



# Costing customer value: an approach for the agile enterprise

Mark J. Hooper, Derek Steeple and Clive N. Winters  
*Coventry University, Coventry, UK*

**Keywords** *Agility, Costs, Manufacturing, Organizational structure*

**Abstract** *In adopting and developing the key elements of agility, there is a requirement for enterprises to overcome the philosophical challenges of a shift from mass/lean production to the customisation environment of agile manufacturing. There is a substantial body of knowledge supporting the use of alternative costing systems for operations and production management and particularly mass/lean production, yet none deal with the emerging philosophy of agility. This paper examines the operational cost environment of organisations seeking to attain agility. The paper considers and defines the inter- and intra-enterprise activities required to support the provision of total solution systems for customers. The paper evaluates the requirements at a strategic and operational level for costing in an agile environment. The operational issues for agile costing systems are explored and discussed through an implementation case study.*

## Introduction

Agility has been hailed as the next generation manufacturing philosophy for companies competing in all sectors of the economy (Kidd, 1997). The term agility refers to the ability of an enterprise to develop and exploit its inter- and intra-organisational capabilities to successfully compete in an uncertain and unpredictable business environment. Projected as the replacement for the lean/mass production philosophy, agility has four prime tenants (Goldman *et al.*, 1995):

- *Total solution products.* Products perceived as solutions to individual customer problems.
- *Virtual organisations.* Leveraging of resources through co-operation.
- *Knowledge management.* Leveraging the impact of people and information on company operations.
- *Entrepreneurial organisation.* Development of flexible, innovative organisational structures.

In adopting and developing these key elements of agility, there is a requirement for enterprises to overcome the philosophical challenges of a shift from mass/lean production to the customisation environment of agile manufacturing. The agile environment is focused on the delivery of total solution systems rather than the traditional product focus associated with the mass/lean production paradigm. This requires emphasis on pricing and marketing strategies based on customer value. This research paper explores the ability of an enterprise to

---

develop and implement no-cost/low-cost methods and techniques for costing total solution systems.

There is a substantial body of knowledge supporting the use of alternative costing systems (e.g. activity-based costing, throughput accounting) for operations and production management and particularly mass/lean production, yet none deal with the emerging philosophy of agility, to our knowledge. That is not to say that alternative costing systems propounded during the last decade cannot be utilised within the agile enterprise, but that they require a change of mindset for their adoption. The focus of this research is essentially to explore the changes in strategic thinking required for the development and implementation of costing systems for the agile enterprise.

The approach defined in this research paper requires the enterprise under study to examine its operational environment. Within this the inter- and intra-enterprise, activities required to support the provision of total solution systems for customers need to be defined. This allows the enterprise to attribute resource costs to the various elements of the total solution provision. Furthermore, definition of inter- and intra-enterprise activities allows for the evaluation at a strategic level of the service provision and virtual relationships to enable the maximisation of agility and customer service.

The work is organised as follows: first a review of literature is provided. The literature encompasses background material on the development of agility as a concept and detail on the strategic and operational issues of implementation. This literature is then integrated with a review of costing system approaches and concludes with an evaluation of the requirements at a strategic and operational level for costing in an agile environment. Second, the operational issues for agile costing systems are explored and discussed through an implementation case study. Finally, the discussion is concluded and proposals for future work presented.

## **Review of literature**

### *The foundations of agility*

The first work to detail the configuration and application of agile manufacturing was the Lehigh report (*21st Century Manufacturing Enterprise Strategy*, 1991). It was argued that computer-based production, information, and communication technologies had developed sufficiently to enable organisations to deploy and synthesise them, creating a new form of competition. These technologies were seen as enabling the integration of human, physical and knowledge based resources within organisations, in new dynamic forms, thus allowing a simultaneous co-operating and competing environment to be created and sustained. It was further argued that this blurred the distinction between manufacturing and service industries, the focus changing from the transformation of raw materials into finished products, associated with mass/lean production, to one based on total solution systems. Agile manufacturing was defined in this instance as:

---

A manufacturing system with extraordinary capability to meet the rapidly changing needs of the market place. A system that can shift quickly amongst product models or between product lines, ideally in real-time response to customer demand.

*The context of agility*

The global manufacturing environment in which companies now compete has undergone “earthquakes, tremors and aftershocks” (Schonberger, 1990). These changes have coincided with the emergence of post mass production economies and their associated enterprises (Toffler, 1971, 1981). The benchmark for companies operating within this arena is the achievement of a global competitive advantage through the use of their manufacturing capabilities (Hayes and Wheelwright, 1985). Such an organisation, termed world class by Hayes and Wheelwright, is centred on the ability to master six critical practices including:

- (1) Development of the workforce.
- (2) Developing a technically competent management group.
- (4) Competing through quality.
- (5) Stimulating worker participation.
- (6) Investing in state of the art equipment facilities (Hayes and Wheelwright, 1985).

Giffi *et al.* (1990) synthesise a number of views of world class manufacturing concluding that it is primarily aimed at achieving quality and customer focus, supported by manufacturing strategy, management approaches, organisational factors, human assets, technology and performance measurement.

Within the framework of world class manufacturing, the need for companies to adopt a more dynamic organisational structure was identified by Miles and Snow (1984). This corporate dynamism was expressed by Hamel and Prahalad (1989) in their strategic intent planning model. The four principles of this model underline and complement the four prime tenants of agility.

Drucker (1990) was perhaps the first author to introduce the concept of the agile enterprise, comparing the present corporate manufacturing structure to that of a cumbersome battleship, essentially monolithic in nature. It was envisaged that the single large battleship model could be replaced by one consisting of a flotilla of smaller, modular organisations, endowed by the nature of their structure, with increased flexibility and responsiveness. This modular approach to delivering customer solutions was underlined by Prahalad and Hamel (1990) who saw the real source of competitive advantage as lying in:

Management’s ability to consolidate corporate-wide technologies and production skills into competencies that empower individual businesses to adapt to quickly changing opportunities.

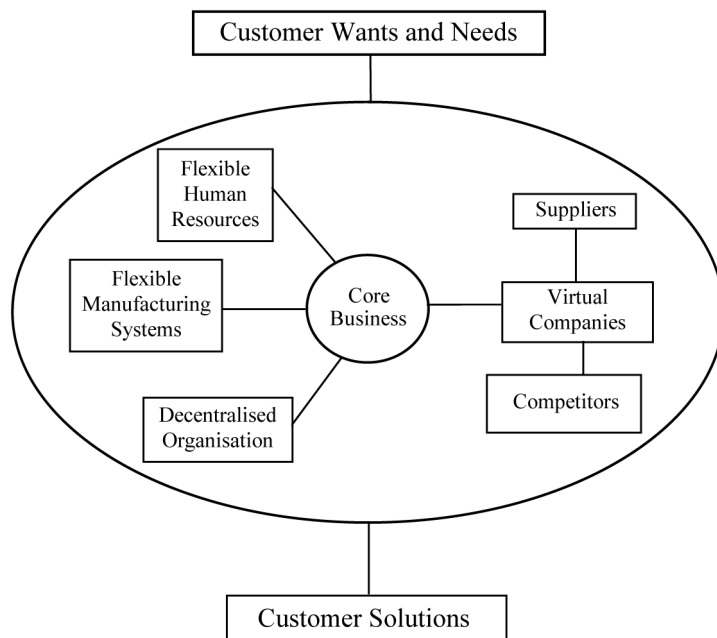
Youssef (1992) supports these view from a time based competition perspective. He suggests that agility can only be achieved by the integration of the customer's hierarchy of needs within the framework of the internal and external environments of the organisation. This is achieved by taking a holistic view of the organisation's advanced manufacturing technologies together with the internal capabilities they possess. This is enabled through the application of information systems and technology.

The challenge of achieving agility has been identified as a key attribute for success in the new business environment in which companies compete (*The EDS European Directors' Survey*, 1998) and has given rise to the adoption of agile manufacturing in the UK automotive supply base (Hooper and Brassard, 1998).

*The structure of agile manufacturing*

In the literature much attention has been given to defining and explaining the structure underlying the agile enterprise (Gottfried, 1994; Earls, 1994; Voss, 1993; Brooke, 1993). These views are synthesised in Figure 1.

The agile enterprise can be viewed as an overall concept encompassing a number of different organisational models each targeted at meeting specific market or customer demands. Puttick's future enterprise model based on five generic sub-types of manufacturing provides such a view (Eureka project number EU 1005, 1995). The five elements contained within this model are defined as (Pandya *et al.*, 1997):



**Figure 1.**  
The structure of agile  
manufacturing

- (1) enterprises focused on flexibility;
- (2) total service;
- (3) technology leadership,
- (4) virtual structures; and
- (5) elasticity.

#### *Agility and manufacturing methodologies*

The relationship between agile manufacturing and other prevailing manufacturing methodologies is central to the ability of organisations to make the transition between mass/lean production and agility. For an organisation to make this transition it must be clear what foundations and prerequisites are required for success. Alternative approaches have been defined for achieving this transition. Adopting a manufacturing systems approach, Booth (1995) takes the view that agility is the synthesis of time compression and lean manufacturing techniques, while Cooke (1995) considers agile manufacturing as an evolution of FMS. In comparison, Rattner and Reid (1994), focus on enabling systems technologies, allowing them to conclude that the achievement of agile manufacturing lies in the evolution of MRPII through CIM to computer integrated engineering (CIE).

These approaches are acceptable based on their individual standpoints, but lack a holistic understanding of the nature of agility. Extending the views of Burgess (1994) agility should be viewed as an umbrella phrase, encompassing a number of diverse systems, technologies and philosophies. Dove (1994) supports this view, defining agility as a core enterprise requirement rather than an operating or transformational strategy.

In making the transition from a mass/lean production enterprise to agility a four-step methodology has been proposed by Maskell (1998) (Table I). Within this outline methodology lean manufacturing principles form the basis for achieving the transition to agile manufacturing.

Hill (1995) concludes that in any manufacturing system a balance occurs in the trade off between flexibility and total product cost. The challenge for all enterprises is to achieve the transition from mass/lean production to agile manufacturing without incurring substantial long-term cost increases and reducing the ability of the enterprise to compete in the marketplace.

#### *Costing systems for traditional mass/lean production enterprises*

Traditional cost management systems for mass production were developed through the principles of scientific management in the early part of the twentieth century. Based on standard costs and overhead allocation on the basis of direct labour hours, these systems became inadequate as increased mechanisation in the 1960s and 1970s created a shift from direct-labour oriented processes to automated production (Skinner, 1978; Drucker, 1978).

The conceptual framework of lean production developed during the 1980s in the USA and Europe (Womack *et al.*, 1990), based on the Toyota production

Traditional manufacturing	Gaining control	World class manufacturing	Agile manufacturing
Complex systems	ERP or MRPII	Lean manufacturing	Enriching the customer
Departmentalise	Better customer service	Just-in-time	Competitiveness through co-operation
EOQ	Reduced inventory (10-25%)	Total quality management	Organising for change and uncertainty
No employee involvement	Lower production costs	Much less costly	People and information
Financial secrecy	Greater flexibility	More responsive	High customer flexibility
High inventory	Better control	Long-term profitability	Integrated flexibility
Inspection	Planned operations	Lead time improvement	Technology
Lack of strategy	Better communications	Productivity improvement	Highly educated and trained workforce
Late delivery		Time to market	Flexible management structure
Long cycle times		Zero defects	Virtual corporations
Politics		Inventory turns	
Record inaccuracy			
Shortages/expedite			
Month-end push			

Costing customer value

635

**Table I.**  
An outline methodology for agile manufacturing

system (*The Toyota Production System*, 1996), emphasised alternative methods of cost control. Systems for lean production have inevitably focused on the supply chain, with benefits provided through partnership across the supply tiers, greater emphasis on the management of manufacturing systems and focus on value-adding and non-value adding activities. The epitome of lean production has been the adoption of cost control methods, including total cost management (Turney, 1991), value chain costing (Porter, 1985) and perceived accountability through the use of open-book costing/negotiation.

While the adoption of cost control methods within lean production has been widespread, there has been little development in the area of costing systems. A recent survey (Winters and Brassard, 1998) revealed that 80 per cent of first tier supplier companies sampled within the UK automotive supply base utilise standard costing methods, with 50 per cent using an additional alternative costing system. This utilisation of standard costing is not unique, the Japanese utilise standard costing methods to promote a strategy of automation within their production environment (Hiromoto, 1988; Hariman, 1990; Morgan and Weerakoon, 1990). In addition to the perceived complexity and resource constraints of implementing alternative costing systems is the need of the

enterprise to utilise standard costing methods to value its products as part of its legal accounts (Hartnett *et al.*, 1994). In adopting an alternative method of costing and overhead allocation a company is required to use its formal accounting system for meeting legal requirements and any advanced costing system for strategic and operational management.

It is this issue of developing and implementing a costing system for strategic and operational management that has led many companies (Bailey, 1991; Merz and Hardy, 1993) to adopt the technique and philosophies of activity based costing. Developed in response to the challenges provided through automation in the 1960s and 1970s, activity based costing was codified during the 1980s (Cooper, 1987, 1989; Cooper and Kaplan, 1991). The technique is essentially two-stage cost allocation with resources from the general ledger being attributed to activities within the enterprise and subsequently allocated to cost objects (products, services or customers) using cost drivers. Its application has been widespread across the manufacturing and service sectors (Bhimani and Pigott, 1992; Bussey, 1993; Ashworth, 1993), acting as a catalyst for enterprises to understand cost behaviour, identify the contribution of its products, services, customers and market segments, and to further continuous improvement activities.

#### *Costing and cost control requirements for agile manufacturing*

In evaluating and proposing costing system requirements for the agile enterprise the level of operational complexity must be determined. In the opinion of the authors, inclusion of the following agile specific activities within the enterprise cost model is particularly important: information provided to customers, co-operation within the extended enterprise to enhance resource capability, and knowledge and skill utilisation of the enterprise and its employees for delivering total solutions. Additionally, the nature of the agile enterprise requires that an associated costing system exhibit the following characteristics:

- *Control*. Proactive focus on reducing the cost of the total solution provision, customised to the operational environment of the enterprise.
- *Forward looking*. Allow judgements to be made on the extent of the future solution provision, provide potential for development dependent on the future strategy of the enterprise.
- *Outward looking*. Relate to the external environment including the inter- and intra enterprise, provide valuable information allowing adequate returns to be developed.
- *Dynamic*. Focus on long-term resource implications, supporting the development of knowledge and skills within the enterprise.

Evaluation of these characteristics against conceptualised costing and cost control methods is detailed in Table II. This reveals the extent of the research problem of costing for the agile enterprise.

Throughput accounting	Standard costing	Activity-based costing
<i>Control</i>		
Focused on price, volume and material costs (no focus on overhead costs)	Provides a breakdown of standard labour and materials usage by activity. Can be used for variance analysis	Provides identification and qualification of value adding and non-value adding activities
<i>Forward looking</i>		
Allows for judgement to be made on the provision of future manufacturing resources	Allows judgement to be made based on historical performance	Allows for comparison regarding the cost of internal and external activities, together with the costs of servicing current and new future markets
<i>Outward looking</i>		
Internally focused on manufacturing performance relative to product profitability	Provides an internal focus on resource consumption. Minimal provision of value for making product/market decisions to be made	Internally focused on activity and resource costs. Can be adapted to understand the costs of the extended enterprise and supply chain
<i>Dynamic</i>		
Focused on current manufacturing processes and methods. Supports the development and use of knowledge to reduce lead-time	Based on set procedures and policies. Externally audible	Enables evaluation/projection of future resources consumption against activity usage

**Table II.**  
Comparison of cost control and costing techniques with agile costing system characteristics

While none of the costing systems outlined provide a total solution, the authors believe that while no specific technique exists for the agile enterprise, activity based costing is perhaps most adaptable. A focus on the strategic elements of agile manufacturing in an implementation of activity based costing will yield significant benefits. This proposition is explored in the case study of Alpha Electronics (for reasons of confidentiality the name of the participating company has been changed to the fictional name Alpha Electronics. Any similarity to another company in existence is purely coincidental, is done without intent, and no inference should be made), detailed below.

### Costing total solution products: an industrial response

Alpha Electronics is a small- to medium-sized enterprise employing 38 people with an annual turnover of £1.8 million. Based in the industrial centre of Coventry, it manufactures printed circuit boards (PCB) for a broad base of end customers in the aerospace, automotive, telecommunication and research industries in the UK. In an increasingly competitive global environment, the UK has seen a significant reduction in its PCB industry resulting from low-cost/high-volume manufacturers in the Far East importing into the UK marketplace. Alpha Electronics by virtue of its size, and most importantly, its focus on

delivering total solution products to customers, has established itself as a leading provider of prototype and low volume circuits with a reputation for delivering reliability, responsiveness and expertise. This focus is the key to its future survival and competitiveness. As an integral part of this, Alpha Electronics was keen to determine the cost of its solution provision. To achieve this required mirroring the operational environment, strategy and cost profile of the extended enterprise in the development of the Alpha Electronics costing system.

*Alpha Electronics: operational environment*

Alpha Electronics manufactures three types of PCB to customer order. These are single-sided, double-sided (plated through hole) and the more complex multilayer boards up to 24 layers. All products are commonly available for fast-track (three to six days) and normal (20-day) delivery. It is the provision of a fast-track delivery capability that provides the current competitive edge for Alpha Electronics in the marketplace. The provision of normal delivery is most under threat from increased global competition. The enterprise does not have the capability to service the needs of high-volume business and is finding it increasingly difficult to obtain normal delivery work of a prototype nature. This market is increasingly being serviced by other manufacturers adopting a loss-leader approach to obtaining high-volume work.

In delivering its total solution provision to customers Alpha Electronics utilises the skills and resources of its inter- and intra-enterprise that include:

- Use of electronic data interchange (EDI) and e-mail to receive customer artwork, in addition to the production and examination of artwork by staff at Alpha Electronics.
- Transfer of design data to CNC drilling and routing machines and for automated inspection.
- Established relationships in the extended enterprise for the production of artwork, circuit testing and certification, tooling and gold plating to customer order for both fast track and normal delivery orders.
- Development, exploitation and adaptation of technological solutions for meeting the current and future needs of the marketplace.
- Management of knowledge throughout the enterprise, allowing changes in product specification, methods of manufacture and the introduction of IT solutions to be efficiently and effectively accommodated.
- Minimal reporting structure in the enterprise, allowing for rapid decision making and ownership in all operations.

Alpha Electronics is indicative of many enterprises in this situation. While fast-track orders are most profitable, it requires a competitive normal delivery element to its business to sustain a marketplace presence and provide the added security of contribution to overhead costs.

The primary issue is one that will affect all agile and potentially agile enterprises. How can an enterprise develop and enhance its total solution provision in order to improve its order winning capability while maintaining its cost and pricing profile in line with order qualifying criteria? This situation has been faced by several organisations including Remmele Engineering (Harrison, 1997) whose management stance is to “offer value, but not at the cheapest price”. The issue within Alpha Electronics is that all orders require differing elements from the total solution portfolio dependent on the customer specification, and that there is insufficient detail within the current costing system to develop costs for this operational environment.

*Alpha Electronics: costing system development*

The implementation of a costing system for Alpha Electronics follows a simple generic method (Winters, 1996). The issue in this case is not the method of implementation, but how the operational environment outlined earlier will be mirrored in the development of the costing system.

Identification of the problem situation within the enterprise by the organisational managers initiates the generic implementation method. In analysing the operational environment it is essential to determine the product/total solution mix and to analyse the value and volume of each customer order. Within Alpha Electronics the solution portfolio is constructed as shown in Table III.

Analysis of manufacturing and support activities reveals the resource requirements for each type of product solution. Activities used within Alpha Electronics include:

- sales order administration;
- design data preparation ;
- diazo development;
- blank cutting;
- drilling (and set-up);
- laminating and exposing;
- etching;
- development of artwork (external);
- gold plating (external) ;
- purchasing;

	No. of orders	Percentage	Value (£s)	Percentage
Single-sided PCB	30	9	5,333	3
Double-sided (plated through hole)	220	67	99,732	62
Multilayer PCB	80	24	56,168	35

**Table III.**  
Solution portfolio

- hot air solder levelling;
- inspection;
- packing and despatch;
- automatic inspection (and set-up);
- routing (and set-up);
- electroplating;
- application of solder resist;
- circuit testing (external);
- tin plating;
- finance.

Each type of product solution requires a particular set of operational activities to be performed. The key in this stage is to identify the range of activities utilised by a product solution, quantify their use and compare this operational activity with the current costing system adopted by the enterprise. In the case of Alpha Electronics it became clear that multilayer printed circuit boards were not priced to reflect their complexity and their demand on inter- and intra enterprise resources.

Evaluation of solutions from the data presented in the operational analysis phase revealed that a redefined direct labour-based system would remain inadequate for the total solution product environment of Alpha Electronics. The variations in activity profile led to the conclusion that the activity centre approach of activity based cost management would prove beneficial in quantifying the value provided by each activity for each generic solution type. In reaching this conclusion, it was recognised internally within Alpha Electronics that a more concerted effort to cost management needed to be adopted to ensure that the value received by customers was adequately reflected in product pricing and that a simple activity-based approach would meet this objective.

In the first phase a simple spreadsheet solution was developed. The initial focus at this stage was to gain ownership of the process within the enterprise and focus attention on the resultant data. In the long term an industry specific business control system was to be implemented that would allow for integral accounting, sales order management, material optimisation and production management. The emphasis was firmly placed on establishing the costing rules and principles “offline” of the business control system to enable them to be appraised and understood within the enterprise and then integrated into the business control system at a later stage.

In developing the spreadsheet solution the activities in the enterprise were aggregated in-line with the detail emerging from the cost information. This was taken from the profit and loss account, invoice data for raw and in-process materials, wages book and depreciation data and analysed over the most recent

---

six-monthly period. Each cost item was assigned wherever possible to an activity centre. Those costs incurred and labelled general overhead (accounting for 25 per cent of total costs) were grouped by cost type (e.g. facility overheads, general production overheads) and allocated to activity centres using resource drivers (e.g. square footage, number of personnel hours, number of direct-labour hours) applicable to the defined cost type. The activities in the enterprise were aggregated to provide 16 main activity centres, the resultant costs of which were to be allocated to the generic groups of total solution products through six cost drivers (e.g. number of orders, set-up time, product area). Additionally, activities utilised in the extended enterprise (e.g. bare board testing, jig construction, laser plotting, electroless nickel immersion gold plating, distribution) were assigned cost driver rates to enable the total solution provision of Alpha Electronics and its extended enterprise to be accurately reflected in cost information.

*Alpha Electronics: a post costing system implementation response*

The response to the updated cost information has been an immediate focus on reducing process waste internally within the enterprise. Concurrently, an evaluation of process methods adopted in the PCB industry has been undertaken with an aim of reconfiguring the operational environment to provide greater support to the high-cost internal processes and a long-term reduction in the cost of total solution products, thus enabling the conundrum of providing total solution products as an order winner while remaining competitive on cost for order qualification to be reconciled. In relation to the product portfolio, it has been recognised that significant costs are expended in obtaining and servicing orders for multilayer printed circuit boards in comparison to the conventional single-sided and double-sided (plated through hole) circuit boards, and this has been reflected in undertaking the process evaluation.

### **Concluding remarks and future directions**

This research paper has identified that agile enterprises require unique management approaches in addition to enhanced manufacturing capabilities. The future of agile manufacturing is based on the ability of an enterprise to make the transition from mass/lean production in an efficient, effective and profitable manner.

The adoption of activity based costing in Alpha Electronics has enabled it to become customer centric. In parallel, its use has identified the long-term resource implications of adopting agility, enhancing the development of knowledge and skills. Additionally, the approach has focused attention on the intra- and inter-enterprise cost structure, allowing the identification and elimination of waste. As a method activity-based costing is compatible with agility, but the change management process has required modification. The strategic approach outlined in this paper and undertaken by Alpha Electronics provides a low cost/no-cost approach for adopting agility.

The successful implementation of activity based costing in Alpha Electronics reveals that agility can be achieved from a lean manufacturing environment. The current adoption and use of agility is limited in both scale and scope by the ability of organisations to implement all the four key tenants identified by Nagel *et al.* (Goldman *et al.*, 1995). In order to extend its application the relationship of Putticks future enterprise model (Eureka project, 1995) with the four prime tenants should be investigated and further researched to generate methods of implementation.

The key for the agile enterprise is to ensure that it can compete effectively with competitors against order qualifiers (including cost) and enhance its provision of total solution products in line with order winners. This work has shown that the flexibility/cost conundrum facing agile and potentially agile enterprises can be overcome.

The results provide a framework that will enable practitioners to anticipate and therefore plan for the likely consequences of adapting to an agile environment, where the distinction between service and manufacturing orientation is unclear. In particular, the ability to identify the cost, value and profit implications of delivering total solution products to a variety of customer bases is required to ensure long-term competitive advantage. This framework allows the dynamic formation of networks or fractal organisations within the value chain to be assessed and optimised to deliver innovative products and solutions to customers' needs.

This paper provides a basis for academics to understand the inherent complexities of adapting organisations to agility. Agile manufacturing forms the basis of a series of management solutions dependent on the external and internal conditions faced by organisations. Rather than one holistic solution to the generic problems faced by organisations, a variety of models are being created, each taking elements of modern manufacturing management practice and synthesising them to form unique total solutions to customer specific requirements and demands. This paper illustrates how the theory and practice of activity based costing can be adapted to fit a particular management solution. The future development of agile manufacturing will require academics to evaluate modern manufacturing management solutions and consider their adoption for agility.

### References

- 21st Century Manufacturing Enterprise Strategy: An Industry View* (1991), Iacocca Institute, Lehigh University, Bethlehem, PA, November.
- Ashworth, G. (1993), "Implementing activity based management at Mercury Communications", *Management Accounting*, December, London.
- Bailey, J. (1991), "Implementation of ABC by UK companies", *Management Accounting*, February, London.
- Bhimani, A. and Pigott, D. (1992), "ABC in a pharmaceutical company: a remedy?", *Management Accounting*, December, London.
- Booth, R. (1995), "In the market", *Manufacturing Engineer*, Vol. 74, No. 5, October, pp. 236-9.

- Brooke, L. (1993), "Is agile the answer", *Automotive Industries*, Vol. 173, August, pp. 26-8.
- Burgess, T.F. (1994), "Making the leap to agility: defining and achieving agile manufacturing through business process redesign and business network redesign", *International Journal of Operations & Production Management*, Vol. 14 No. 11, pp. 23-34.
- Bussey (1993), "ABC within a service organisation", *Management Accounting*, December, London.
- Cooke, J.A. (1995), "Agility counts!", *Traffic Management*, August, pp. 27-31.
- Cooper, R. (1987), "The two stage procedure in cost accounting: part one", *Journal of Cost Management*, Summer.
- Cooper, R. (1989), "The rise of activity based costing: part three: how many cost drivers do you need and how do you select them?", *Journal of Cost Management*, Winter.
- Cooper, R. and Kaplan, R.S. (1991), "Profit priorities from activity based costing", *Harvard Business Review*, May/June.
- Dove, R. (1994), "The meaning of life and the meaning of agile", *Production*, Vol. 106, November, pp. 14-15.
- Drucker, P. (1978), *Management Cases*, Heinemann, London.
- Drucker, P. (1990), "The emerging theory of manufacturing", *Harvard Business Review*, Vol. 68, May-June, pp. 94-102.
- Earls, A.R. (1994), "Agile manufacturing finds firmer ground", *Computerworld*, Volume 28, Part 9, 28 February.
- (The) *EDS European Directors' Survey* (1998), EDS EMEA Market Relations, UK
- Eureka project number EU 1005, *Factory for the Future: Synopsis of Final Report* (1995), Department of Trade and Industry, HMSO, London.
- Giffi, C., Roth, A. and Seal, G. (1990), *Competing in World Class Manufacturing: America's 21st Century Challenge*, Business One Irwin, Homewood, IL.
- Goldman, S.L., Nagel, R.N. and Preiss, K. (1995), *Agile Competitors and Virtual Organisations: Strategies for Enriching the Customer*, Van Nostrand Reinhold, New York, NY.
- Gottlieb, D.W. (1994), "Government pushes agile manufacturing", *Purchasing*, Vol. 117 No. 4, 22 September, pp. 33-4.
- Hamel, G. and Prahalad, C.K. (1989), "Strategic intent", *Harvard Business Review*, Vol. 67, March-April, pp. 63-76.
- Hariman, J. (1990), "Influencing rather than informing: Japanese management accounting", *Management Accounting*, London.
- Harrison, A. (1997), "From lean to agile manufacturing", *Institution of Electrical Engineers, Digest No. 97/386*.
- Hartnett, N., Lowry, J. and Luther, R. (1994), "ABC and Australian accounting standards", *Australian Accountant*, December.
- Hayes, R.H. and Wheelwright, S.C. (1985), *Restoring our Competitive Edge: Competing through Manufacturing*, John Wiley & Sons, New York, NY.
- Hill, T. (1995), *Manufacturing Strategy*, Macmillan, London.
- Hiroto, T. (1988), "Another hidden edge: Japanese management accounting", *Harvard Business Review*, July-August.
- Hooper, M.J. and Brassard, M. (1998), "A survey of manufacturing practice within the UK automotive industry", *Proceedings of the 15th Conference of the Irish Manufacturing Committee*, University of Ulster at Jordanstown, 2-4 September, pp. 365-74
- Kidd, P.T. (1997), "Agile enterprise strategy: a next generation manufacturing concept", *Institution of Electrical Engineers, Digest No. 97/386*.

- 
- Maskell, B. (1998), *The Four Steps to Agile Manufacturing*, Brian Maskell Associates Inc., Cherry Hill, NJ.
- Merz, M. and Hardy, A. (1993), "ABC puts accountants on design team at HP", *Management Accounting*, September.
- Miles, R.E. and Snow, C.C (1984), "Fit, failure and the hall of fame", *California Management Review*, Vol. 26 No. 2, pp. 10-28.
- Morgan, M.J. and Weerakoon, P.S.H. (1990), "Japanese management accounting: its contribution to the Japanese economic miracle", *Management Accounting*, June, London.
- Pandya, K.V., Karlsson, A., Sega, S. and Carrie, A. (1997), "Towards the manufacturing enterprise of the future", *International Journal of Operations & Production Management*, Vol. 17 No. 5, pp. 502-21.
- Porter, M. (1985), *Competitive Advantage*, The Free Press, New York, NY.
- Prahalad, C.K. and Hamel, G. (1990), "The core competencies of the corporation", *Harvard Business Review*, May-June, pp. 79-91.
- Rattner, L. and Reid, R.A. (1994), "The information processing roles for mid-level production management in agile manufacturing", *Proceedings of the IEEE International Conference on Systems Man and Cybernetics Part 1*, San Antonio, TX, Conference No. 42,882, pp. 518-24.
- Schonberger, R.J. (1990), *Building a Chain of Customers: Linking Business Functions to Create the World Class Company*, The Free Press, New York, NY.
- Skinner, W. (1978), *Manufacturing in the Corporate Strategy*, John Wiley & Sons, New York, NY.
- Toffler, A. (1971), *Future Shock*, Pan Books, London.
- Toffler, A. (1981), *The Third Wave*, Pan Books, London.
- (The) *Toyota Production System* (1996), Toyota Motor Corporation, International Public Affairs Division and Operations Management Consulting Division, Toyota City.
- Turney, P. (1991), "Common cents: the ABC performance breakthrough", *Cost Technology*.
- Voss, B. (1993), "A new spring for manufacturing", *Journal of Business Strategy*, January/February, Vol. 15, pp. 54-7.
- Winters, C.N. (1996), "An implementation study of activity-based cost management in small- and medium-sized enterprises", PhD thesis, Coventry University, Coventry.
- Winters, C.N. and Brassard, M. (1998), *Re-engineering the Automotive Supply Chain. Project report for World Class*, Coventry University, Coventry.
- Womack, J.P., Jones, D.T. and Roos, D. (1990), *The Machine that Changed the World*, Free Press Paperbacks, Simon & Schuster, New York, NY.
- Youssef, M.A. (1992), "Agile manufacturing: a necessary condition for competing in global markets", *Industrial Engineering*, Vol. 24 No. 12, pp. 18-21.