direct mounting



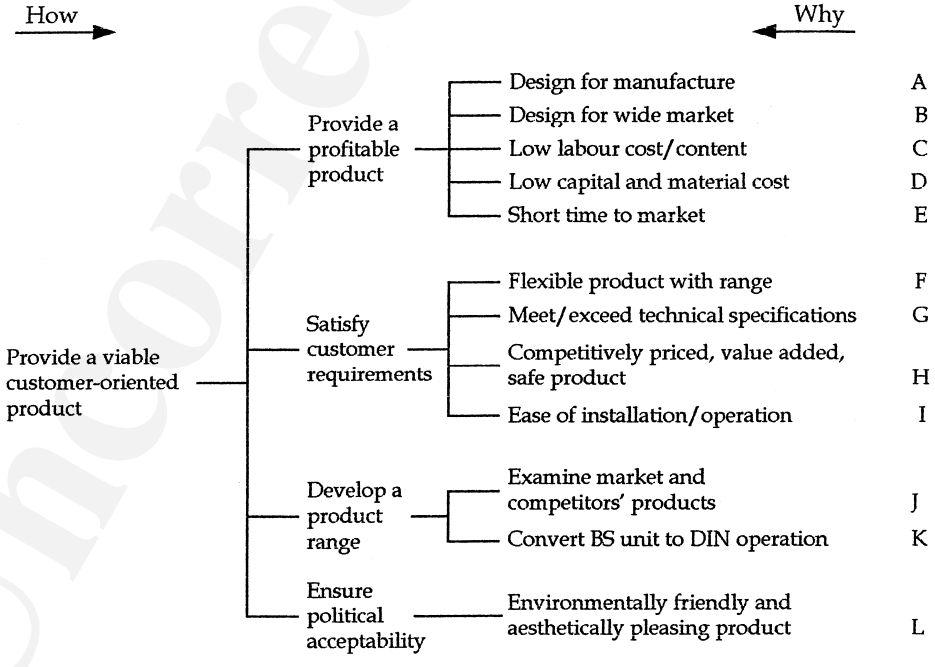


Fig. 1. (a) Value tree; (b) modified value tree.

of the current carrying components. C was a combination of A and B, but would have a single one-piece housing, with a removable front cover and cable crutch and flexibility in the polarity of the phases.

The value team, in another workshop, carried out a multi-attribute evaluation of the three prototypes against the 11 criteria established earlier in the process. The result of this assessment is shown in Fig. 4.

	B	C	D	E	F	G	H	I	J	K	L
A	B-3	A-2	A-2	A-E	F-2	G-4	H-2	I-2		A-K	L-3
B		B-C	B-D	E-2	B-F	B-2	B-H	B-I		B-K	L-2
C			C-3	E-2	F-2	G-4	H-3	I-3		C-K	L-3
D				D-3	F-2	G-4	H-3	I-3		D-3	L-2
E					F-2	G-4	H-3	I-2		E-2	E-L
F						G-4	H-F	1-3		F-K	L-2
G							G-4	G-4		G-4	G-L
H								I-2		H-4	H-L
I										I-4	L-3
J											
K											L-4

4 = Major preference
3 = Medium Preference
2 = Minor Preference
1 = No preference

	Raw score	*Weighted score*
A = Design for manufacture	6	0.04
B = Design for wide market	11	0.08
C = Low labour cost/content	5	0.03
D = Low capital and material cost	7	0.05
E = Short time to market	8	0.06
F = Flexible product with range	11	0.08
G = Meet/exceed specifications	33	0.23
H = Competitively priced and safe	18	0.12
I = Easy installation/operation	20	0.14
J = (Deleted)		
K = Convert from BS to DIN	4	0.02
L = Environmentally friendly	22	0.15
Total	145	1.00

Fig. 2. 'Criteria' weighting analysis.

From Fig. 4 it can be seen that each prototype was rated against each of the criteria and given a score within a range of 1–10. An explanation of some of the ratings is shown in the key just below the table. Based on the stated criteria, the preferred scheme was prototype A. The value team carried out cost/worth estimates for each scheme and found that the cost to worth ratios would be in the range 1.3:1 to 1.4:1. Scheme A was therefore recommended to the seller for acceptance and for further development and refinement during the definition stage and subsequently, the production stage of this potential new product.

6. Project outcome

Based on these VP exercises, Company G decided to initiate prototype designs for a range of five different heavy-duty, indoor cut-outs with current ratings between 200 A and 600 A. For an investment of about £40,000, their investigations indicated that there was a potential annual sales within Ireland of about £220,000. The estimated selling price, ranging from £40 to £125 per unit, would depend upon current rating and number of phases.

Company G was impressed by the enforced discipline of VP and the way it involves vertical slices within their organisation. Company G saw, through this exercise, the customer as the central focus in what they produce. By involving the customer, they are hoping that such

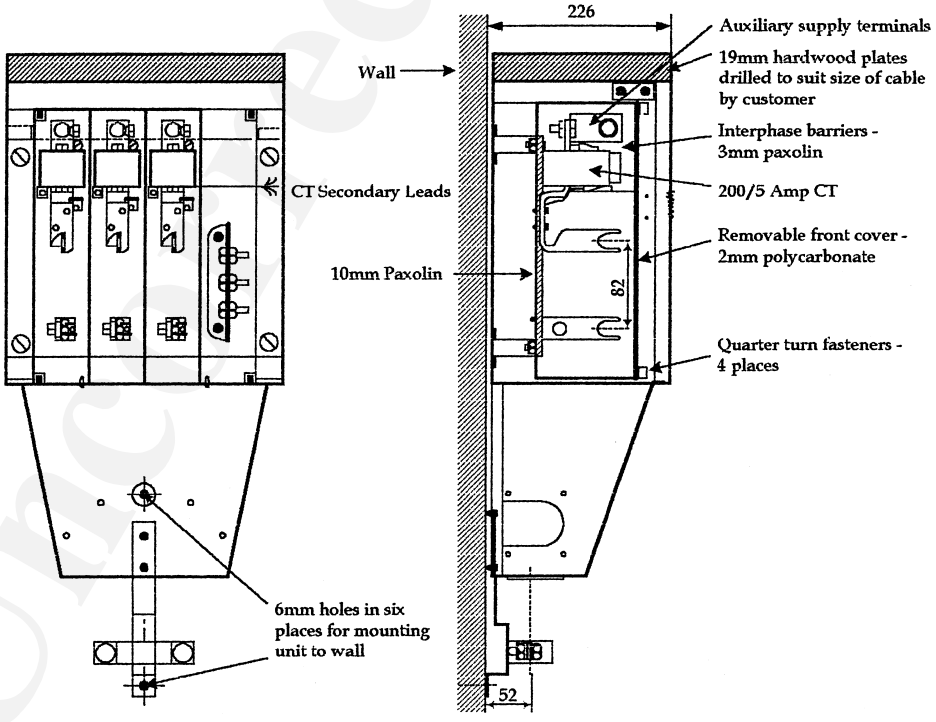


Fig. 3. Heavy duty cut-out prototype.

Reference	A	B	C	D	E	F	G	H	I	J	K	L	Total
Weighting	.04	.08	.03	.05	.06	.08	.23	.12	.14		.02	.15	
Design A	7/.28	8/.64	5/.15	8/.40	9/.54	8/.64	9/2.1	7/.84	9/1.3		9/.18	7/1.0	8.07
Design B	5/.20	6/.48	7/.21	8/.40	9/.54	6/.48	8/1.8	8/.96	6/.84		4/.08	7/1.0	6.99
Design C	4/.16	7/.56	4/.12	7/.35	8/.48	9/.72	4/.92	6/.72	4/.56		4/.08	6/.09	4.76

A = Design for manufacture
B = Design for wide market
C = Low labour cost/content
D = Low capital and material cost
E = Short time to market
F = Flexible product with range
G = Meet/exceed specifications
H = Competitively priced and safe
I = Easy installation/operation
J (deleted)
K = Convert from BS to DIN
L = Environmentally friendly

Key: 1 = Poor
3 = Fair
7 = Good
10 = Excellent

Fig. 4. Evaluation of prototype options.

partnerships will reduce waste and will increase their competitiveness. They are convinced that up-front rigorous conceptualisation, well before committing to tooling and manufacturing, is absolutely essential for ensuring that the right product gets to the right market. Company G believes they now know how to go about creating products that will satisfy their customers and potential customers. It would now appear that Company G are themselves a satisfied customer when it comes to using VP.

7. Summary comments

This case study attempts to demonstrate the significance of incorporating certain techniques from what is recognised as value management into the early conception stage [13] of projects. By engaging the buyer's and seller's personnel in brainstorming sessions to determine what is needed and what is to be provided, an environment and ethos is established that focuses on buyers' needs and wants and involves them within the strategical framework [14] necessary for such provisions.

The application of what was used in this case study to produce a product would be equally applicable if the final deliverable was a project, a service, or a process. Measurable criteria against which various options can be scored is absolutely essential if we are to avoid providing the wrong outcome to a pre-determined project need. The measurable criteria can best be developed between buyer and seller when engaged face-to-face within disciplined working sessions. By comparing and scoring the criteria against one another, a way is provided of evaluating qualitative measures. It is this evaluation of qualitative criteria that is often short-circuited in project conceptualisation — accordingly, achieving the right project outcomes will often suffer.

Once the criteria and their importance in providing for the overriding purpose of the project have been established and agreed, a means exists for comparing technical, economic and socio-political assessments of each option.

Although this paper has concentrated on the up-front stage of a project there is significant merit in using the techniques of value management throughout all stages of a project's life cycle. The very minimum that should be expected on any project is the use of such tools as, value trees, simple multi-attribute weighting technique, and design option evaluations, during the conception stage of all projects.

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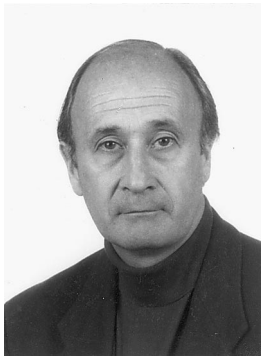

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