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Improving product introduction through appropriate organization: the development of the SIMPLOFI positioning tool

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Abstract: This paper presents the SIMPLOFI positioning tool. This tool has been devised to assist in the quest for an appropriate product development organization. The positioning tool, given a specific product introduction within a specific environment, will give recommendations for an organization for that product's development. The tool's key feature is that it is contingent; i.e. its proposals depend upon the environment in which it is used.

The paper begins by giving an overview of the tool in terms of its need, its target user group and its physical embodiment. The paper then demonstrates the effectiveness of the tool to potential users in two ways:

1. It validates the tool by examining its theoretical provenance.
2. It verifies the tool by testing it in case study environments.

Seven case study applications of the SIMPLOFI positioning tool from five companies are presented. The companies in which the tool was tested are The Rover Group, Instron, Morris Mechanical Handling, Markham and Company and Hawker-Siddeley Switchgear.

The paper concludes by identifying how far the effectiveness of the tool has been demonstrated and further ways in which the tool can be developed.

Keywords: new product introduction, product development, concurrent engineering

1 OVERVIEW OF THE SIMPLOFI POSITIONING TOOL

1.1 The need for the tool

New product introduction continues to be a vital business process for the success of an industrial organization. Given the leverage of product introduction, it is not surprising that many initiatives have concentrated on improving product introduction performance. These include techniques and approaches such as:

- (a) integrated product development [1],
- (b) concurrent engineering [2],
- (c) time compression technologies including rapid prototyping [3],
- (d) goal-directed project management [4].

The MS was received on 12 April 1999 and was accepted after revision for publication on 3 September 1999.

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In many cases, these approaches overlap and often include each other within their definitions. For example, successful concurrent engineering implementations have been shown to range from the use of lightweight teams through to highly autonomous project teams depending on a particular company's environment [5]. The industrial practitioner therefore faces a bewildering display of choices in the way he or she can improve product introduction performance. Furthermore, techniques will often have been disseminated at a very high level or are very generalized in their approach [6, 7]. The industrial practitioner needs assistance in converting these generic strategic objectives into specific tactical actions that will be meaningful for his or her particular organization. The identification of an appropriate methodology is vital, as some strategies to improve product introduction performance can, if used in the wrong situation, make matters worse. For example, von Braun [8] and Crawford [9] discuss cases where reducing lead-time for product introduction was not the most appropriate strategy and was in fact harmful to successful operation.

Given the importance of product introduction and the lack of clarity in identifying ways in which to improve its performance, a tool that could give recommendations for an appropriate organization (in the widest sense of the word) for product introduction in order to improve its performance would be very useful. It is this need that the SIMPLOFI positioning tool seeks to address.

1.2 The target user group for the SIMPLOFI positioning tool

The SIMPLOFI positioning tool assists those responsible for product introduction within an organization in answering the question:

I know what product I want to introduce—How do I organize the introduction of this product to achieve this most effectively?

The SIMPLOFI positioning tool is aimed at the individual who is responsible for product introduction and is, at the start of a specific product introduction, trying to determine what an appropriate organization would be for that specific activity. The precise title of the individual would obviously vary from company to company, but a typical title would be Project Director or in some cases Project Manager.

The final level of detail needed to specify an organization for a particular product introduction can be immense. Particular individuals with particular skill sets will need to be identified; precise reporting lines to other individuals will need to be specified; processes will need to be documented so that they can take the form of formal operating procedures; and the exact type and volume and capabilities of the tools (e.g. what type of workstation running what software) will need to be identified. Detailed project time-scales for all of the product's subsystems will also need to be determined for the individual project. However, it is unlikely that the person responsible for the overall project would wish to be involved in this level of decision making at the inception of a project. He or she would first need to make a series of decisions of a broader nature (e.g. Shall I operate this project in teams?, How many disciplines should these teams involve?, How far should I parallelize activities in this project?). It is at this level of debate that the SIMPLOFI positioning tool assists in making decisions. It specifically helps in identifying the appropriate position for the company on the continuum outlined in the section above for a specific product introduction.

The tool's focus on organizing for one specific product introduction may appear unrealistic for some potential users. If an enterprise undertakes one large product introduction at a time then the problem of organizing for that specific product introduction is synonymous with the organization of all product introduction activities and the application of the tool seems highly appropriate. However, it is more likely that a number of

product introductions will be undertaken at the same time and that any new product introduction will need to integrate with these. The positioning tool in its current form will produce an organization for the new product introduction, not for the overall organization. However this does not preclude the use of the tool. The requirements for the individual projects act as an important first step in producing the structure of the whole product introduction organization. This 'aggregation' process will form the next step in the development of the SIMPLOFI positioning tool and the development of this capability is discussed in Section 4.2 of this paper.

1.3 The physical embodiment of the tool

The SIMPLOFI positioning tool comprises the following elements:

- (a) a workbook,
- (b) a diskette containing the tool's force-resolution software,
- (c) a booklet containing a number of case study applications of the tool,
- (d) a booklet outlining the tool's development,
- (e) an explanatory video.

The tool is intended for use in a 'stand-alone' situation by the potential user.

The output from the tool gives recommendations on an appropriate organization for a specific product introduction in the following terms:

- (a) the structure of teams,
- (b) control mechanisms (whether control mechanisms should reside with functions or projects),
- (c) the degree to which the process should be parallelized,
- (d) how specialized people operating the process should be,
- (e) the degree of automation in the tools used.

The tool positions the organization along five continua that represent the five choices presented above; hence it is referred to as the positioning tool. The recommendations on each of these five choices are given in the form of an ExcelTM spreadsheet (see Fig. 1). This needs to be interpreted with the aid of the interpretation sheet given in Fig. 2. The point on the interpretation sheet corresponding to the output from the Excel spreadsheet needs to be identified by the user. He or she can then identify the position for the organization of the specific product introduction that the tool is recommending.

A workbook elicits the input to the SIMPLOFI positioning tool. It asks the user to quantify a series of predetermined 'forces' that are acting upon the particular product introduction in question. These forces fall into three categories:

SIMPLOFI Product Introduction Overview Tool

Product :-

Sample Product

Fill in the Characteristics for the Product You wish to Introduce :-

product

CIPS	0.3
CPUi	1
novelty of market/tech	0.2
low product cost	0.2

product introduction

speed	1.5
reliability	1.1
operat. cost	0.9

constraints

empowermt.	0
skills retn.	1.2
p.l. size	0.2
centralizatn.	1
inv. funding	1

STRUCTURE

CONTROL

PROCESS

PEOPLE

TOOLS

contributing factors :-

FUNCTIONAL	PROJECT
operat. cost	0.9
specializatn.	1
centralizatn.	1
size	0.2
CPUi	1
p.l. reliability	1.1
novelty	0.2
p.l. speed	1.5
CIPS	0.3
prod. cost	0.2
pril. process	1
empowermt.	0

contributing factors :-

SEQUENTIAL	PARALLEL
novelty	0.2
operat. cost	0.9
prod cost	0.2
cpu i	1
p.l. speed	1.5

contributing factors:-

SPECIALISED	NON-SPECIALISED
novelty	0.2
skill retn.	1.2
CIPS	0.3
operat. cost	0.9

contributing factors

MANUAL	COMPUTERISED
inv. funding	1
CIPS	0.3
p.l. speed	1.5
operat. cost	0.9

Fig. 1 The SIMPLOFI positioning tool output

- (a) product forces,
- (b) product introduction forces,
- (c) constraint forces.

The type of activity that the user is asked to undertake to quantify these forces is illustrated in Fig. 3, which is an excerpt from the positioning tool's workbook. When the user has quantified these forces using the workbook,

the user enters the resultant values into the table at the top of the Excel spreadsheet illustrated in Fig. 1.

1.4 The development of the tool

The tool was designed and developed by the Department of Manufacturing Engineering in Loughborough

Fig. 2 The SIMPLOFI tool interpretation sheet (the 'structure' and 'process' continua were based on the work of Wheelright and Clark [10])

University. It formed part of the output of the SIMPLOFI (SIMultaneous engineering through PeopLe, Organizations and Functional Integration) project that was undertaken jointly with the HUSAT (Human Sciences and Advanced Technology) Research Institute at Loughborough University and funded by an Engineering and Physical Sciences Research Council grant [11].

2 THE VALIDATION OF THE SIMPLOFI POSITIONING TOOL

2.1 The contingent nature of product introduction organization

A key feature of the positioning tool is that, unlike the majority of its predecessors, it emphasizes the contingent

Complexity of the Internal Product Structure (CIPS)

0	1	2
Product is extremely simple in terms of both no. of components and technology e.g. bolt	Product has medium complexity in terms of no. of compts. and/or technology e.g. a co-ordinate measuring machine	Product is extremely complex both in terms of technology and no. of compts. e.g. a passenger jet

Chosen Value -

Complexity of the Product User Interface (CPUI)

0	1	2
Product is 'designed-to-order' with a complete specification provided by the customer e.g. special project civil engineering equipment	Product is 'designed-to-forecast' where customer's needs are comparatively easy to understand e.g. consumer white goods	Product is 'designed-to-forecast' where the customers needs are very difficult to understand e.g. perfume

Chosen Value -

Effect of Product Cost on Company Profitability

0	1	2
Product cost has minimal effect on company profitability e.g. computer software	Product cost has a medium importance to company profitability e.g. machine tools	Product cost is extremely important to company profitability e.g. high-volume, commodity goods such as plastic mouldings

Chosen Value -

Product Novelty

0	1	2
Product and process technology and the market environment is completely familiar to the company e.g. a cycle manufacturer making another conventional cycle	Product/process technology and market environment contain some unfamiliarities for the company e.g. a cycle manufacturer designing a specialist cycle from composite materials	Product/process technology and market environment is completely unfamiliar to the company e.g. a cycle manufacturer designing a printed circuit board

Chosen Value -

Fig. 3 An excerpt from the SIMPLOFI positioning tool workbook

nature of product introduction organization [12, 13]. Furthermore, the tool does not identify a single influencing factor but uses a range of influences, i.e. product introduction organization represents a multivariate contingency. The tool identified uses a range of influences or 'forces' present in the product introduction environment to recommend an organization for that product introduction.

The reasons for adopting this sort of approach are as follows:

1. The theoretical precedents for using a contingent approach. The need for contingency when developing organizational theory has long been recognized [14]. This requirement needs to read across to the current body of work devoted to improving product introduction performance. Much of the work on improving product introduction performance has focused on generic principles rather than tailoring these to particular situations. For example, Swink *et al.* [6] and Funk [7] discuss the lack of literature on the

Table 1 Forces influencing product introduction

Product forces	Complexity of the product Complexity of the product's relationship with the market-place Novelty of the product technology or product market to the company Importance of product cost on company competitiveness
Product introduction forces	The importance of product introduction speed The importance of product introduction reliability The importance of product introduction operating costs
Constraint forces	Often these are highly specific to a particular market segment or even to a particular company but some generic constraints include: The importance of empowerment as a company philosophy The importance of centralization of decision making as a company philosophy The size of the potential pool of resources for product introduction The availability of investment funding The importance of skills retention

operationalization of concurrent engineering to specific circumstances.

2. Practical examples of successful contingent approaches. Perhaps the most powerful arguments for a contingent approach to product introduction organization are provided by the diversity of organizational solutions that are successfully employed within companies. For example, Backhouse and Brookes [5] present a wide variety of structural types involved in product introduction that are working equally effectively. Clark and Fujimoto [15] and the development of their work by Dann *et al.* [16] identify how product complexity influences the way product introduction is organized in terms of team structures and types of tools utilized. Von Braun [8] and Crawford [9] quote examples of situations where following a generic strategy (reduction of time-to-market) actually results in a situation that is inimical to some companies.
3. The need for multivariate contingency. Work by Brookes and Backhouse [17, 18] and that of Swink *et al.* [6] and Funk [7] shows that product introduction organization appears to be the result of many variables that need to be investigated in order to understand what an appropriate organization might be. The variables or 'forces' used by the SIMPLOFI positioning tool are as follows:
 - (a) product forces—those forces that acted as a result of the products inherent nature;
 - (b) product introduction forces—those forces that acted as a result of the nature of product introduction itself;
 - (c) constraint forces—those forces produced by the environment in which the product introduction was conducted either due to the wider company or the market place.

Each of the force categories was identified as having further components, as shown in Table 1. These individual forces were established from the existing work on

contingency and the experience of the SIMPLOFI project.

2.2 The use of a systemic modelling framework

Another important feature of the positioning tool is its representation of product introduction organization as continua of choice of five design elements (namely structure, control, process, people and tools). The reasoning behind this choice lies in the work of systems theory. Product introduction is the sort of purposeful transformation activity that takes place in organizations that are highly amenable to using systems theory to model. Product introduction is concerned with the transformation and creation of all the information to manufacture a product. This sort of system can be characterized in terms of its statics (the *people* and *tools* performing activities and the relationship *structure* between them), the dynamics (the transformation *process* undertaken) and its *control* mechanisms. These five 'design' elements were therefore selected to characterize different forms of product introduction organization.

Each of these design elements will have issues pertaining to their effective configuration. Improving product introduction performance may impact upon each of these (see Table 2). As Table 2 illustrates, a variety of options exist for the specification of each of the five product introduction elements. The SIMPLOFI positioning tool chose to focus on one key aspect of each product introduction element. Each area was selected against the following criteria:

1. It was an area of keenest debate. It was important to insure that the crucial areas in improving product development performance were covered.
2. It was an area where existing research had been performed. As a limited amount of previous work had been performed in this area relating product organization introduction to performance, it was important

Table 2 Quality function deployment and failure modes effect analysis

Product introduction design element	Definition	Design issues
Process	The activities and their sequence that need to be performed to introduce a product	Parallel versus sequential Formal versus informal
People	The people who are performing the product introduction process and the skills and expertise they need for that role	Specialist versus generalist Skill requirements
Tools	The tools that are used in the product introduction process	Manual versus computerized Use of quality tools (e.g. QFD, FMEA, etc.) Use of time compression technologies such as rapid prototyping
Structure	The relationships between the people that perform the product introduction process	Lightweight versus heavyweight teams Functional versus project Team membership
Control	The mechanisms by which the introduction of new products is controlled	Goal-directed project management Informal versus milestone Functional versus project

to make the best use of this by focusing on the areas where existing work had been carried out.

3. It was a key influencing factor on the success of product introduction. Unless the areas selected had a significant role in determining the success of product introduction it was no use focusing upon them. If the area was not important, the tool would be useless as it could give recommendations on features that did not impact upon performance.

The aspects of each product introduction design element that were selected are given below. These aspects formed the continua of choice that are illustrated in Figs 1 and 2.

1. For the *structure* element → *project versus functional*. The issue of where a team lies along the spectrum that stretches from a completely functional team to a completely project focused one is one of the keenest debates in implementing concurrent engineering. Wheelright and Clark [10] have provided useful concepts in this field of 'lightweight' and 'heavyweight' teams and have given guidance on appropriate usage for each structure.
2. For the *control* element → *project versus functional*. Control of product introduction projects is usually via time-based and resource-based mechanisms; in order to be effective these need to be allied to the structure of the proposed solution.
3. For the *people* element → *specialist versus generalist*. The decision on how knowledge is incorporated into people's roles is a crucial one for organizational learning and for organizational agility. Expert knowledge can be concentrated into specialist roles or disseminated throughout the organization into generalist roles, or a combination of specialists and generalists can be used.
4. For the *process* element → *serial versus parallel*. The implementation of concurrent engineering is often

seen as synonymous with the complete parallelization of the new product introduction process. However, making a process more parallel has implications for risk management, resource usage and management time. An appropriate solution for a particular project may lie anywhere along the spectrum from completely parallel to completely serial.

5. For the *tools* element → *manual versus computerized*. Computerization of product introduction activities can take the following forms:
 - (a) automating transformation activities,
 - (b) automating communication activities,
 - (c) automating storage and retrieval activities.

The use of these can lie along a spectrum from complete automation to a completely manual approach. The tool gives a recommendation along the spectrum of where it would be appropriate for a company to position itself for a particular product introduction. This is meant for initial guidance and does not replace the need for a detailed cost-benefit analysis before any decision to purchase new equipment is made.

Figure 4 summarizes the five design elements and the key aspect of each element that the SIMPLOFI positioning tool considers. These elements were used as the modelling framework to communicate different product introduction organizations.

2.3 The use of a force-resolution approach to relate contingent influences to product introduction organization

In order to recommend an appropriate organization, the SIMPLOFI positioning tool required a mechanism to relate the forces that impact upon product introduction to the five individual elements of the modelling framework. The model for this approach was based on that used by Mintzberg [19] to design complete organizations.

Fig. 4 The product introduction design element continua

Individual forces were allocated to the design elements that they influenced and the direction in which they 'pulled' along each continuum was identified. (Note that the same force may influence a number of elements.) The distribution of the forces used in the SIMPLOFI positioning tool is shown in Fig. 5.

The distribution of forces to either end of the continuum is obviously key to the appropriate nature of the results of the positioning tool. The current version of the positioning tool allocated these on the basis of organizational 'heuristics' (e.g. 'the more novel a project the more project focused structure is required'). These were derived from two sources:

- a review of best-practice literature that related product introduction organization (in its broadest sense) to product introduction success;
- the experience of the case studies performed by the SIMPLOFI project.

The appropriateness of distributing the forces to the design element continua using these heuristics was tested by the verification of the tool discussed at the end of this paper.

It is apparent from Fig. 5 that each of the five form element continua is likely to have forces 'pulling' it towards both extremes of the continuum. These opposing forces need in some way to be 'resolved' in order to understand where the most appropriate point for a specific product introduction lies along the continuum. The resolution mechanism needed to identify the direction of the overall 'resultant' force and its 'displacement' along the continuum. The resolution mechanism adopted by the SIMPLOFI positioning tool is as follows:

- The magnitude of the forces for a specific situation was established by rating them from 0 to 2.

- The resultant force and its direction was established by 'resolving' the forces along the continuum.
- This resultant force was then envisaged as acting upon a pointer in a datum position in the centre of the continuum. The centre of the continuum was set at 0 and either end of the continuum at -1 and 1. The displacement along the continua that it produced was in the direction of the resultant force and was calculated as follows:

Displacement

$$= \frac{\text{resultant force}}{\text{total force possible in that direction}}$$

Total force possible was calculated by multiplying the total number of forces that can act in that direction by the maximum force value.

The mechanism for resolving forces would always be, to a degree, arbitrary. This mechanism was chosen as it provided a spread of results across the continuum and ensured that solutions at the extreme of the continua were rarely recommended. The verification of this method was achieved in the case studies discussed below.

3 VERIFICATION OF THE SIMPLOFI POSITIONING TOOL

3.1 The verification methodology

The verification of any tool to improve product performance is fraught with difficulties. In order to verify the tool in terms of the effect of recommendations on product introduction performance, the following difficulties would need to be overcome [20]:

Fig. 5 The distribution of the forces along the product introduction design element continua

1. *The time lag.* Product introduction is a process whose outcome cannot be truly assessed until well into the product life-cycle. This may be years after the process began.
2. *The influence of other factors.* Unlike manufacturing, product introduction is not a repetitive process. It is very unlikely that changes in the operation of product introduction would be entirely due to implementing a new organization on the basis of the tool's recommendations. For example, the initial specification given to the process may be more or less realistic than before. The actual product may differ in terms of its complexity or overall risk.
3. *Measuring quality.* The concept of quality for product introduction has no widespread currency. The quality of a manufacturing process can be simply expressed in terms of its conformance to specification and its manufacturing in a minimum time using minimum

resources. No direct parallel will exist for product introduction.

The nature of these difficulties is not unique in the evaluation of organizational methodologies and tools. Robson [21] discusses that in these circumstances it is acceptable to evaluate a tool not in terms of its recommendations *per se* but in terms of the users' viewpoint of those recommendations. A similar approach was therefore used to verify the operation of the positioning tool. The tool was not evaluated in terms of the output performance of the product introduction. (The product development lead-times in the case study situations are significant and lie outside the duration of this evaluation.) The tool was evaluated in terms of the users' viewpoint of how it assisted in determining the configuration of product introduction for the case study areas. This approach limited the conclusions that could be drawn

Table 3 Case study companies used to verify the SIMPLOFI positioning tool

Company	Number of employees (for 1996)	Turnover (for 1996)	Product used for tool evaluation	Company personnel who undertook evaluation
MMH Limited: design and manufacturer of industrial hoists and cranes	600	£40m p.a.	A cost-reduction crane exercise A complete redesign of a chain hoist	Engineering Manager Development Projects Manager
Rover Group Limited: design and manufacturer of automobiles	30 000	£6.5bn p.a.	Mid-life update for a 4 × 4	Project Manager
Instron Limited: design and manufacturer of materials testing machinery	1200	£100m p.a.	Control panel for a servo- hydraulic testing machine	Corporate Product Group Manager
Markham and Company Limited: design and manufacturer of large capital equipment	300	£20m p.a.	Wind turbine Tunnelling machine	Works Director, Technical Manager
Hawker-Siddeley Switchgear Limited: design and manufacturer of switchgear	250	£40m p.a.	Composite switchgear	Concurrent Engineering Steering Group

from the tool's evaluation. It could not be said with certainty that the tool improved product development performance, but conclusions could be drawn on whether the users of the tool thought that it would.

3.2 Testing the tool in case study environments

Table 3 gives details of the companies in which the SIMPLOFI positioning tool was tested. Table 3 also describes the type of product introduction the tool was applied to and the company personnel who undertook the evaluation.

The sample of companies in which the tool was evaluated is obviously not representative of the whole range of product introduction applications. However, it does give sufficient diversity in product and in product introduction environment (in terms of design-to-order and design-to-forecast, product life-cycle volumes, etc.) for the results of the case study to give some guidance on wider applicability of the tool. The case study evaluation of the tool comprised the following stages:

Stage 1: Initial contact with the users evaluating the tool.

Only one of the tool evaluators had any prior knowledge of the tool. Initial contact with the other evaluators comprised the following:

- a brief description of the tool and the benefits that it could provide;
- a delineation of their role in the evaluation (including identification of a suitable product introduction to which to apply the tool).

Stage 2: tool evaluation. The company personnel then used the SIMPLOFI positioning tool on the particular product introduction that they had selected. With one exception, this took place with a SIMPLOFI

researcher present. The researcher then questioned the users on:

- whether the results from the tool were valid;
- whether the format of the results was meaningful;
- whether the tool was easy to use.

The user was also given the opportunity to make any further comments about the positioning tool.

Stage 3: feedback to the company. A report on the case study was produced that included the evaluator's comments on the tool. This was fed back to the evaluator and amended as the evaluator required.

Applications of the SIMPLOFI positioning tool to the case study companies, including the tool output, are contained in the Appendix. All of the users in the case study evaluations of the tool found that the tool was:

- producing appropriate results;
- at a meaningful level for implementation;
- easy to use (given the prototype nature of the tool).

Comments from the case study evaluators as a result of using the tool are summarized in Table 4. The evaluator's experience of the positioning tool highlighted uses for the tool that had not been considered in its development:

- The use of the tool in resource allocation. The positioning tool had been envisaged as assisting in the choice of an appropriate organization for a particular project. Case study evaluators saw a potential for the tool in providing justification for allocating resources between projects or the provision of extra resources.
- The use of the tool to ensure congruence of viewpoints across functions. The case study experience indicated

Table 4 Evaluator's comments

Company	Evaluator's comments
MMH Limited	The tool recommendations were valid and the evaluation exercise was useful. The tool could be used to justify resource for a particular product introduction. It would be useful if the tool could give quantitative information on performance losses if its recommended structure is not adopted.
The Rover Group Limited	The results were valid but were not surprising. The tool would be useful in the initial phases of a project. It would provide a useful 'bargaining' tool to ensure that adequate resources were allocated to the team. The tool would need to interface with project planning software.
Instron Limited	It was surprising that such sensible results could be produced from a technique that seemed so simple. The structure recommended by the tool was more 'projectized' than the structure actually used in Instron. It would be useful if the tool was capable of quantifying the performance losses due to using an inappropriate structure as this figure could then be used to justify additional resources.
Markham and Company Limited	The tool's results were realistic and meaningful. The evaluation exercise was useful. Using the tool promoted cross-disciplinary discussions which would not usually have occurred in an 'operations-driven' environment.
Hawker-Siddeley Switchgear Limited	The graphical nature of the tool output was good. Focusing the whole issue of organization on five key elements was good. Some of the tool's results were surprising, but the tool allowed a trace-back to which force was the most influential in this part of the recommendation and allowed the original setting to be changed.

that the process of using the tool was as important as the results it gave. In situations where more than one individual was responsible for determining the weighting of the organizational forces on product introduction, this process allowed them to clarify what they expected of the product and its introduction.

Further developments on the basis of user experience are discussed in more detail in the next section.

4 SUMMARY, FURTHER DEVELOPMENTS OF THE SIMPLOFI POSITIONING TOOL AND CONCLUSIONS

4.1 Summary of the investigation

The objective of this paper was to present the SIMPLOFI positioning tool and to demonstrate its effectiveness to potential users in recommending appropriate organizational structures for individual product introductions. The paper sought to demonstrate its effectiveness by validating the tool by examining its provenance and verifying the tool by applying it in case study environments.

4.1.1 Validation of the tool

The process of validation implies that the tool has been shown to be well grounded and defensible. The theory on which the tool is based has been shown to come from two main sources:

- (a) systems theory and
- (b) a multivariate contingency approach to organizational design.

Both of these areas embody significant research effort and have been used by other researchers in related fields. In this sense, it can be argued that the tool is well grounded.

The tool has also been developed using an approach that demonstrates internally cohesive logic. It models the influences on product as 'forces' acting in opposite directions along a continuum of possible organizational solutions. These forces are then resolved and the resultant force translated into its associated displacement along this continuum. In this sense, the internal logic of the tool can be argued to be defensible.

A tool can be valid without being effective and therefore the verification of the operation of the tool was also demonstrated.

4.1.2 Verification of the tool

The operation of the tool in terms of the users' opinion of that operation has been verified in a very limited environment. Despite the limited area of verification, results suggest that the positioning tool would be effective in other situations due to:

- (a) the unanimity of findings: all of the users reported favourably on the tool's effectiveness;
- (b) the diversity of case study environments: the case studies took place in a variety of environments, as demonstrated by the way in which the forces were ranked during the tool application.

Taking the evidence of validation and verification together, this paper has demonstrated that the SIMPLOFI positioning tool has the potential to be effective in structuring product introduction in a number of

environments and is worthy of further investigative applications.

4.2 Further tool developments

The following further developments could be made to the SIMPLOFI positioning tool.

4.2.1 *Improving the user-friendliness of the tool*

The user-friendliness of the tool could be greatly increased if the whole package was based in a WindowsTM environment. The initial assessment of the magnitude of product introduction forces could then take place in a software environment, which would then automatically feed into the force-resolution package. An automated tool could also ensure better error checking and facilitate the use of the tool in iterative 'what-if' scenarios.

4.2.2 *Quantification of performance losses*

Case study users indicated that it would be useful to understand quantitatively the performance sacrifices that would ensue if a company did not adopt the organization proposed by the positioning tool. This would be useful when justifying additional resources to allow more autonomous project teams. Although quantitative performance measurements may be too problematic, the tool could be developed so that it could give qualitative performance measures for particular organizational solutions.

4.2.3 *Linking with downstream project planning mechanisms*

Case study users also indicated that it would be useful to link the tool with downstream project planning mechanisms. Work has already proceeded with linking the tool to a function allocation system but the link at this stage is not automated. Further work is required to develop this and also to link the output of the positioning tool to better-known project planning packages.

4.2.4 *User generation of forces and the influence of forces*

As intimated in the discussion on the influences of product introduction, specific company 'constraint' forces often act upon product definition. The tool could be developed to allow the user insertion of these by asking the user to specify their effect on the five design element continua. This would enable the tool to make more valid suggestions for particular company circumstances.

4.2.5 *Increasing the tool's whole system capabilities*

Currently the positioning tool only focuses on one product introduction. As discussed in the first section of

this paper, the tool could be developed so that the organization of the whole product introduction system could be considered in enterprises that introduced more than one product at a time. This would enable resource conflicts across projects to be considered and would give a more useful output to those responsible for the whole of the product introduction activity within an enterprise.

4.2.6 *Use of the 'force-resolution' approach for other areas of organizational design*

The five-element framework developed for communicating alternate product introduction organizations could be used in other areas of the enterprise. The principle to understanding the forces on those elements and resolving the forces also has potentially wider appeal. The positioning tool could therefore be developed for other areas of enterprise design.

4.3 Conclusions

The purpose of the SIMPLOFI positioning tool was to assist in the selection of an appropriate organization for a particular product introduction. This selection is made more difficult by the multiplicity of decisions facing those individuals responsible for organizing product introduction and the fact that an inappropriate decision may have significant performance implications.

The tool has demonstrated, in a series of case study applications, that it has the capability to assist in this activity. The case study findings were of sufficient unanimity and the companies participating of sufficient diversity to indicate that this experience would be echoed elsewhere. If the suggestions for further work outlined in this paper are carried out, both in terms of improving tool functionality and testing it with a wider audience, then the positioning tool could offer substantial improvements in product development performance to all individuals who are responsible for selecting an appropriate configuration for product introduction within an organization.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the support they received from the participating companies, to acknowledge the support of the EPSRC who funded the project of which this work formed a part and to thank the referees for their comments.

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APPENDIX

Using the SIMPLOFI positioning tool in Morris Mechanical Handling Limited

The company

Morris Mechanical Handling Limited (MMH) is a company specializing in the design and manufacture of industrial hoists and cranes. The company has approximately 600 employees and a turnover of £40m per annum. MMH is a wholly owned subsidiary of P&H Material Handling Inc., its US parent.

Its product portfolio ranges from industrial hoists that are made in volume in a design-to-forecast situation to large design-to-order products for cranes for applications such as ship-to-shore container handling.

The product

Two products were selected on which to use the SIMPLOFI positioning tool from two separate operating divisions of the company:

1. The T500 series of products. This range represented a standardization of previous products and was being introduced to give cost reduction benefits. Competitors had already performed a similar activity and it was perceived that MMH was losing market share because its products were too expensive. By standardizing the products it was hoped that MMH would be able to offer its customers a lower price.
2. The 300 series of electric chain hoists. The 300 series of hoists had been selected for a complete redesign with the objective of using innovative technology and industrial design to produce a product for the late 1990s. Morris' competitors had already produced similar units. The 300 series was past its preliminary design stage and had received the go-ahead to be designed as a production item.

The tool application

The tool was used by the Engineering Manager of the division responsible for the T500 series and the Development Projects Manager from the division responsible for the 300 series. They each ranked the forces in the tool's force framework. The results of using the tool for the T500 series and the 300 series are presented below:

For the T500 series:

The *structure* recommended by the tool lies between a lightweight and heavyweight team solution. A Project Manager is required who has strong influence over core skills, but it may be appropriate to represent other functions by liaison appointees. However, all team members retain links back to their original functions. The drivers that prevented a more project-orientated solution were

the low rankings given to product complexity and novelty, the importance of product cost to profitability and the very small size of the product introduction system.

The *control* mechanisms will need to reflect the structure by having strong project-focused control systems on time and even perhaps resource, but need to maintain a functional control mechanism as well.

The *process* will need to be fairly parallel. It will certainly need to perform some activities in parallel as well as insuring up-front communication across all areas. The prime drivers for parallelization are the relatively low product novelty and the relatively high need for speedy product introduction.

The tool recommended that the *people* within the product introduction system would need to have some areas of specialist knowledge. The main drivers for this recommendation were the relatively low novelty and product complexity and the balance, tipping slightly in favour of skills retention, between that factor and the need to minimize product introduction operating costs.

The tool recommended that the *tools* used in the introduction of this product should reflect a high degree of computerization. The prime drivers in this situation were the need for high-speed product introduction balanced against a situation where only limited investment funding was available.

For the 300 series:

The *structure* recommended for the 300 series is similar to the T500 series, which is not unexpected given the similarity of the products. The structure lies between a lightweight and heavyweight team solution but more strongly pulled towards a heavyweight team solution. This would suggest that the core team may need to be wider for the 300 series. This situation arose mainly because of the greater novelty of the 300 series and the greater importance given to low product cost.

The *control* mechanisms recommended by the tool echoed the structure and were similar to those proposed for the T500 series.

The *process* recommended by the tool was less parallel than for the T500 series. This reflected the greater novelty inherent within the 300 design and hence the greater risk of higher development costs if activities themselves were actually carried out in parallel.

The specialization requirements of the *people* to staff the product introduction process were higher for the 300 series. The major factor at play here again was the emphasis given on product novelty in the 300 series' force framework.

The positioning tool recommended that comparatively highly automated *tools* should be used in the product introduction process. The results for the 300 series indicated a more automated solution than for the T500 series because of the greater availability for funding for investment in the product introduction process.

Industrialist's comment

The Engineering Manager and the Development Projects Manager thought that the recommendations for the product introduction were valid and that the exercise was useful. The Engineering Manager thought that the tool could be used to help in gaining the resource to dedicate to this particular product introduction. He commented that if a similar product was to be introduced that there would be no need to run through the tool and that it would be useful if the tool could give more quantitative information on the results of operating away from the tool recommendation. The Development Projects Manager highlighted that novelty may be a concept that not only applies to products or markets but also to the process of introducing new products itself.

SIMPLOFI Product Introduction Positioning Tool

Product :-

T500 series

Fill in the Characteristics for the Product You wish to Introduce :-

product

CIPS	0.3
CPUI	1
novelty of market/tech	0.2
low product cost	0.2

product introduction

speed	1.5
reliability	1.1
operat. cost	0.2

constraints

empowermt.	0
skills retn.	1.2
p.l. size	0.2
centralizatr.	1
lack of inv.	1

STRUCTURE

contributing factors :-

FUNCTIONAL		PROJECT	
operat. cost	0.2	size	0.2
specializatr.	1	CPUI	1
centralizatr.	1	pi. reliability	1.1
		novelty	0.2
		p.l. speed	1.5
		CIPS	0.3
		prod. cost	0.2
		pril. process	1
		empowermt.	0

CONTROL

PROCESS

contributing factors -

SEQUENTIAL		PARALLEL	
novelty	0.2	prod cost	0.2
operat. cost	0.2	cpui	1
		p.l. speed	1.5

PEOPLE

contributing factors:-

SPECIALISED		NON-SPECIALISED	
novelty	0.2	operat. cost	0.2
skill retn.	1.2		
CIPS	0.3		

TOOLS

contributing factors

MANUAL		COMPUTERISED	
inv. funding	1	CIPS	0.3
		p.l. speed	1.5
		operat. cost	0.2

SIMPLOFI Product Introduction Positioning Tool

Product :-

AAG New 360

Fill in the Characteristics for the Product You wish to Introduce :-

product

CIPS	0.75
CPUI	0.85
novelty of market/tech	1.3
low product cost	1.5

product introduction

speed	0.8
reliability	1.1
operat. cost	1.3

constraints

empowermt.	1.5
skills retn.	1.5
p.l. size	0.3
centralizatr.	1
lack of inv.	0.5

STRUCTURE

contributing factors :-

FUNCTIONAL	PROJECT
operat. cost	1.3
specializatr.	2
centralizatr.	1
	size
	CPUI
	pi. reliability
	novelty
	p.l. speed
	CIPS
	prod. cost
	pril. process
	empowermt.

CONTROL

PROCESS

contributing factors :-

SEQUENTIAL	PARALLEL
novelty	1.3
operat. cost	1.3
	prod. cost
	cpui
	p.l. speed

PEOPLE

contributing factors:-

SPECIALISED	NON-SPECIALISED
novelty	1.3
skill retn.	1.5
CIPS	0.75
	operat. cost

TOOLS

contributing factors

MANUAL	COMPUTERISED
inv. funding	0.5
	CIPS
	p.l. speed
	operat. cost

Using the SIMPLOFI positioning tool in the Rover Group Limited

The company

The Rover Group is a company that designs and manufactures a wide range of cars. It has 30 000 employees and has a turnover of £6.5 bn per annum.

The product

The product selected was the mid-life update for a 4×4 vehicle. This obviously would not have the same degree of novelty as a completely new model.

The tool application

The tool was used by the Project Manager of the product in question. The rankings given by the Project Manager are shown in the spreadsheet. This force framework reflects the extremely difficult task that a product introduction in this environment has to face. It is subject to both extremes in terms of speed and reliability of product introduction and at the same time must introduce a highly complex product in both its inherent technology and the complexity of understanding what the user wants from it.

The results of using the tool are also presented in the spreadsheet:

The *structure* recommended by the tool is highly orientated towards an autonomous project team. A project manager would have most team disciplines formally allocated to him or her and retaining no links to their original functions. There may, however, be some disciplines with which it will be important to retain some functional links. This position is recommended because

of the combination of high product complexity and the emphasis on speed and reliability in the product introduction environment.

The *control* mechanisms will need to reflect the structure by having strong project-focused control systems on time and resource with very little, if any, functional elements of control.

The *process* will need to be very parallel. It will need to perform many activities in parallel. The only factor that prevents an even more parallel solution being recommended is the high value given to product novelty.

The tool recommended that the *people* within the product introduction system would need to have many areas of specialist knowledge. The main drivers for this recommendation were the combination of high product novelty, skills retention and inherent product complexity.

The tool recommended that the *tools* used in the introduction of this product should reflect a high degree of computerization. The prime drivers in this situation were the need for high-speed product introduction and the complexity of the product.

Industrialist's comment

The Project Manager thought that the recommendations from the tool were valid though he was not surprised by them as Rover already worked in an environment that accepted the need for high parallelization and integration. He said that the tool would be useful in the initial phases of the project and may provide a 'bargaining tool' for ensuring that adequate resources were allocated to the team. He also stated that he would need to go down to a lower level of detail for actual project planning.

SIMPLOFI Product Introduction Positioning Tool

Product :- **Midlife Facelift, 4x4 vehicle**

Fill in the Characteristics for the Product You wish to Introduce :-

product

CIPS	1.6
CPUI	1.8
novelty of market/tech	1.5
low product cost	1

product introduction

speed	1.9
reliability	1.9
operat. cost	0.6

constraints

empowermt.	1.5
skills retn.	1.7
p.l. size	1.9
centralizatn.	0.5
lack of inv.	1

STRUCTURE

contributing factors :-

FUNCTIONAL		PROJECT	
operat. cost	0.6	size	1.9
specializatn.	2	CPUI	1.8
centralizatn.	0.5	pi. reliability	1.9
		novelty	1.5
		p.l. speed	1.9
		CIPS	1.6
		prod. cost	1
		pril. process	2
		empowermt.	1.5

CONTROL

PROCESS

contributing factors :-

SEQUENTIAL		PARALLEL	
novelty	1.5	prod cost	1
operat. cost	0.6	cpui	1.8
		p.l. speed	1.9

PEOPLE

contributing factors:-

SPECIALISED		NON-SPECIALISED	
novelty	1.5	operat. cost	0.6
skill retn.	1.7		
CIPS	1.6		

TOOLS

contributing factors

MANUAL		COMPUTERISED	
inv. funding	1	CIPS	1.6
		p.l. speed	1.9
		operat. cost	0.6

Using the SIMPLOFI positioning tool in Instron Limited

The company

Instron is one of the world's leading manufacturers of materials testing equipment. It has 1200 employees, 400 of which are based in the United Kingdom, with a turnover of £100m per annum.

The product

The product selected was an 8800 control panel that fits on a variety of servo-hydraulic testing machines.

The tool application

The tool was used by a Corporate Product Group Manager who had also been responsible for implementing Concurrent Engineering within Instron.

The results of using the tool are presented in the spreadsheet:

The *structure* recommended by the tool was that of a heavyweight team with some team disciplines permanently attached to the project team. The main drivers for this were the requirements for speed and reliability in product introduction, product complexity and the importance of product cost to company profitability.

The *control* mechanisms will need to reflect the structure by having strong project-focused control systems on time and resource with some functional elements of control retained for those team disciplines retaining a link to their original functions.

The *process* will need to be parallel. It will need to perform a significant number of activities in parallel. This recommendation arose because of the relatively low values given to product novelty and the importance of low-cost product introduction and the high values given to the importance of product cost and product introduction speed.

The tool recommended that the *people* within the product introduction system would need to have a significant number of areas of specialist knowledge. The main drivers for this recommendation were the combination of the importance of skills retention and inherent product complexity.

The tool recommended that the *tools* used in the introduction of this product should reflect a high degree of computerization. The prime drivers in this situation were the need for high-speed product introduction and the complexity of the product.

Industrialist's comment

The Product Group Manager was surprised that sensible results could be produced from a technique that apparently seems so simple. The actual team structure adopted by Instron was less 'projectized' than that recommended by the tool. The manager expressed a wish to be able to use the tool to quantify the performance that he was losing by not adopting the recommended structure so that he could begin to justify the acquisition of additional resources.

SIMPLOFI Product Introduction Positioning Tool

Product :- **8800 CONTROL UNIT**

Fill in the Characteristics for the Product You wish to Introduce :-

product

CIPS	1.5
CPUI	1
novelty of market/tech	1
low product cost	1.5

product introduction

speed	1.7
reliability	1.9
operat. cost	0.5

constraints

empowermt.	1
skills retn.	1.7
p.l. size	1
centralizatn.	1
lack of inv.	1

STRUCTURE

contributing factors :-

FUNCTIONAL	PROJECT
operat. cost	0.5 size
specializatn.	2 CPUI
centralizatn.	1 pi. reliability
	novelty
	p.l. speed
	CIPS
	prod. cost
	pril. process
	empowermt.

CONTROL

PROCESS

contributing factors :-

SEQUENTIAL	PARALLEL
novelty	1 prod cost
operat. cost	0.5 cpui
	p.l. speed

PEOPLE

contributing factors:-

SPECIALISED	NON-SPECIALISED
novelty	1 operat. cost
skill retn.	1.7
CIPS	1.5

TOOLS

contributing factors

MANUAL	COMPUTERISED
inv. funding	1 CIPS
	p.l. speed
	operat. cost

Using the SIMPLOFI positioning tool in Markham and Company Limited

The company

Markham and Company is a designer and manufacturer of large capital equipment. It has five main product lines:

- (a) large-bore tunnelling machines,
- (b) small-bore tunnelling machines,
- (c) mining winding equipment,
- (d) wind turbine equipment,
- (e) large contract machining.

It has a turnover of £20m per annum and 300 employees (approximately).

The product

Two products were selected for the purposes of testing the tool. These were not specific products but representative composites from two of the product ranges that Markham and Company design and manufacture:

- (a) a wind turbine,
- (b) a tunnelling machine.

Wind turbines operate in a largely design-to-forecast market where a number of turbines will be made for one design. Tunnelling machines are designed and made to order and hence, have very limited production runs (usually one or two). These products represented Markham and Company design activities.

The tool application

The tool was used by the Works Director and Technical Manager. They jointly determined the force framework for each product as shown on the spreadsheets. The results of using the tool are also presented in the spreadsheets:

For the wind turbine:

The *structure* recommended by the tool was a team that lay between a lightweight and heavyweight solution but one that leaned strongly towards a heavyweight team with core members having a strong attachment to the project. This was recommended by the tool even though the weighting given to the importance of operating cost and the need for specialization was very high.

The *control* mechanisms reflected the structure by having strong project-focused control systems on time and resource with some functional elements of control retained for those team disciplines retaining a link to their original functions.

The *process* will exhibit the performance of activities in parallel but rather up-front communication. This recommendation arose because of the high values given to novelty and the need to reduce product introduction operating cost.

The tool recommended that the *people* within the product introduction system would need to have a significant number of areas of specialist knowledge. The main drivers for this recommendation were the combination of the importance of skills retention and inherent product complexity.

The tool recommended that the *tools* used in the introduction of this product should reflect a high degree of computerization. The prime drivers in this situation were the need for high-speed product introduction and the complexity of the product.

For the tunnelling machine:

The *structure* recommended by the tool for the tunnelling machine project was similar to that of the wind turbine and lay between a lightweight and heavyweight solution with a strong bias towards the heavyweight team. This would mean that a project manager would need to be appointed with most skills in the team formally allocated to it while still maintaining links back to their original function. It would be sufficient for less core skills in the team to be represented by a liaison role. This recommendation arose despite the strong pull to the functional from the influence of minimizing product introduction cost and the high specialization because of the high importance placed upon product introduction speed and reliability and the high values given to product complexity and novelty.

The *control* mechanisms reflected this structure by promoting a project focus while maintaining functional reporting routes back to the functional heads.

The tool recommended that the *process* should adopt an approach that was more parallel than for the wind turbine. The tool recommended that up-front communication should be encouraged and that some activities should be performed in parallel. This situation arose because of the very high weightings given to product introduction speed. This is despite the importance given to product introduction operating cost in the initial force framework.

The tool suggested that the *people* involved in the process would need to be fairly specialized but less so than for wind turbines. This occurred because of the values given to product complexity and the importance of skills retention, and again took place despite the requirement for a very low product introduction operating cost with its ensuing requirements for a flexible workforce. The process suggested was more parallel than wind turbines because of the lack of novelty in tunnelling machines for Markham when compared with wind turbines.

The recommendation given for the degree of automation for the *tools* used in product introduction was to adopt a highly computer automated approach in terms of communication, storage and automation of individual activities.

Industrialist's comment

The results of the tool met with a favourable response from the Works Director and Engineering Manager. They felt that the results were realistic and meaningful

and that the exercise using the tool had been useful. They suggested that the tool had promoted cross-functional discussions which would not usually have occurred in an operations-driven environment.

SIMPLOFI Product Introduction Positioning Tool

Product :- **Wind Turbine**

Fill in the Characteristics for the Product You wish to Introduce :-

product

CIPS	1.3
CPUI	0.8
novelty of market/tech	1.4
low product cost	1

product introduction

speed	1.2
reliability	1.2
operat. cost	1.5

constraints

empowermt.	1.6
skills retn.	1.5
p.l. size	0.2
centralizatr.	0.8
lack of inv.	1

STRUCTURE

Functional

Project

contributing factors :-

FUNCTIONAL		PROJECT	
operat. cost	1.5	size	0.2
specializatr.	2	CPU1	0.8
centralizatr.	0.8	pi. reliability	1.2
		novelty	1.4
		p.i. speed	1.2
		CIPS	1.3
		prod. cost	1
		pril. process	1
		empowermt.	1.6

CONTROL

Functional

Project

PROCESS

Sequential

Parallel

contributing factors :-

SEQUENTIAL		PARALLEL	
novelty	1.4	prod cost	1
operat. cost	1.5	cpui	0.8
		p.i. speed	1.2

PEOPLE

Specialised

Non-Specialised

contributing factors:-

SPECIALISED		NON-SPECIALISED	
novelty	1.4	operat. cost	1.5
skill retn.	1.5		
CIPS	1.3		

TOOLS

Manual

Computerised

contributing factors

MANUAL		COMPUTERISED	
inv. funding	1	CIPS	1.3
		p.i. speed	1.2
		operat. cost	1.5

SIMPLOFI Product Introduction Positioning Tool

Product :-

Tunneling Machine

Fill in the Characteristics for the Product You wish to Introduce :-

product

CIPS	1.6
CPU	0.2
novelty of market/tech	0.5
low product cost	1.6

product introduction

speed	1.6
reliability	1.6
operat. cost	2

constraints

empowermt.	1.1
skills retn.	1.5
p.l. size	0.2
centralizatr.	1.1
lack of inv.	0.5

STRUCTURE

contributing factors :-

FUNCTIONAL	PROJECT
operat. cost	2
specializatr.	1
centralizatr.	1.1
size	0.2
CPU	0.2
pi. reliability	1.6
novelty	0.5
p.l. speed	1.6
CIPS	1.6
prod. cost	1.6
pril. process	1
empowermt.	1.1

CONTROL

PROCESS

contributing factors :-

SEQUENTIAL	PARALLEL
novelty	0.5
operat. cost	2
prod cost	1.6
cpu	0.2
p.l. speed	1.6

PEOPLE

contributing factors:-

SPECIALISED	NON-SPECIALISED
novelty	0.5
skill retn.	1.5
CIPS	1.6
operat. cost	2

TOOLS

contributing factors

MANUAL	COMPUTERISED
inv. funding	0.5
CIPS	1.6
p.l. speed	1.6
operat. cost	2

Using the SIMPLOFI positioning tool in Hawker-Siddeley Switchgear Limited

The company

Hawker-Siddeley is one of the world's leading manufacturers of switchgear equipment. It has 250 employees across two sites and operates with a turnover of £40m per annum. When the case study took place the tool company was in the process of implementing Concurrent Engineering and was looking for a development project on which to pilot new working practices.

The product

The product selected was not an actual product but a composite product that resembled the development project that the team were likely to use for their pilot project.

The tool application

The tool was used by the Concurrent Engineering Steering Group which was a multidisciplinary part-time team set up to guide the implementation of Concurrent Engineering. The results of using the tool are presented in the spreadsheet:

The *structure* and *control* continua indicated that concurrent engineering teams should have a structure that lies between a lightweight and heavyweight structure. This meant that there should be a dedicated Project Manager who had a core team of people over which he or she had significant control. The remaining disciplines could be represented in a less dedicated manner. However, all members of the team still reported to their functional heads. The control mechanism used reflected this structure by having strong project focused monitoring procedures (time and resources), but also retained some monitoring links on resource utilization back to the functional heads of team members.

The results of the *process* continuum suggested that the most appropriate form of process was one in which up-front communication would take place but activities themselves would not occur in parallel. This solution was sequential due to the high rating that the Steering Group had given to the novelty of the product in the initial force framework. (In a highly novel situation performing activities in parallel will be more risky and the results of each activity are less likely to be known when embarking upon it.)

The *people* continuum suggested that the project required a high degree of specialization; i.e. expert knowledge should be concentrated into particular roles rather than spread throughout the organization. Again this was influenced by the high value that the team had given to product novelty in the initial force framework. The high degree of specialization indicated here works against the use of project-focused teams and the benefits that they bring in terms of reduced time-to-market and lower product cost.

The *tools* continuum indicated that a highly computer automated environment should be used. This was determined by the relative freedom of investment funding. This recommendation was therefore highly sensitive to changes in this factor.

Industrialist's comment

The Steering Group liked the graphical nature of the tool and the way in which it broke down the problem into five key elements (i.e. structure, control, process, people and tools). Some of the results of the tool were surprising to the Group but these could be traced back to the high value given to product novelty and highlighted the fact that the tool may need to be used hierarchically. (Only certain functions exhibited a high degree of novelty; the rest of the switchgear represented a fairly 'known' approach.) The team found the feedback discussion particularly useful.

SIMPLOFI Product Introduction Positioning Tool

Product :- **composite switchgear**

Fill in the Characteristics for the Product You wish to Introduce :-

product

CIPS	1
CPUI	0.5
novelty of market/tech	1.5
low product cost	0.2

product introduction

speed	1
reliability	1.2
operat. cost	1

constraints

empowermt.	1
skills retn.	1
p.l. size	1
centralizatr.	1
lack of inv.	0.8

STRUCTURE

contributing factors :-

FUNCTIONAL	PROJECT
operat. cost	1 size
specializatr.	2 CPUI
centralizatr.	1 pi. reliability
	novelty
	p.l. speed
	CIPS
	prod. cost
	pril. process
	empowermt.

CONTROL

PROCESS

contributing factors :-

SEQUENTIAL	PARALLEL
novelty	1.5 prod cost
operat. cost	1 cpui
	p.l. speed

PEOPLE

contributing factors:-

SPECIALISED	NON-SPECIALISED
novelty	1.5 operat. cost
skill retn.	1
CIPS	1

TOOLS

contributing factors

MANUAL	COMPUTERISED
inv. funding	0.8 CIPS
	p.l. speed
	operat. cost