Information Technology - the glue for Mass Customisation

It is real and it is here……

There is undoubtedly a growing interest in Mass Customisation amongst manufacturing companies. Most obvious activity is in the USA which is probably three to five years ahead of the UK in embracing this approach. However there is also significant awareness in the UK. IBM surveyed 40 UK manufacturing companies last year on their experience and responses to customisation. 84% said that customers are increasingly demanding customised products or services. We followed up this survey with a masterclass held at Jaguar Cars together with the DTI and Foundation for Manufacturing and Industry with 50 senior executives from a number of major companies. This confirmed the awareness amongst senior UK executives in UK manufacturing that customisation and choice was becoming an increasingly relevant business area.

Originally coined in 1987 by the futurist Stan Davis more as a provocation than an observation, Mass Customisation can be defined as providing customised products and services using fast and flexible business processes. Providing customisation itself is nothing new, many specialist companies have been doing it for years. Craft producers are experts at meeting customer demands *exactly.* However they do so at a cost: their business processes are typically not optimised for the required speed and flexibility and thus they charge more and take longer than a mass produced equivalent. The traditional made-to-measure Savile Row suit embodying quality and individuality in a high cost package is a good example. What a Mass Customiser does is to provide this customisation on a *mass* basis, but doing so in a way that enables costs and timescales to be on a par with mass production - giving customers Savile Row individuality and quality but at off-the-peg cost and availability.

…. but it's harder in manufacturing

Mass Customisation is far more advanced in service industries such as Finance and Insurance than in Manufacturing. The main reason is that the product in these industries is generally information and thus material logistic issues are absent. In implementing mass Customisation in manufacturing companies, the logistics of the supply chain and of the factory floor are major inhibitors. In the new Mass Customised world, manufacturers have to 'Make to Order', not to Plan or to Stock; they have to provide much higher variety in their products, whilst providing short lead times and minimising the cost of this variety. Whilst there are a number of methods of providing a Mass Customisation stance in the market for manufactured products (including Retailer/Dealer customisation as illustrated by Vision Express with their 24 hours eyeglass service), providing customisation direct from the factory is ultimately the best long term competitive position. For in business, the nature of relationships is becoming increasingly important, those companies that do not have strong end-customer relationships increasingly run the risk of becoming commodity suppliers.

Companies providing such factory-based customisation need to have a foundation of lean production and modular products before starting down this road. Part of the challenge is to provide the required IT support for the operational environment required for Mass Customisation. The use of IT is core to the concept of mass customisation, providing the near 'zero' costs of dealing with additional variety. But it is perceived as a difficult area, being the third highest perceived barrier to implementing increased customisation, in our survey.

IT is required at the core

In conventional Mass Production, low costs are achieved primarily through economies of scale, resulting in little variety, as typified by Henry Ford's original view on customer choice: 'Any colour as long as it's black'. In contrast Mass Customisation achieves low cost primarily through economies of scope, i.e. the application of a single process to produce a greater variety of products or services more cheaply and more quickly. Therefore Mass Customisation creates variety and customisation through flexibility and quick responsiveness. Motorola was one of the pioneers in introducing radical new approaches to the manufacturing and fulfilment of its pagers at the end of the 1980s to counter low Figure 1: Mass Customisation model (Source IBM 1997)

cost competition. IT was key to the new system, linking laptops for order configuration at dealers to the factory where they were made to order on a robotised assembly line. Computerised scheduling, sequencing and tracking was used to enable a time of 1 hour from order receipt to shipment. Similarly IT was key when the IBM factory at Greenock in Scotland moved to make to order and customisation for its PCs in 1992. It would be wrong to suggest

that there are no examples of companies which have implemented elements of Mass Customisation without a high dependency on IT. However, those such as Panasonic Bicycle which employ a blend of craftsman-culture and limited IT typically are only producing a small volume of products, in the order of 50 units per day for Panasonic Bicycle compared to 5000 per day for IBM Greenock. At these higher volumes and mix, there is simply too much complexity and consequent opportunities for error, for manual control systems to be used.

IT has three key roles to play in providing a Mass Customisation capability:

- **It must power business process modules which are fundamental to Mass Customisation**
  - Such as Order Configuration and Design

- **It must provide the 'effortless' integration between a set of 'soft-wired' business process modules**
  - Such as linking Sales Order Processing with Design Engineering (for quickly reviewing customisation requests and advising on price) and with Production (for determining lead time and releasing orders directly to manufacturing schedules) in 'near real time'

- **It must be exploited to drive new product and service customisation offerings**

Using IT to drive key process modules

Sales Order Configuration

Providing a higher variety of options and customisation adds to the complexity of the order-taking process, which becomes instead an order configuration process. The Sales Order Processing modules of many MRP2 systems are inadequate to this task and companies will need to look at integrating a specialist Sales Configurator tool which enables functions such as multiple variants, Internet link and even customer control. For it often makes sense to put the customer in charge of the order configuration process, accessing it (Source: IBM 1996)

through the Internet or another package. The IBM PC Company implemented a Lotus Notes based system called PartnerInfo to link dealers to the IBM fulfilment process, allowing order configuration, placement and tracking as well as the viewing of product brochures and availability. CD World, a Swiss technology company, is working on a development which will totally integrate order configuration and manufacture and put the customer in control. It is planning to launch a network of Music Point units in 1998 enabling consumers to create customised Compact Disks of their favourite songs, costing a similar price to standard CDs. This system will be based on computer terminals in record shops linked to a database of over 1 million songs. CD World has teamed up with IBM and Hewlett-Packard to provide this system.

New Product / Variant Introduction

Product modularity and the capability for the fast introduction of new variants is key to mass customisation. This requires close working between the Order Processing and Design groups. For other than the smallest of businesses, this increasingly requires the use of Product Data Management (PDM) systems, whether they are formal PDM tools such as IBM's ProductManager or simply a basic automated workflow and communications tool implemented in groupware like Lotus Notes. Three dimensional CAD, enabling solid modelling is increasingly becoming a basic requirement for most design organisations, and more so if the customer is to be directly involved in the customisation design of the product. A good example of this is the Ross Operating Valve company based in the USA, which turns out one-of-a-kind valves for the chemical industry in 3 days, from customer involvement in the design on their CAD system to manufacture in their integrated CAD/CAM machining system. Information Technology is also key in helping companies maintain the disciplines required for a modular design, by minimising unnecessary proliferation, by linking parts classification libraries to the CAD and PDM systems. This ensures that it is easier and quicker for designers to re-use rather than re-invent parts, something that is fundamental to cost-effective customisation.

Manufacturing Scheduling, Release and Tracking

Mass customisation poses a major challenge to a manufacturing environment, requiring Make to Order and a highly variable and unpredictable model mix. Software tools such as finite capacity schedulers and simulation can help optimise the use of available capacity. John Deere utilised a finite capacity scheduling tool based on genetic algorithms to 'breed' optimised schedules on a daily basis for its Illinois planter factory. Tracking orders from when they are released to manufacturing, through key production stages to completion and shipping to the customer, also needs to be (Source: IBM 1997)

considered. IBM Greenock used their Lotus Notes-based PartnerInfo system to track orders through from placement to delivery. Product and parts bar-coding help ensure that the correct configuration is built. Ensuring that orders do not get lost or delayed and that they are processed correctly is a task that can only be performed by a Manufacturing Execution and Tracking system such as IBM's Factory Operations Executive once the combination of volume and variety becomes too high for manual approaches.

Customer and Supplier Communications

The increasing importance of the customer relationship is emphasised with Mass Customisation, where the individual customer, not a niche or segment, is being served. Really understanding what your customer wants and needs is in no way a trivial task as can be seen by the fact that this was rated as the major difficulty experienced by those companies who had increased the amount of customisation they offered in the IBM survey. IT has a very powerful role to play in this area. Exploiting the Internet to communicate with the customers is key. Dell sell $1m of PC a day from its Web site, growing 20% month and plan to customise web pages for on-line order for corporate customers. "The Internet is the ultimate direct model" says Michael Dell, CEO. We would not disagree. IBM's web-based information and ticketing system at the 1996 Olympic Games processed over $5 billion worth of tickets and the website handled more than 180 million hits. It was based on one network comprising over 7,000 PCs together with mainframe and mid-range systems. Another major IT technology which is relevant is in using data warehouse and mining technologies to maximise the understanding of customers wants and opportunities.

Knowledge Management

Successful learning on a corporate scale requires the effortless collection, storage, analysis, synthesis and distribution of information. Be it a snippet picked up from a competitor conversation, a customer call report, information on order to ship times in a factory, this is all grist to the mill of organisational learning. It is key to becoming and remaining a Mass Customiser. *"Our employees continually have to be more creative and innovative in finding ways to reduce cost, improve quality and increase customer service. The only way to do it is to learn from the best in the world and share that learning throughout the organisation,"* so said John Neill, Unipart Group Chief Executive. Unipart focus strongly on organisational learning and have opened their own Unipart University. They have also applied IT, in the form of Lotus Notes, as a means of breaking down the traditional barriers to learning.

Making Mass Customisation happen

So, Information Technology is key to the implementation of Mass Customisation. However, delivering successful Mass Customisation requires both re-engineering and an intense customer closeness. BPR is needed to deliver the foundation of fast and flexible business processes together with modular products and services. Customer closeness ensures that customisation is provided in a form that is valued by the customer. In both areas, an integrated approach embracing business processes, organisation, customers and IT is required.

So what next ?

Information content customisation is potentially the most ideal approach to mass customisation as material management issues become minor. The software content of the product thus becomes the customisable element and can be customised and downloaded into a common hardware platform. This is increasingly becoming applicable for many products such as Personal Computers, Mobile Phones, Pagers and Home Entertainment Systems. With technologies such as the 'wireless web' potentially enabling products to be continually linked with other products and services or companies, it is clear that the borders between products and processes is becoming ever more blurred. Embedding Internet links into products to enable remote diagnostics and upgrading of

functionality exploits IT processes to enhance the product. The partnership agreement between Mercedes and IBM to implement such technologies into future Mercedes models is a good example of this. These effectively blur the distinction between products and services which are 'self customising' and those which are customised prior to the customer receiving them. It is just another example that reminds us how core IT is to today's organisation and how fast we are moving away from the IT 'glasshouse' of old. It is also another reason why IT managers must focus on the business as much as the technology and be seeking to 'provoke' operational business managers into understanding the increasing opportunities provided by Information Technology.

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This article was written by Alastair Ross, now Director at Codexx