

History and overview of mass customization



Mass Customization is an idea of bring mass production economics to further more value in customers satisfactory than before with just deliver one unit which is unique. David J. Gardner's declare that he been helping manufactures implement mass customization since the early 1980s before Stanly Davis bestselling book in 1987 written about mass customization more in high-level business strategy for implementing mass customization to a manufacturing company.[1] Mass Customization have become standard now in the 21st century. Let's have some quick view for the evolution of the different business paradigms over the time:

In above diagram, we can see that in the 19th -20th century many manufacture are inventing their business with the method of craft production, mass production and engineer-to-order technology by producing end product in profit and speed. When nearly the end of 20th century most manufacture try to revolute their businesses to mass customization paradigms which is more to distinct business paradigms by producing an product on demand and more in customer's preference fit.[2]

1. 2 Introduction to Mass Customization

Mass Customization term was become well-known since Joseph Pine published his book " Market of One- Creating Customer Unique Value through Mass Customization". In this book he defined Mass Customization as " producing, developing, marketing and delivering affordable low cost and high quality of goods and services that give customer nearly what they want." In other words, the goal is provide end product that meet exactly what they want. [1][2] In Mass Customization business paradigms it must be dynamic or flexible enough to provide customer to design needed products

themselves. Thus, it must be quick responsiveness to what customer needs, quantity supply, time of deliver and etc... In order to provide customer satisfaction the pricing cost and quality of products are important to be improved. [1]

In this 21st century the most popular industry that success implements the Mass Customization and made a great benefit providing economic price to customer is Dell. Dell has become the world leader for PC markets in direct sales via Internet. In the way Dell site sell its computer is simply using the concept ' build-to-order' which other words are for mass customization. They provide an arrangement of products and explain clearly to their customer what options the customer can select by their individual needs. The excellent job that Dell has done is build the on demand customize end product after customer proceed the order at their site and ship to customer less than 24hour. This is how Dell success in their business strategy by organized easy customized product across the enterprise and become the extended enterprise that the whole world known.

Even though there are many companies in different kind of industry was success implementing the Mass Customization but there is also many of them fail. In the case study of business and economic research team with the title " Failure of the Automobile Industry in Mass Customization Practices" they mention that Mass Customization is not feasible for all companies or industries. Thus, in order for a company to success in implement Mass Customization strategy they need some key success factor require of strategy. [1] This will further discuss later chapter in the subject " Key Success Factor".

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1. 3 Mass Customization (MC) toolkit

Many companies in different kind of industries started to offer customer opportunity to customize their own products online. The companies provided a web-based mass customization (MC) toolkit that allow customer who prefer to have individualized products just like PCs and Laptops (Dell. com), T-Shirt (CustomInk. com), Sneakers (Nike. com), Kitchens (IKEA. com), Skis (Edelwiser. com) or Cars (Mini) to their specific preferences. MC toolkits defined as a set of user-friendly design tool which allow user to trial and experience of the design process and it deliver simulated immediate feedback on the outcome of design idea. Once a satisfactory design are made and paid, the products specification will be transferred to manufacture production system to be produced and delivered to the customer. Below have some of the existing web-based MC toolkit examples from different kind of industries:

Figure 1. 0 An Overview of MC toolkit examples from ([www. mass-customization. de/mc07/](http://www.mass-customization.de/mc07/))

Mass Production Vs Mass Customization

2. 1 Characteristics of Mass Production

Mass production development process in to produce large amounts of standardized products in the arrangement of assembly lines.[4]

Typically use large-scale production lines moving tracks or conveyor belts moving down the object of various workers.[4]

Usually mass production is suitable for large and semi-homogeneous consumer groups. [4]

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Mass production is a large-scale capital-intensive production process:

Although low labor costs and production efficiency, but through large-scale production machinery itself requires a lot of money and skilled labor to install equipment in large quantities.[4]

Advantages

Reduce the possibility of human error, improve product quality, reduce labor costs and reduce non-productive work. [4]

Disadvantages

Assembly line products are difficult to change once implemented and hard time of establishment. [4]

Figure 2. 0 Ford factory, first moving assembly line, 1913.

2. 2 Characteristic of Mass Customization

According [www. madeforone. com](http://www.madeforone.com), declare that mass customization enable customers to determine the exact product or service specification, and have the product or the price available to them closer to a general public for such services have replaced. [4]

Mass customization often rely on production output, is customized for each user the use of flexible computer-aided manufacturing system. [4]

Mass customized products in minimizing the cost of using the build-to-order method, in which a project is not constructed until the receipt of the order, is an important factor. [4]

The product is built to meet the needs of individual customers. [4]

It is a software-based product configuration that allows it to add / change a core product features. [4]

In many cases, if a company offers “ individual products,” the products are not made separately, but the emergence of mass production and variants or become personalized. [4]

The interface or configure the system, is one of the important part that mediates between consumers and manufacturers as a key success of mass customization – without a friendly-user interface and ease of use, the company will be difficult to be successful. [4]

3. 0 Benefits and Drawbacks of Mass Customization (MC)

3. 1 Benefits of MC

Since the increase in number and variety of “ custom device” by increasing the efficiency of reducing low-profit.

Mass customization is a way to improve profits and reduce costs strategy of species.

Whether your company is looking for incremental improvements or take your business next level, your company can not thrive as a “ custom”, if the number and / or types are increasing.

Mass customization is an enterprise-wide business model to improve efficiency across the enterprise, increase efficiency, expand your sales channels.

Accelerate collaborative mass customization, the correct implementation of, and created a real excitement.

3. 1. 1 Benefit in the perspective of manufacture

May help to gain a competitive advantage

Lower costs (storage costs, costs related to Product is not for sale)

Higher income - the amount of profit agency manufacturers are likely to fall into

account, and customers willing to pay customized products at higher prices.

Build customer loyalty

Better needs analysis - customers through design their own products to provide a number of information about their preferences.

Manufacturers and less endangered by demand changes in preferences (market turmoil)

3. 1. 2 Benefit in the perspective of customer

Products more suited to customer preferences

Greater opportunity to evaluate alternatives

Whether it is possible to buy at any time and any place (In the case of purchase through the Internet)

Convenience of customers

3. 2 Drawbacks of MC

3. 2. 1 Drawbacks in the perspective of manufacture

As for the management of high demand and production systems.

Sometimes costly investment in IT, a flexible manufacturing system and the necessary training.

The risk of failure - in addition to mass customization success stories, there are some cases of failure are too many.

3. 2. 1 Drawbacks in the perspective of customer

Takes longer deliver period

Cannot experience the final product Before buying

More complex buying process

Usually anonymous purchase

4. 0 From Mass Production to Mass Customization

In according to the journal "Cracking the Code of Mass Customization" the researcher has come out with the factors that needed in order to emerge from Mass Production to Mass Customization. The factors are 'Three Fundamental Capabilities' (solution space development, robust process design and choice navigation) and also with several approaches and tool to help companies to develop those capability.[2]

4. 1 Three Capabilities Required (Fundamental Capabilities)

4. 1. 1 Solution Space Development

Identify the product attribute differences along these customers. [2]

Innovation Toolkit: This software enabling customers to the large pool into a unique product change their preferences, so that each customer stressed that the demand may not be happy.

Virtual Concept Testing: An effective through the creation of virtual prototyping and evaluation of submitted scores differentiated products approach the concept of potential customers.

Customer Experience Intelligence: A tool for continuous collection of customer data transactions, behavior or experience and analyze information to determine customer preferences.

4. 1. 2 Robust Process Design

Reuse or reorganization and value chain of existing resources to meet the different demands of customers streaming [2]

Flexible automation: Automation is not fixed or rigid, and can handle custom tangible or intangible goods

Process modularity: Split into reusable or re-performance of the module differentiated customer value chain of existing organizations and resources.

Adaptive human capital: Developing the management and staff who can handle the new and ambiguous tasks.

4. 1. 3 Choice Navigation

Support customers in defining their own solutions, while minimizing the burden of complexity and choice [2]

Assortment matching: Software solution to match an existing space characteristics (is a set of options) with the customer demand model, and then make product recommendations

Fast-cycle, trial-and-error learning: Is a way to enable customers to build their demand model and test the interaction between the model and the available solutions to match

Embedded configuration: Products that understand how they should adapt to the customers and then reconfigure itself accordingly

4. 2 The Mass Production-Mass Customization Continuum

In order for a business from mass production to mass customization they must go through the process of building the organizational capabilities (solution space development, robust process design and choice navigation). During the process company might need to improve all three capabilities at the same time. Dell, has done developed their personal organizational capability toward mass customization that suitable for them and bring ford great result of sales and customer satisfactions. [2]

Figure 3. 0 Dell define it solution space and build a very robust processes, choice navigation still improving.

5.0 Key Success Factors

Mass customization is that manufacturers able to produce customize product on demand, large-scale and lower costs. But how can we do this? Most experts believe that mass customization will success depends on the following factors: [1]

5.1 Modular Product Design

Each module retains its specific processes (or work) business authority. Without this, personalized products will be very difficult, time consuming, the terms of the slow and very expensive. In modular product design, product designs are under some module or process so that able to produce any type of customization. [1]

Requirements

When necessary preparatory work (which requires an effective supply network), skilled and qualified staff of highly educated investment.

High standardization of components

For organizational structure, improve the coordination between modules

Benefits

Standard components maximize in number of forms used in all products.

Shorten production time: because all the modules can be done simultaneously (and not in a sequence) to complete, and therefore greatly reduce the time needed for the production.

Easy to diagnose production problems (quality, defective products and etc.), resulting in a special isolation control potential quality issues

5. 2 Flexible Manufacturing Process

Mass Customization produces a variety of different products. This requires a high degree of flexibility in manufacturing systems. This factor reflects the capacity to adapt to the differences in the products as a result of the lead time, cost in changing the system and small sum of ordered products.

Usually if a company is to effectively organize its modular product design, flexible manufacturing system, so it provides the type and characteristics of time reducing costs. [1]

5. 3 Sophisticated Order Management

Mass customization is based on deep understanding of customer needs. Because individual needs are very different, order management system is critical to enhance the manufacturer and customer relationships. It (the system) to provide such a database, each client works open a wide range of profiles, and manage the large number of orders for many customers and clients the breadth, and through tracking, and allows easy access to the status of each order in anytime. [1]

Requirements

Close the relationship with customers

High system capacity to handle large amounts of information (databases, transactions, etc.)

Along the value chain (through the order management system) is highly integrated: a high degree of customer participation in the means of product configuration, marketing, sales, manufacturing, distribution, customer requirements also need to know accurate information.

An order management system, a typical example is Dell Computer. The site (www.dell.com) allows customers to interact directly with the companies presented their demands. Customers from a number of options, select with the products, just click on the screen to order these products. As the inventory and manufacturing, integrating all the departments Dell sales, marketing, finance, billing, logistics, such as through the website, order processing, all of these sectors at the same time, the result is that customers can immediately know, in a very fast and accurately all conditions of purchase.

5. 4 Integrated information system

Information system's role in mass customization is the key to success. The main features of mass customization - the uncertainty of the requirements - plus the requirements of flexible manufacturing, short delivery times, flexibility and rapid response capacity accurately, for an efficient information system to ensure that the information mobile phone is smooth and accurate between customers and manufacturers, has become the company's segments. In order to manage this small to minute, and more to multiple decision-making, decision support systems, integration of all participants in the organization of information, as well as with customers and manufacturers is essential. [1]

5.5 Postponement of assembly

The uncertainty of demand for mass customization is a production operating costs are a major obstacle. The system run-time requirements than low production capacity point of view is a fear of sleep, because the manufacturers have closed down days operating on fixed assets, inventory management costs, salaries of maintenance work, heavy, etc., but these costs can be eliminated if the company solutions to lower demand for delay operations. However, it can still ensure that the operation will restart quickly, if demand suddenly rose.

A solution to address this challenge is generated by externalities. For example, Nike does not produce itself and its partners in Asia, responsible for the production through the contract. Nike's investment in assembly, material inventory of machines, workers, and factory management is essentially zero. So, when demand falls, Nike just to adjust the contract delivery schedule. In this way, the burden of fixed costs is no longer Nike. For some products, its packaging division is the foundation, the company can outsource packaging steps to reduce the uncertainty of demand fluctuations.

[1]

6. 0 The Evolution to Mass Customization

Mass Production

Craft Production

Mass Customization

Engineer-to-Order

Craftsmanship

Time

18th century 21st century

6. 1 Craftsmanship

Craftsmanship is the oldest thousands of years the only methods of production. It is based on a few handmade commodities and delivery of services in a small workshop manual production. At the end of 18th century and in the beginning of 19th century there was a breakthrough and started move in to craft production.

6. 2 Craft Production

Craft production or (One-off production- individual article or a large-scale production prototype) is the process of manufacturing by hand with or without aid of tools. [5] Therefore, hand tools begin to display by machine and the craftsmanship productions goods and services important reduce from time pass though process in moving to craft production.

In term of craft production it refers to parts of the handmade production is automated, but through human factors (skills, experiences and traditions) remains is significant. Craft production was move in at 19th century.

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6.3 Mass Production

Mass production (also called flow production, repetitive flow production, series production, or serial production) is production of large number of standardized products, including in particular on the assembly line.[6] In different way of production goods and delivery services simultaneously with manufacturing machine is mass production.

In craft production one shop craftsmen busy get parts and assembly together, but in mass production one or more duplicate each worker using the same tools to perform the same consistent product flow or near the action-related tasks.[6] In the starting of 20th century Mass Production was being a standards for many companies. So, what is the improvement from craft production to mass production then? See below advantages and disadvantages of mass production.

Advantages

Shorter time to production (exact tool or parts always on hand cut short assembling time) [6]

Human error are reduce cause mostly process carry by machinery. [6]

Reduction labour cost and increase production speed per unit carry out by machinery in large-scale. [6]

Disadvantages

Inflexible or difficult to change the production line and takes long time to implement it. [6]

Difficult to satisfy individual taste by the similar production.[6]

6. 4 Engineer-to-Order

Engineer to order (ETO) is a manufacturing concept, the finished product built to unique customer specifications. General Assembly and the raw materials inventory, but may not go to the product assembly, until the receipt of customer orders and part of the design. ETO products may require a project number, a unique set of materials, as well as routes, and usually a very long time and complexity. Active participation and engineers throughout the design process of ordering products. [7]

ETO same time may refers to Build-to-Order (BTO) which is also a production approach of waiting the order confirm and build it. BTO and ETO are the approach that is most nearer to Mass Customization approach because it waited customer to confirm their order that they choose and produce it. In the middle of 20th century ETO was being implemented.

6. 5 Mass Customization

Mass Customization is an approach that combination with mass production, but is delivering customize product to individual. According to Frank Piller et al said in the business of consumer-focused line of creative strategy, mass customization can be seen as first elaborated the concept, with more than twenty years (the term was created in 1987, Stan Davis) history. [8]

Mass customization, it seems becoming the 21st-century standards. It offering customize product that meet individual demands and still remain the efficiency of mass production. To achieve these efficiency requirements,

mass customization system is defined by a fixed solution space in order to stabilize but still flexible, the characteristics of the reaction process. [8]

Therefore, the costs associated with mass customization should allow for a price level that does not mean the market as a switch. The solution is the use of space, who is in the process of the manufacturer's comprehensive definition of value creation, configuration or modify the options in a given choice of their respective solutions. If you do not deeply involve in the customer, the manufacturer will not be able to fully fill the needs of each individual product. Special tools package should enable customers to perform their tasks in this configuration. [8]

From the evolution from craftsmanship to mass customization, we can see how business flow comes through started focus on individual, then to many consumers and lastly come back again to focus back on individual needs to gain competitive advantages.

Mass customization can be categories into three type (Sung Park) said:

Digital Front End/Digital Back End: Described it as like the Amazon based on your interest in a fully digital fashion unique pages. [8]

Digital Front End/Physical Customization and Assembly: Most businesses will fall into this bucket of mass customization. You design Web-based CAD interface stuff, and some of its factories for the production of improved traditional manufacturing process. E. g. NikeiD, fashion Playtes, or Paragon Lake. [8]

Sensor based Front End/CAD-CAM Back End: This is a relatively passive experience, the best description of the Bronte sisters. In their case the sensor, so that your mouth model, and automated equipment (three-dimensional printer) produces a scanned copy of the physical. There is little human intervention or interference. [8]

7.0 The Effects in Mass Customization

Through the research of Mass Customization (MC), I found a very good journal that support MC effects that generate value to customer which title “The ‘ I Design It Myself’ Effect in Mass Customization”.

Many companies has offer their website that enable customer to customize their own individual customize product which manufacture can produce once confirm order. To this matter, MC toolkits was the significant and roles to gain competitive advantages to generate economic value to customer. There were four factors for MC toolkits needed to achieve: [3]

Preference fits: achieved by self design products (should be as high as possible) [3]

Design effort: which is refers to cost (should be as low as possible) [3]

The awareness of being the creator of the product design: a feeling of accomplishment from the process of self designing in subject value of the product. [3]

Willingness to pay: when the feeling of accomplishment of the self-design are high then the WTP will be high also and generate value to the creator. [3]

Above factors are important for companies to develop MC toolkits generate values to the consumer. Therefore, the user-friendly interface, innovative and design of MC toolkits should be good enough to gain customer satisfaction in term of the effects that mention above.

8. 0 Critical Evaluations

8. 1 Why I choose Mass Customization for FYP project?

For explain question above, first we need to know now normally most people can sell things online within just 15min or less than 30min, then they can create a website and start their businesses from (ebay, blog and free site... etc). So, what is my purpose to implement Mass Customization approach in my FYP project? It is to gain competitive advantages and innovative of web design to attract people come to my site.

As now ecommerce have been commonly heard and become a traditional way for businesses online. So, what will makes it different? Let's see the answer below:

Picture 1: This is the traditional way of T-shirt selling online from (www. t-shirts. com)

Picture 2: This is the site that implemented mass customization method that selling T-shirt by customer own design from (www. rainbowsports. com)

Now, we can clearly see the answer of implementation of mass customization in online business is important and some strategies and factors to success in mass customization as I have discussed above at Chapter 3. 0, 4. 0, 5. 0 and 7. 0.

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8. 2 What is the way to create Mass Customization Site?

Well, there is no fix way or range of making a mass customization site as long as we can develop the MC toolkits. As we study in IT in TARC College we learn a lot of technology, software tools and programming languages that can help us to design and come out with our own toolkits by the range our knowledge and effort we put in.

I have decide some several ways to create a T-shirt Customization tools with using Asp. net (visual basic code) for the Web pages, Oracle database (Oracle Express 10g free version), Silverlight or Adobe Flash CS3 Professional (Flash which use to create the MC toolkits for T-shirt customization).

8. 3 Does MC make your FYP project applicable to real business?

Yes, it will be possible if my project been successfully meeting those requirements in the key success factors and achieved the effects that mention above chapter 7. 0 and 5. 0. Thus, also include with the advanced of programming code and tools being used to develop a standard website that can probably compete against other companies website.

MC website can be in three type of categories that mentions at the 6. 5 mass customization to make our site in specific area focus on customer. Thus, to create a uniqueness MC website we need to refer to 4. 1 Three Fundamental Capability that needs to be continuously improved for goods and services provided using MC toolkits.

8. 4 Will your complete your FYP with what you have planned?

For this matter, it will be possible done but in term of time given maybe is a bit rush and hard to complete fully with myself alone. So, this is where the challenge I should face and to wisely spending the time in researching coding and designing user-interface. Therefore, I may look forward to my friend in other courses to help in different area such as flash in action script 3. 0 and designing.

Lastly, I hope this project would be successful completed in time and in future work it may possible for me to look forward 3D customization in web design.

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