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Using IDEF and QFD to develop an organizational decision support methodology for the strategic justification of computer-integrated technologies

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The paper presents some issues relevant to the strategic justification of computer-integrated enterprise technologies for small and medium-sized manufacturing enterprises. To address the issue of making a strategic justification or 'business case' for these technologies, an organizational decision-making methodology that incorporates the strategies of the firm is needed, among other requirements. A research and development approach that integrates Quality Function Deployment and IDEF0 functional modeling to determine the requirements and processes for the justification methodology is presented. This approach has implications for future research and development for similar organizational decision-support processes and business-process reengineering.

Keywords: quality-function deployment, IDEF0, strategic justification

Current and future directions in the US domestic industrial economy point to further global competitive pressures on manufacturing enterprises of all sizes. For organizations to be able to compete on this global level, there need to be national and industrial visions, as well as enterprise-level visions. A recent industrial competitive paradigm that serves as a focus for all these visions is the 'virtual enterprise'. This vision requires that enterprises be able to form and function across organizational boundaries in the development, production, and distribution of various products, in a relatively short period of time. One requirement is that the enterprise be 'agile' enough to function within this environment. The computer-integrated enterprise (CIE) and computer-integrated enterprise technology appear to provide a framework and tools (respectively) through which manufacturers can flourish in a competitive environment. However, being able to adopt and implement these CIE technologies is a very difficult endeavor for most enterprises.

CIE technologies are necessary to help enterprises become agile enough to form interorganizational *ad hoc* partnerships that emphasize each enterprise's core competencies[1]. Examples of some of these technologies are computer-integrated manufacturing systems, flexible manufacturing systems, computer-aided process planning, computer-aided drafting and design, electronic data interchange, manufacturing resource planning systems, and distributed database systems. These technologies comprise three integral elements: hardware, software and organizational ware (e.g. training requirements).

Technology strategy is only one way of achieving a computer (or competitively) integrated enterprise. Organizational strategy and integration are another important dimension. A comprehensive definition for an integrated enterprise is as follows.

An enterprise is a collection of all internal and external activities (routines) necessary to operate a business. Integration consists of the linkage and coordination of these activities so that they function as a whole. This includes the coordination of vision, strategy, guidelines, methodologies, resources, and tools to support and optimally achieve overall business goals. The guidelines and methodologies encompass all enterprise activities and their coordination by the management of information, technologies and processes[2].

In this paper, we focus on the development efforts and approach for a methodology to help in justifying, or making a business case, for these strategic technologies. This approach helps to provide insights for project managers who focus their efforts on business-process improvement and reengineering. A brief introduction and review of various issues related to the adoption, acquisition and justification of CIE technologies set the environmental context of this development project. We describe how we have used two organizational tools to develop this methodology, and a brief review of the tools is included. The results of this project are described. Some general and specific implications of using the defined approach are summarized in the conclusions.

CIE technology justification background

The benefits of CIE technologies have been defined in the literature. These benefits include increased customer responsiveness, flexibility of organizations, higher-quality products and services, shorter leadtimes, and improved process controls. For organizations to be competitive on a global basis, these technologies have become a requirement. Unfortunately, studies and surveys have shown that the majority of organizations are slow to adopt these strategic technologies. This adoption rate is even slower for small and medium-sized enterprises (SMSEs)[3]. The literature provides a number of reasons for this slow adoption.

Issues in the adoption of CIE technology

Some of the issues in the justification of CIM/CIE and other advanced manufacturing technologies (AMT) include the following[4–8]:

- *High capital costs and risks:* Capital costs are much higher, and thus the payback period is much longer than that for conventional systems. New technology poses higher risks mainly because of unfamiliarity with the technology.
- *Myopic approaches to justification:* Industry uses simple measurements and has short-sighted goals for returns on investments.
- *Inappropriate capital budgeting procedures:* Traditionally, approaches have tended to be bottom-up procedures for generating new equipment proposals, with narrow levels of analysis.
- *Quantification dilemma:* The dilemma consists of the difficulty of quantifying the indirect, intangible benefits, and the lack of appropriate measurement methodologies and approaches for accurate performance measurements.
- *Prediction of benefits over extended period of time:* It is difficult to determine what the benefits will be in the long run. There are problems in the scheduling of investments and the expected returns.
- *Technological uncertainties:* The rapid evolution of new technologies has created a sizable knowledge gap among manufacturing and financial professionals. 'Wait and see' attitudes, fears of obsolescence, and lack of worker acceptance of new technologies has made the justification process even more difficult for these technologies.
- *Inadequacies of costing methods:* Traditional costing approaches need to be adjusted to take into consideration the lessening impact of labor, and to focus more on relating indirect costing approaches to manufacturing functions. Appropriate cost tracing systems will be required.
- *Differing natures of operations:* Methods of operations and controls that differ from traditional approaches require new approaches for costing also.
- *Analysis based on subsystems and suboptimization:* Models are essentially single-criteria approaches with narrow problem definition. Portions of the system are considered, and not the full system.

These and other issues have made the call for strategic financial models and strategic justification even more pronounced. The response has been overwhelming and over 400 citations from before 1990 have focused on this issue[9]. However, in this literature, there is little emphasis on the specific requirements of SMSEs when it comes to justifying the acquisition of CIE technology. This is the purpose of the research and development approach presented below.

Small and medium-sized enterprise requirements

A major concern is the suitability of these justification models for SMSEs. Numerous issues relating to SMSEs must be addressed that most models have not considered. The traditional approaches are flexible enough to be used by these organizations, but the lack of strategic focus provides just as many problems for SMSEs as for large enterprises. A look at specific issues facing SMSEs is necessary. Few practitioners and researchers have focused on the special needs of SMSEs. Much of this has to do with the variations in these organizations and the lack of information pertaining to their needs. By focusing on a very well defined segment, it will be easier to help develop the tools and techniques appropriate for these organizations. The research approach presented below will help to both identify the special needs of SMSEs, and define the technologies that will help them meet their goals.

More than ever, these tools are needed to aid SMSEs in making their decisions. SMSEs have many unique characteristics that distinguish them from their larger counterparts. These unique characteristics, as well as CIE technology characteristics, need to be considered in the development of justification tools. The characteristics include the requirement that strategic justification tools and methodology should be available to SMSEs that (a) are low-cost, (b) are easy to use with few technical-support requirements, (c) take into consideration some of the unique financial constraints that SMSEs have, (d) act as learning and training devices in relation to the types of CIE technology available for their environment, and (e) take into consideration the strategic and financial factors that are most dominant in SMSEs. They should also integrate the strategic planning and implementation stages of the business process.

These and other requirements will be extracted from 'customers' using a quality-function deployment (QFD) approach as described below.

Business-case project

The process used for the development of strategic-justification tools and methodology, to make a 'business case', is an approach that integrates QFD design tools with IDEF0 functional modeling. QFD has been used to determine the customer requirements for a strategic justification methodology, and IDEF0 has been used to describe and document the methodology. Before we go into detail about the research and development associated with this project, brief reviews of QFD and IDEF0 are presented.

Quality-function deployment review

QFD is a tool that is used to ensure in a systematic way that the development of product features, characteristics and specifications, as well as manufacturing and process requirements, are driven by the demands (voice) of the customer. It is a tool that has been used to relate customer requirements to the design and manufacture of products, and to link the marketing, engineering and manufacturing functions of the enterprise. It has been used to implement such ideas as concurrent engineering and design for manufacture in numerous organizations.

Figure 1 shows the central element of a QFD analysis. It shows what has been called the 'house of quality'[10], and at the centre is the matrix-relationship diagram. In this matrix, the rows (along the left hand side) each represent *what* the customer requires. Associated with each requirement is an importance value that has to be elicited from the customer.

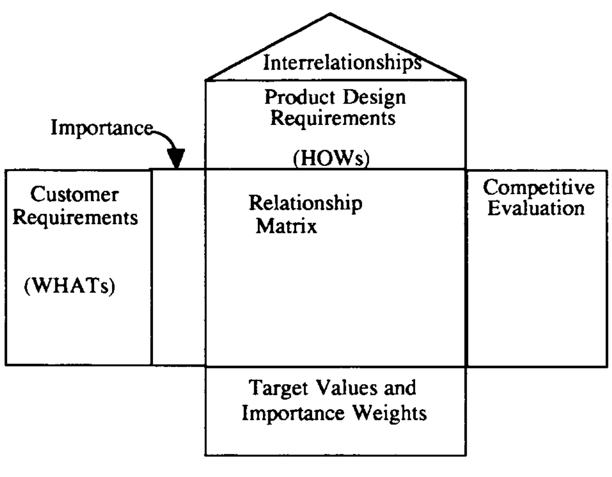

Figure 1 QFD house of quality

Along the top portion of the matrix are the design requirements for *how* to meet the customer's requirements (in this paper, the design requirements are for a methodology, instead of a product). The roof of the house consists of the relationships among the various design requirements (the roof was not used for this project). At the bottom of the house are the importance measurements and target values of each of the design requirements. The right-hand side of the box shows the comparative evaluation of competing alternatives (for this project, competing alternatives were assumed not to exist). The central portion of the house is made up of a number of cells that relate the design requirements to the customer requirements. If there is a relationship between specific requirements, the 'strength' of this relationship is signified within each cell. Examples of these elements are presented further below.

A second house is used to design the methodology. The design requirements of the first house acted as the *whats* of the second house. The *hows* of the second house were represented by various steps within the methodology. These are described below with the development methodology. A more in-depth review and description of the QFD process can be found in References 10 and 11.

IDEF0 review

The IDEF0 functional-modeling technique was developed for systems design and analysis for the US Air Force Integrated Computer Aided Manufacturing (ICAM) program[12]. IDEF is an acronym for ICAM Definition. Since there are a number of tools within the IDEF family, they have been assigned numbers, and IDEF0 is the functional-modeling technique.

Within IDEF0, functions are represented by boxes, and interfaces are represented by arrows, as shown in *Figure 2a*. The boxes represent functions such as activities, actions, processes and operations. Boxes are distinguished by an active-verb phrase inside the box, for example the Make Part box in *Figure 2b*. Arrows indicate data. In IDEF0, data can be information (such as 'current status'), or physical objects (such as 'raw materials'). Their names are noun phrases, such as Raw Materials or Tools. The position of the arrow indicates the type of information being conveyed.

The arrows entering and leaving the boxes on the left and right represent *Inputs* and *Outputs*, respectively. Inputs represent elements that are needed to perform the function. Outputs show the data that is produced as a result of the function. The function transforms the inputs into the outputs.

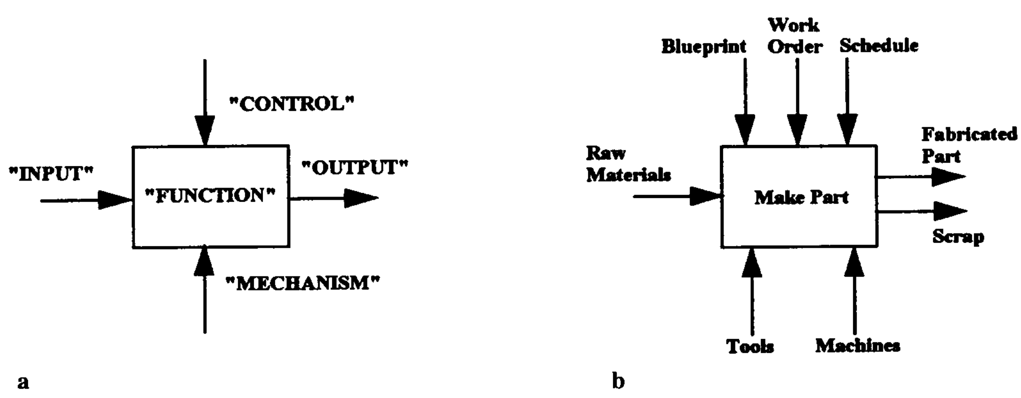

Figure 2 IDEF0 modeling approach; (a) general elements, (b) specific elements

Arrows which enter from the top indicate *controls*, or things which constrain or govern the function. Arrows entering the bottom of the boxes are *mechanisms*. Mechanisms can be thought of as the person or device which performs the function.

An IDEF0 model is made up of several integrated diagrams. Each diagram contains more detail about a box from a more general diagram. The process of describing a box in more detail is known as decomposing a function. The more general diagram is called the parent of the detailed diagram. IDEF0 models are read in a top-down fashion. The top level diagram, also called the context or A-0 diagram, summarizes the overall function of the system, which is represented by a single box. The A0 diagram represents the first decomposition of the system. The A0 diagram and all subsequent diagrams usually contain 3–6 numbered boxes. The numbers help to tie the diagrams together. For example, in *Figure 3*, box 2 of the A0 diagram is decomposed in diagram A2. Box 3 of the A2 diagram is decomposed in diagram A23, and so on. All the diagram names begin with A, which stands for 'activity'. Each arrow entering or leaving an upper box must also be shown entering and leaving the lower-level diagram.

For more information about the use and practice of IDEF0 and IDEF modeling techniques, see References 13 and 14.

Development process of methodology

The major steps in the development of the business-case methodology occurred in three phases: (a) the establishment of the project teams, (b) the development of the first QFD matrix, and (c) the concurrent development of the second QFD matrix and the IDEF0 definition of the methodology.

Project teams

For this project, the development process involved three teams: a customer team, a development team, and an expert team. The customers, or end users, of the tool were defined as discrete parts manufacturers of durable goods who were either SMSEs or stand-alone divisions of larger firms. Consequently, customer-team members included SMSE members and larger-enterprise divisional personnel. Because they may be the largest suppliers of the capital necessary to invest in these technologies, the customer team also included financial institutions. We incorporated venture capitalists and bankers into the customer team, because these are two of the primary sources of finance for technology for small firms identified by the US Department of Commerce[15].

A good mix of analysts and decision makers was sought, as well as SMSE and large-enterprise division managers. Four major discrete parts industries were targeted in our design matrix: the aircraft/auto, electronics, machine-tool, and fabrication industries. Geographical categorization was also used in the creation of three customer teams: there were three regional customer teams with approximately eight members per team. The customer teams defined the requirements for the QFD matrices.

The development team comprised three groups: staff and faculty from the Automation Robotics and Research Institute, USA, staff from the Industrial Technology Institute, USA, and industry members of the US National Center for Manufacturing Sciences tactical action group. There was thus a good mix of academia and industry in the development team. Similarly, the expert team consisted of individuals who had carried out academic research in the justification field of study, or had addressed these issues in a practitioner setting over many years. Expert-team members provided input to the QFD matrices and acted as reviewers for the IDEF0 kits.

Building the product-planning matrix

The first step in the development process consists in building the QFD matrices. The goal of this step is to elicit the requirements of the customer through the QFD process. For the purpose of this project, the QFD process was only concerned with the development of the first two matrices, as shown in *Figure 4*. Briefly, the customer requirements are the input to the *product-planning matrix*, which helps to determine the design requirements that are the inputs into the *part-deployment matrix*. The part characteristics of the part-deployment matrix in *Figure 4* comprise the functional processes of the methodology which are represented in IDEF0 format.

The customer teams met in a series of five meetings to develop the product-planning matrix. Since the customer teams were geographically dispersed, their requirements and importance levels were developed from feedback for the design teams, and consensus was eventually reached after design-team categorization and definition. The definition phase was carried out by listening to the taped conversations

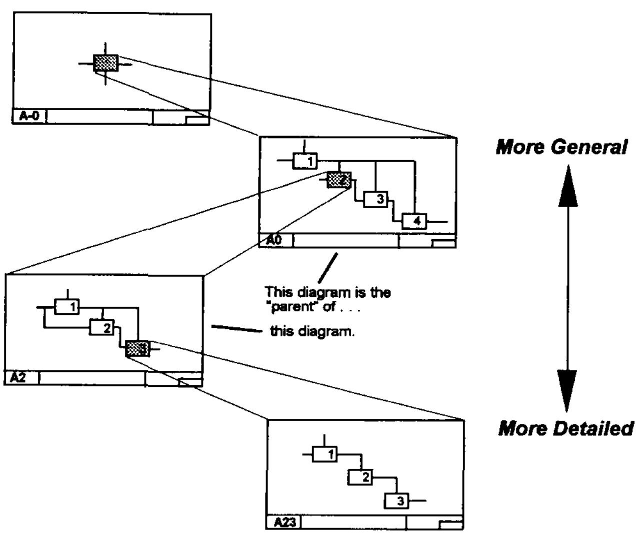

Figure 3 General decomposition of IDEF0 modeling approach

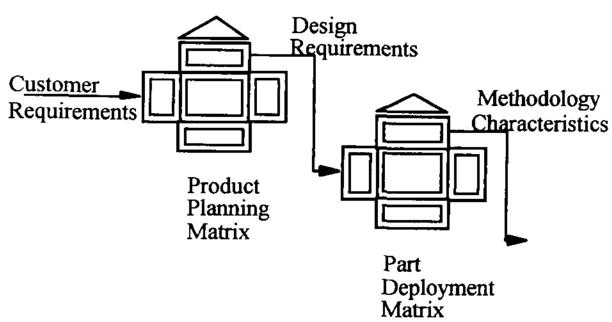

Figure 4 Business-case methodology development process

of the discussions associated with each of the requirements. These definitions were sent to and evaluated by the customer teams, so that they could make sure that their requirements were included.

The results of this study for the product-planning matrix were 52 customer-team requirements. These requirements are shown in *Figure 5* within the complete product-planning matrix for the business-case methodology. These requirements were grouped into five major requirements categories by the design team: tool flexibility (these requirements focus on the flexibility of the eventual tool that will use the methodology), cost-analysis factors, transition characteristics, organizational acceptance of the methodology and its results, and corporate and strategic factors.

Consensus relative importance ratings were developed using the analytical hierarchy process technique[16]. All three groups of teams (design, customer and expert) developed the design requirements as well as target values.

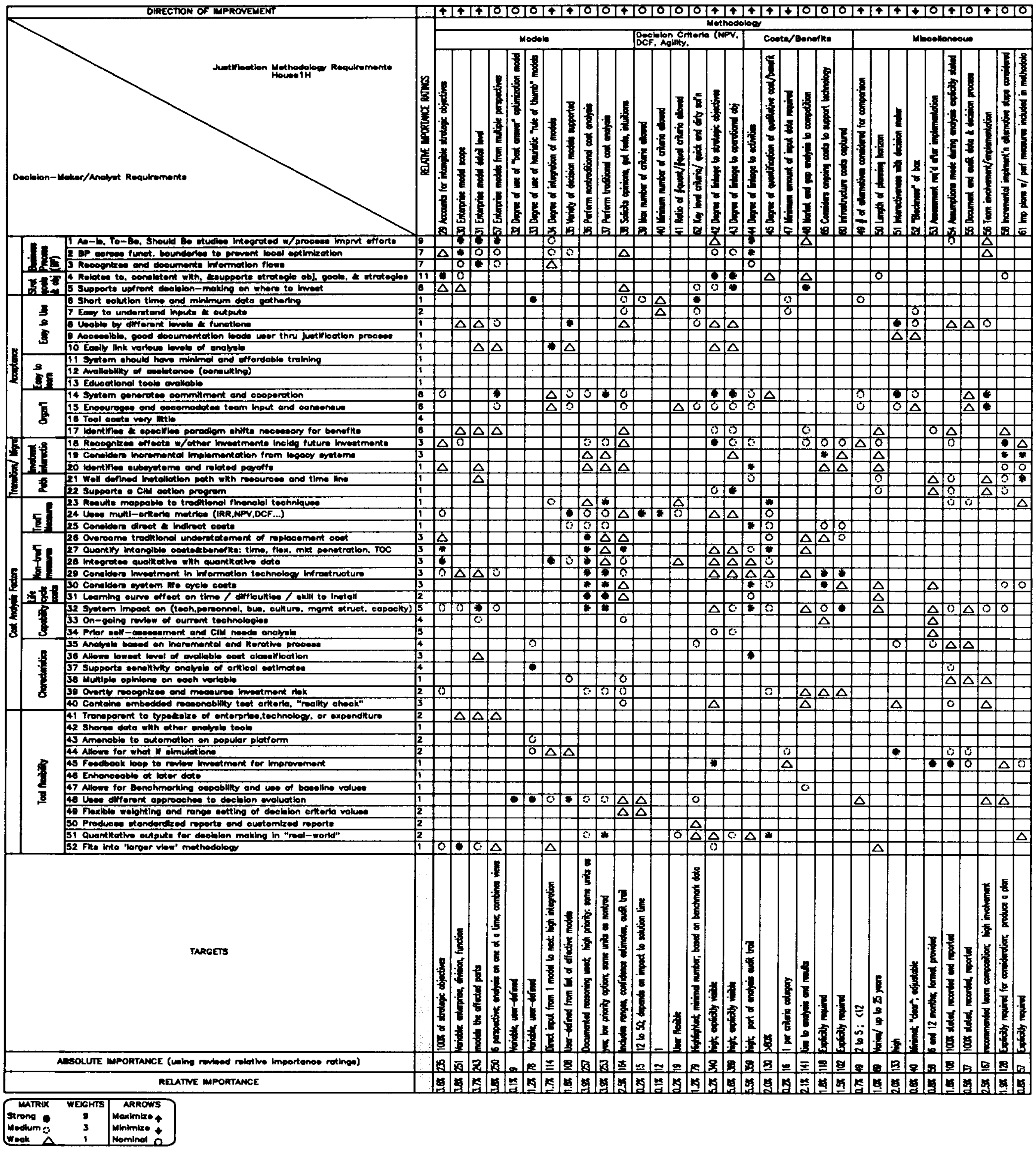

Figure 5 Product-planning matrix for development of business-case methodology for justification of integrated-enterprise technology

The major design-requirements categories for the methodology were *models, decision criteria, costs/benefits, and miscellaneous characteristics.*

The longest portion of this phase of the study was spent on determining the strength of the relationships between the design and customer requirements. Since the matrix had 33 design requirements and 52 customer requirements, 1716 (33 × 52) relationships were addressed by each of the three customer teams. The categories of relationship considered were strong (indicated by a circle with a dot in middle), medium (circle), weak (triangle), and none (blank). The QFD relationship scores recommended by the literature are 9 for a strong relationship, 3 for a medium relationship, and 1 for a weak relationship. Other weight factors may have been used, but it was felt that a strong relationship should stand out and not be dominated by a number of weak relationships, and hence the use of the exponentially larger weights for a strong relationship.

For example, in *Figure 5*, the first design requirement, 'accounts for intangible strategic objectives', has a strong relationship with the 'relates to, consistent with, and supports strategic objectives, goals and strategies' customer requirement for the methodology. The target for this design requirement (shown at the bottom of *Figure 5*) is that 100% of the strategic objectives should be taken into consideration by the methodology. The absolute importance values of the design criteria were calculated by a simple summation of the products of the relative-importance ratings of the customer requirements and the values of the relationship strengths in the design-requirements column. This is a standard approach that has been used by most QFD practitioners.

The design requirements from the product-planning matrix were then used as the *whats* or rows of the parts-deployment matrix. The development of the part-deployment matrix required that the methodology-development approach, i.e. the development of the IDEF0 models, was used simultaneously.

Concurrent parts-deployment matrix and IDEF0 methodology development

As mentioned above, the final product is a methodology for making a business case using strategic justification of integrated-enterprise technology documented using the IDEF0 modeling technique. The results at the A0 level of the final document are shown in the IDEF0 model in *Figure 6*. There are five major interrelated activities at the A0 level: *identify system impact* (A1), *identify transition impact* (A2), *estimate costs and benefits* (A3), *perform decision analysis* (A4), and *audit decision* (A5). Since the primary purpose of this paper is to describe the development methodology, the detail associated with each of these activities and their definitions is left to a subsequent paper.

An abbreviated decomposition of these activities is as follows:

[A0] Perform strategic justification of IET
  [A1] Identify system impact
    [A11] Review decision environment
      [A111] Document and understand vision and strategy
      [A112] Document and understand
      [A113] Document and understand

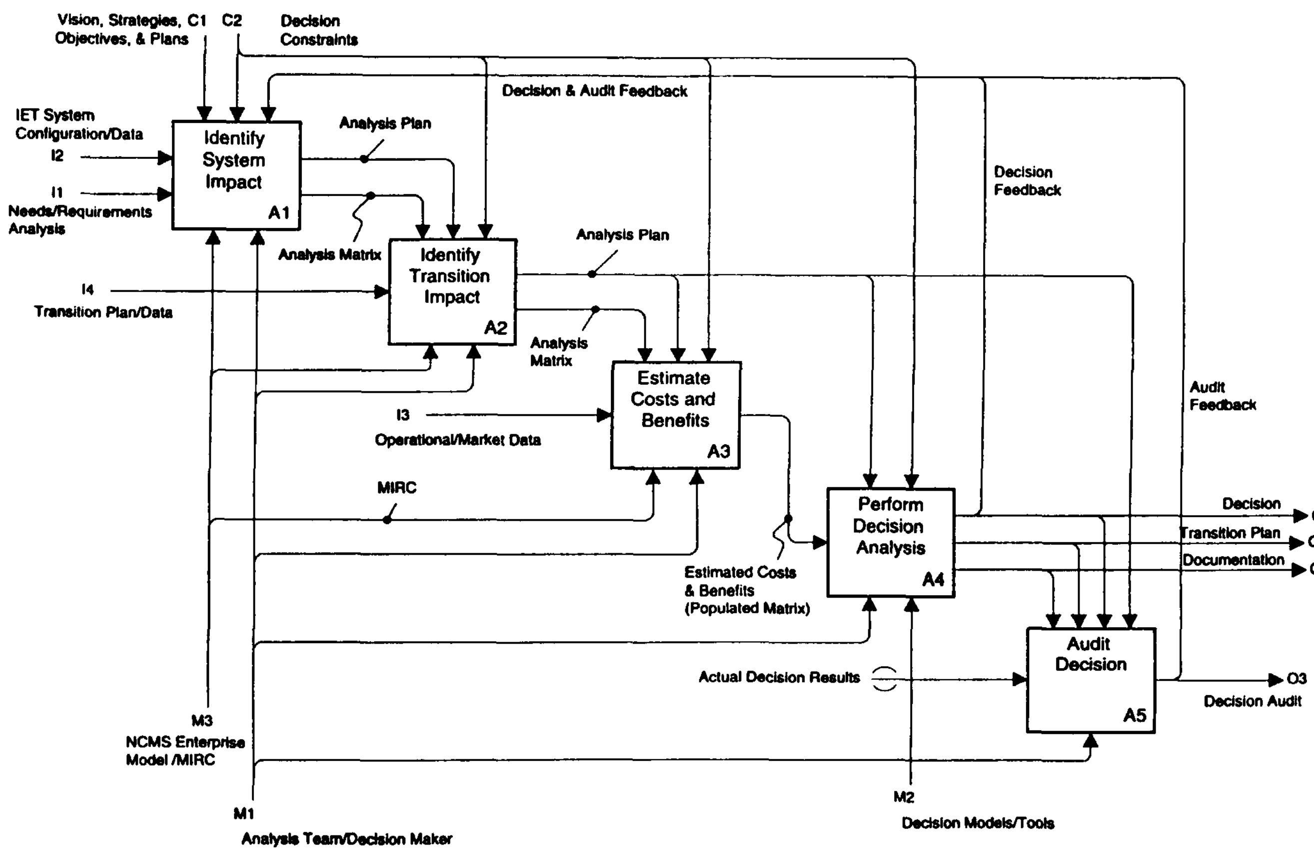

Figure 6 High-level IDEF0 model of methodology for strategic justification of integrated-enterprise technology

[A114] Document and understand
[A115] Review audit/decision feedback
[A12] Link system to enterprise
•
•
•
[A15] Create analysis plan
[A151] Determine tasks
[A152] Assess and assign resources
[A153] Develop timeline
[A154] Approve/maintain analysis plan
[A2] Identify transition impact
•
•
•
[A3] Estimate costs and benefits
•
•
•
[A4] Perform decision analysis
•
•
•
[A5] Audit decision

The activities were decomposed to the *AXXX* level, or two levels below these high-level definitions. The first-level activities (A1, A2, A3, A4 and A5) and their decomposed activities were the methodology characteristics for five separate parts-deployment matrices, one for each major activity. *Figure 7* shows one of these part-deployment matrices, and the relationships of the A1 activities and its associated decomposed activities with the design requirements from the product-planning matrix. As we can see in *Figure 7*, the A111 activity 'document and understand vision and strategy' has a strong relationship with the design requirement of 'accounts for intangible strategic objectives'.

The primary purpose of this matrix is to make sure that activities meet the design requirements for the methodology. This development approach does not focus on the level of attainment and goals for the methodology, that is, the development of scores associated with each activity. Thus we are not concerned with looking at interrelationships or target values for the parts-deployment matrix shown in *Figure 7*.

The process for completing these part-deployment matrices and the IDEF0 methodology development were concurrent. That is, as the activities and their linkages were being determined for the business-case methodology by the design team, readers (reviewers of the methodology, who were customer-team and expert-team members) would comment. Simultaneously with the readers' activities, the design team was making sure that the design requirements were being met by filling in the part-deployment matrix relationships.

Business-process reengineering implications

The characteristics of this development approach show how activities of the methodology, and any business process, can be separated to meet design requirements. This QFD/IDEF0 development approach has broader implications than those associated with this project. Even though we have used this for a 'product' that is really a set of processes, a similar approach can be used for a *process-deployment matrix* when developing production processes for a durable product.

Additionally, it is potentially applicable to reengineering and business-process improvement methodologies. Many of these business-process improvement methodologies use the IDEF0 functional modeling technique to help reengineer or redesign business processes. The traditional approach to redesigning the processes usually incorporates *as-is* and *to-be* models of the processes that are to be reengineered. One problem with this approach is the relatively large amount of time used to model an *as-is* system. To help shorten, or even eliminate, the *as-is* step, the QFD/IDEF0 linkage can be used to generate characteristics of the *as-is* and *to-be* models, where the 'customers' are individuals or mechanisms that utilize these activities. This is also an approach that helps to combine and compare the various functional views of the enterprise processes in a logical manner. Thus, a tool, QFD, that is usually used for concurrent engineering of products can be used for concurrent reengineering of processes through its linkage with IDEF0 modeling.

Summary and conclusions

The objectives of this paper were to provide insights into a method that can be used by project managers to elicit customer product requirements for a nondurable product and to develop a process to deal with these requirements. We have demonstrated the need for an organizational methodology for making a business case to invest in strategic integrated-enterprise technology. We were successful in concurrently developing a methodology that met customers' requirements, where the customers were the users and the beneficiaries of this business-case methodology. The success of this development approach for designing and building a methodology has implications for business-process improvements.

The approach defined in this paper is unique in that little published work has shown and discussed the linkage between QFD and IDEF0 tools, a linkage that seems to be a natural fit. A number of issues in enhancing this approach need to be addressed, including the following:

- The competitive-evaluation parts of the quality houses (see *Figure 1*) can be used to evaluate *as-is* and *to-be* models of business processes without having to develop detailed models. Benchmarking data for business processes can also be integrated with the competitive-evaluation section.
- Benchmark data can also be used as target values of the product-planning matrix for each of the activities.
- The IDEF0 models are not only composed of activities. An issue that needs to be addressed is that of how to incorporate the inputs, outputs, controls and mechanisms associated with these models into the QFD development process.

The next phase of this project is to pursue some form of automation of the IDEF0 procedure. This is more easily accomplished, since much of the documentation of the approach is in IDEF0 form. IDEF0 fits in with a number of other IDEF tools that exist to help in the automation of functional models[17].

	Justification Methodology Requirements House2HM / AUG 25, 1993 House 2hm1	METHODOLOGY TARGETS	ABSOLUTE IMPORTANCE (using revised relative importance ratings)	A1 Identify System Impact																						
				A11 Review Decision Environment					A12 Link System to Enterprise				A13 Derive Metrics				A14 Create		A15 Plan Analysis			
				A111 Document & Understand Vision & Strategy	A112 Document & understand Decision Constraint	A113 Document & Understand Needs/Req'ts to b	A114 Document & understand System Component	A115 Review Audit/Decision Feedback	A121 Develop/Select/Understand Enterprise Activi	A122 Develop/Understand Enterprise Strategy Mo	A123 Link Activities to System Components	A124 Link Strategies to Strategic System Attribut	A131 Identify & Select Metrics for Traditional Anal	A132 Identify & Select Metrics for Strategic Analy	A133 Calculate Weights for Strategic Metrics	A134 Develop Utility Functions	A141 Create Traditional Analysis Matrix	A142 Create Strategic Analysis Metrics	A151 Determine Tasks	A152 Assess & Assign Resources	A153 Develop Timeline	A154 Approve / Maintain Analysis Plan
Methodology – Models	29 Accounts for intangible strategic objectives	100% of strategic objectives	235	◉		○	○			◉		◉		◉	◉	◉		◉				
Methodology – Models	30 Enterprise model scope	Variable: enterprise, division, function	251						◉		◉		◉				○					
Methodology – Models	31 Enterprise model detail level	models the affected parts	243						◉		◉		◉				○					
Methodology – Models	57 Enterprise models from multiple perspectives	6 perspective; analysis on one at a time; combines views	250						○													
Methodology – Models	32 Degree of use of "best answer" optimization model	Variable, user-defined	9																			
Methodology – Models	33 Degree of use of heuristic "rule of thumb" models	Variable, user-defined	78																			
Methodology – Models	34 Degree of integration of models	Direct input from 1 model to next: high integration	114								○	○					◉	◉				
Methodology – Models	35 Variety of decision models supported	User-defined from list of effective models	108														◉	◉				
Methodology – Models	36 Perform nontraditional cost analysis	Documented reasoning used; high priority: same units as tr	257											◉	◉	◉		◉				
Methodology – Models	37 Perform traditional cost analysis	yes; low priority option; same units as nontrad	253											◉	◉	◉	◉					
Methodology – Models	38 Solicits opinions, gut feels, intuitions	Includes ranges, confidence estimates, audit trail	164	○	○	○	○	○				◉	○	○	◉	◉						
Methodology – Decision Criteria (NPV, DCF, Agility,	39 Max number of criteria allowed	12 to 50; depends on impact to solution time	15																			
Methodology – Decision Criteria (NPV, DCF, Agility,	40 Mininum number of criteria allowed	1	12																			
Methodology – Decision Criteria (NPV, DCF, Agility,	41 Ratio of #quant/#qual criteria allowed	3:1	19																			
Methodology – Decision Criteria (NPV, DCF, Agility,	62 Key level criteria/ quick and dirty sol'n	Highlighted; minimal number; based on benchmark data	79																			
Methodology – Decision Criteria (NPV, DCF, Agility,	42 Degree of linkage to strategic objectives	high; explicitly visible	340							◉		◉		◉	◉	◉		○				
Methodology – Decision Criteria (NPV, DCF, Agility,	43 Degree of linkage to operational obj	high; explicitly visible	369						◉		◉		◉			◉	○					
Methodology – Costs/Benefits	44 Degree of linkage to activities	high; part of analysis audit trail	359						◉		◉		◉				◉					
Methodology – Costs/Benefits	45 Degree of quantification of qualitative cost/benefit	>80%	130							○		○	○	◉	◉	◉		○				
Methodology – Costs/Benefits	47 Minimum amount of input data required	1 per criteria category	16																			
Methodology – Costs/Benefits	48 Market and gap analysis to competition	ties to analysis and results	141										○	○	○	○	○	○				
Methodology – Costs/Benefits	65 Considers ongoing costs to support technology	Explicitly required	118			○	○		○		○		◉				◉					
Methodology – Costs/Benefits	60 Infrastructure costs captured	Explicitly required	102			○	○		○		○		◉				◉					
Methodology – Miscellaneous	49 # of alternatives considered for comparison	2 to 5 ; <12	49																			
Methodology – Miscellaneous	50 Length of planning horizon	Varies/ up to 100 years	69																			
Methodology – Miscellaneous	51 Interactiveness with decision maker	high	133	◉	◉	◉	◉	◉					◉	◉	◉	◉	◉	◉				
Methodology – Miscellaneous	52 "Blackness" of box	Minimal; "clear"; adjustable	40																			
Methodology – Miscellaneous	53 Assessment req'd after implementation	6 and 12 months; format provided	58																			
Methodology – Miscellaneous	54 Assumptions made during analysis explicitly stated	100% stated, recorded and reported	108	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉
Methodology – Miscellaneous	55 Document and audit data & decision process	100% stated, recorded, reported	37					◉														
Methodology – Miscellaneous	56 Team involvement/implementation	recommended team composition; high involvement	167	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉	◉		
Methodology – Miscellaneous	58 Incremental implment'n alternative steps considere	Explicitly required for consideration; produce a plan	128																			
Methodology – Miscellaneous	61 Imp plans w/ perf measures included in methodolo	Explicitly required	57					◉					◉									
Targets																						

Figure 7 Part-planning matrix for activity A1

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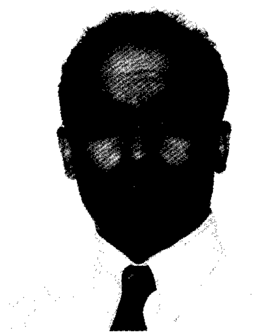

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