MASS CUSTOMIZATION

PRESENTED BY

Francesca Codoni
francesca.codoni@unifr.ch

Christian Martinelli
christian.martinelli@unifr.ch

SUPERVISOR

Prof. Dr. Andreas Meier, Department of Informatics

FACULTY OF ECONOMICS AND SOCIAL SCIENCES
Friday, the 2nd of June 2006
# Table of contents

1. Introduction .................................................................................................................................................. 3
   1.1. What is Mass customization? .................................................................................................................. 3

2. CRM, eCRM and Mass Customization........................................................................................................... 4

3. Drivers and Key attributes of Mass Customization ..................................................................................... 5
   3.1. The drivers of a mass customization strategy .......................................................................................... 5
   3.2. The Key attribute of mass customization ............................................................................................... 6
   3.3. The two perspectives of mass customization ......................................................................................... 6

4. The information cycle of Mass Customization ............................................................................................ 7
   4.1. Listen to your customers ......................................................................................................................... 7
   4.2. Configuration ......................................................................................................................................... 8
   4.3. Manufacturing planning ......................................................................................................................... 8
   4.4. Production and supply chain integrator ................................................................................................. 8
   4.5. Relationship management ..................................................................................................................... 8

5. The classification of Mass Customization strategies .................................................................................. 9
   5.1. Collaborative customization .................................................................................................................... 10
   5.2. Adaptive customization ........................................................................................................................ 10
   5.3. Transparent customization .................................................................................................................... 10
   5.4. Cosmetic customization ....................................................................................................................... 10

6. The key components of a Mass Customization strategy ........................................................................... 11

7. Benefits and impacts of Mass Customization ........................................................................................... 12
   7.1. Benefits of mass customization .......................................................................................................... 12
   7.2. Impacts of mass customization ........................................................................................................... 13

8. The collaborative customer co-Design ....................................................................................................... 14
   8.1. The mass confusion phenomenon ....................................................................................................... 14

9. Mass Customization in action ................................................................................................................... 15
   9.1. NIKE ID – www.nikeID.com ................................................................................................................. 15
   9.3. Barbie - Not all products may be good candidates for customization .................................................. 17

10. Conclusion .................................................................................................................................................. 18

11. Bibliography ............................................................................................................................................. 19

12. Appendixes ............................................................................................................................................. 20

APPENDIX 1: Classification of success factors .......................................................................................... 20
APPENDIX 2: NikeID – Footwear end Equipment customization .................................................................... 22
APPENDIX 3: Lego Factory screenshot ..................................................................................................... 23
1. Introduction

“It is the customer who determines what a business is”

Peter F. Drucker¹, 1954

1.1. What is Mass customisation?

Today’s business environment is characterized with extremely tight competition between companies, countries and even entire continents. Companies are forced to constantly reduce costs and outperform when pursuing efficiency and effectiveness at the same time. Moreover, companies are struggling to reach effectiveness to retain customer loyalty, and customers are becoming increasingly demanding placing pressure for customer service.

While Davis coined the term in 1987², the concept attained wide popularity with Pine's book in 1993³. In Pine’s opinion, to retain customer loyalty companies should serve every customer as an individual offering customised products and services at a reasonable price. The difficulty is finding a reasonable trade-off between cost control and production of customer value. In 1996 Hart defines Mass customisation as:

“The ability to use of flexible processes and organizational structures to produce varied and often individually customised products and services at the price of standardized, mass-produced alternatives”⁴

According to Hart the goal of Mass customisation is not “anything-at-any-time” but is establish, from the customer's perspective, the range within a given product or service can be meaningfully customised for that customer, and then facilitate the customer's choice of options from that range.

In fact Mass customization is a remarkably attractive proposition both for consumers and producers. Consumers get a reasonably priced, tailor-made product reflecting their personal selection of colours, features, functions, and styles. Producers, for their part, get to reduce their inventories and manufacturing-overhead costs, to eliminate waste in their supply chains, and to obtain more accurate information about demand. In other words mass customisation is a win-win proposition. More recently, Tseng and Jiao define mass customization as:

“Producing goods and services to meet individual customer's needs with near mass production efficiency”⁵

In fact, if at the beginning of the century industrialized economies were based on mass production, now a combination of advances in information and technology is making increasingly possible to “mass customize” and by consequence rapidly respond to consumers with customized products at mass production prices.

2. CRM, eCRM and Mass Customization

The concepts of Customer relationship management (CRM) have been there since the concept of buying and selling came into being. In fact customer is not new and relations between the both have always existed.

**Customer Relationship Management** can be defined as a business strategy to select and manage the most valuable customer relationships. CRM requires customer-centric business philosophy and culture to support effective marketing, sales and service processes. CRM applications can enable effective customer relationship management if an enterprise has the right leadership, strategy and culture.

**Electronic Customer Relationship management** (eCRM) is considered to be a software tool and a technology solution in this Information Technology industry. eCRM is a sort of business practice which aims to help enterprises leverage technology solutions to better understand and provide for their clients’ needs and wants. The benefits arising from the convergence of computing, content and communications technologies are significant.

CRM focuses on maintaining profitable and advantageous relationships to the customers through all channels of communication. The rapid expansion of the Internet and its increasing usage add new opportunities and new challenges to the application of eCRM in businesses. The Internet has several well-known capabilities:

- 24h x 7days availability (information availability independent of time);
- Communication without borders;
- Fast and cheap information access;
- Cheap and personalized interaction.

A higher market transparency is achieved through fast and cheap information access. Moreover, the availability of information 24h x 7days and communication makes the maintenance of long-term profitable customer relationships even more important for businesses represented on the Internet, since switching to another business does not require much effort from the customer’s side.

The term mass customization has been introduced describing the production of products and services for a relatively large market with respect to the individual preferences of each customer, for costs similar to those required for a mass production of a similar standard product\(^6\). There are many aspects relevant for traditional CRM, which are also valid in eCRM. However, further opportunities and challenges for customer interaction and the maintenance of customer relationships arise. On the one hand does exist very cheap way of individualizing customer interaction through Internet. On the other hand, more transparent markets and the competitor on the Web being just “a click away” make retaining profitable customers more challenging. Mass customization can open new ways of doing business in this changing and challenging business environment.

---

3. Drivers and Key attributes of mass customization

3.1. The Drivers of a mass customization strategy
Basically the combination of strategic challenges and new technological possibilities is the driver of mass customization. As explained before mass customization means the production of goods and services for a large market. Those goods and services must satisfy the following options:

- **DIFFERENTIATION OPTION**
  Goods and services exactly meet the needs of every individual demander with regard to certain product characteristics.

- **COST OPTION**
  The costs of goods and services roughly correspond to costs of standard mass-produced goods.

- **RELATIONSHIP OPTION**
  The information collected in the course of the process of individualization serves to build up a lasting individual relationship with each customer.

Figure 1: The three levels of mass customization

3.2. The key attributes of Mass Customization

One of the main tasks of Mass Customization is to shift the center of attention from buying on price to one of buying on satisfied needs and wants, at a competitive and affordable price. Companies that are engaged in Mass Customization generally seek to fragment the market through economies of scope in contrast to the consolidation and reduction in choice through economies of scale. The key attributes of Mass Customization are listed below:

- Customize services around standard products and services;
- Customizable products and services;
- Quick response throughout the value chain;
- Point-to-delivery customization;
- Customization of end products and services through modularity.

3.3. The two perspectives of mass customization

![Figure 2: Company’s and consumer perspective of mass customization](source: Adapted from C. Dixon, Online Customization, Glassmeyer/McNamee, Center for digital studies, 04.05.2005.)

Considering these two perspectives, it makes sense to customize mainly when:

- the customers are not able to make their own desired product from current offerings;
- it will be impossible for a company to offer all the products if the product itself has many different permutations;
- the consumers desire to have choices. Customizing products will increase the demand on the consumer side because of the participation to the design process;
- company culture will allow a customization policy. If designers want their products enter the market as they have originally designed then customization may not be a good cultural fit;
4. The information cycle of Mass Customization

Companies whom pursue Mass Customization in a successful way integrate a variety of important tasks. In other words the build an integrated information flow that is capable to cover transactions and uses information gathered during the fulfillment of a customer-specific order to improve their knowledge base.

The information cycle model shall stress the importance of an interconnected and integrated flow of information through the representation of the processes and tasks described before.

![Figure 3: The information cycle of mass customization](image)

**Listen to your customers**
- Needs, desires, experiences during use of a product

**Distribution and Customer Relationship Marketing**
- Individual delivery
- Building long lasting customer relationships
- Knowledge

**Production and Assembly**
- Control of flexible manufacturing (FMS), standardized pre-fabrication, Kanban systems

**Existing Customers**
- Re-use information about customer (databases)

**New Customers**
- Gathering information needed for customization (configurators / design tools)

**Manufacturing Planning**
- Configuration, customer specific design (CAD), production lots, sequencing, hybrid MRP II, modular SCM

**Supply Chain Integration**
- Information about customization of specific parts within integrated supply chains (JIT)


### 4.1. Listen to your customers

This first phase of the cycle start focusing on the individual needs of each customer. Each mass customization program need to have as a center focus all information about the desires of a customer group regarding the product. Even though one of the major meaning of mass customization is that a mass customizer doesn’t accomplish every wish of its customers, it is essential to listen carefully to prospective customers to design a set of product variants and individualization options that on the one hand side has sufficient possibilities for customization, but one the other hand is as simple as possible in order to reduce complexity (which are directly correlated with costs).
4.2. Configuration

This process consists in transforming customers’ wishes in concrete product specifications. This is one of the most difficult and significant parts that any mass customization business has to face.

A clear distinction has to be made between old and new customers. For new customers, a general profile of their desires and wishes has to be built up. Afterwards this profile is transformed into a product specification. At this stage new technologies such as recommendation engines provide help. To be able to configure for regular customers the existing customer profile has to be used. The old configuration may be presented and customers just asked for variations. The following sales have to be as easy as possible. Only following such configuration we can build-up good customer loyalty. Most leading companies have implemented powerful instruments to build trust and show reliability in order to reduce the risk by prospective customer in mass customization processes:

4.3. Manufacturing planning

Once the configuration is checked in the production planning to get customer specific dates for delivery, the order is transferred into specific manufacturing tasks. As following tasks we have the scheduling activities. The production tasks are transferred to responsible process units, whereby suppliers may be integrated in the customization of some parts, too. In successful mass customization concept all time and money consuming iterative reconfiguration has to be eliminated.

4.4. Production and supply chain integration

Until now, the whole mass customization process is based on an information level only. Therefore the following activities are consisted in manufacturing the product ordered. Throughout this phase information management has to take care that the right specification of an order are at the right work place at the right time. If we look at advanced mass customization concept, external suppliers may be integrated into the customization process. This will permit to extend the degree of individualization, a lower production time needed in processes, cost savings due to specialization and faster learning effects. Also in this phase information activities are of very big importance. To be able to transfer the customer specific information between the factories integrated information flows and shared applications are required.

4.5. Relationship management

This phase does not only consist in building long lasting customer relationship. Further knowledge about the customers has to be acquired. It is shown in the information cycle that not only information about the customer but the production process itself has to be collected in a knowledge base to improve efficiency and quality in follow-up business (Peppers/Rogers, 1997). This will allow to better serve old and new customers and production planning can be improved continuously.
5. The Classification of Mass Customization strategies

Gilmore and Pine have identified four distinct approaches to mass customization, which they call collaborative, adaptive, cosmetic, and transparent. When managers design or redesign a product, a process, or a business unit, each of the approaches for possible insights should be examined in order to best to serve their customers. In some cases, a single approach will dominate the design. Often, however, managers will discover that they have to mix some or all of the four approaches to serve a particular set of their customers.

The 4 types of mass customization:

- Collaborative customization
- Adaptive customization
- Transparent customization
- Cosmetic customization

Figure 4: The 4 faces of mass customization

5.1. Collaborative customization
Firms talk to individual customers to determine the precise product offering that best serves the customer's needs. This information is then used to specify and manufacture a product that suits that specific customer. Customizing the representation permits customers to participate in the design stage and play with the possibilities available to them. In fact the main phase of collaborative customization focuses on design, but companies can apply this approach not only in this place of the value chain. In the case of collaborative delivery services, customers specify exactly where, when, and how to place goods, which then drives the entire flow of work processes. Collaborative customizers not only deliver the product to the customer but also customize that delivery. In effect, there is no supply chain anymore; instead, a demand chain is created. At last but not least in collaborative customization there is a minimization of costs by not keeping inventories of finished products. Raw materials or component parts are stocked, and finished products are made only in response to the actual needs of individual customers. Moreover, a given product is transported only to those places where it is needed.

5.2. Adaptive customization
Firms produce a standardized product, but this product is customizable in the hands of the end-user. Adaptive customization create standard goods or services that can easily be tailored, modified, or reconfigured to suit customer’s needs without any direct interaction with the company. Each customer independently derives his or her own value from the product because the company has designed multiple permutations into a standard, but customizable, offering. It is the product itself that interacts with customers.

5.3. Transparent customization
Firms provide individual customers with unique products, without explicitly telling them that the products are customized. In this case there is a need to accurately assess customer needs. Instead of requiring customers to take the time to describe their needs, transparent customizers observe behaviours over time, looking for predictable preferences. Of course, this attribute requires time to deepen its knowledge of customers and to move progressively closer to meeting individual preferences. Businesses ripe for transparent customization are those whose customers do not want to be bothered with direct collaboration.

5.4. Cosmetic customization
Firms produce a standardized physical product, but market it to different customers in unique ways. A company should adopt the cosmetic approach when its standard product satisfies almost every customer and only the product’s form needs to be customized.
6. The key components of a mass customization strategy

When a company is faced to the decision concerning the implementation of a mass customization strategy, the consideration of many factors is necessary. The factors that must be taken into account are both external and internal to the company. Successful mass customization strategies arise from a blend of all the following factors:

Figure 5: External and internal factors of a successful mass customization

7. Benefits and Impacts of Mass Customization

7.1. Benefits of mass customization

Mass Customization is beneficial for both sides, the customers and the firm. From the Customer’s point of view a strong benefit is the ability to find and or design products and services that meet their needs. It has been proved that customization increases satisfaction. From the Firm’s point of view customization helps to reduce inventory, enhances customer loyalty, and avoid the pitfalls of commoditization. In Mass Customization’s firms new products arise through an interactive process of working directly with the market. The final product is a result of a co-design and production process of the customer and the firm. When this process of Customization is held across a bigger number of Customers, new insights come to light about customer’s preferences. Therefore it is easier to drop attributes and offerings that are not attractive and enhance those that are frequently requested. The service given from the firms is to allow customers to access to the manufacturing facilities to design and produce their own products. If companies are able to combine customer configuration with a mass production strategy, companies can also use the insights from the customized products to shape their mass-produced line.

**BENEFITS FOR THE FIRM**

- Allow economies of scale through production part commonality
- Reduced part proliferation
- Reduced inventory through reduced internal variety
- Provides opportunity for better value-added services
- Provides, for the portion of the business that is manufactured for inventory, more accurate market information on changing customer tastes and the actual tradeoffs they make in choosing products. Also offers opportunities for more accurate forecasting.
- Helps redesign the operations and logistics, leading to processes that result in “better, cheaper, and faster” products and services.
- Helps in developing and maintaining customer databases and allows better utilization of IT to implement “segment of one” strategies.
- Gets the customer to spend more on the products and services.
- Builds relationship with customers, thus achieving higher customer satisfaction and loyalty.
- Offers opportunity for better channel management.
- Stimulates continuous innovation.

**BENEFITS FOR THE CUSTOMERS**

- Meeting exact customer requirements
- For a significant segment, the benefits of customization are worth a premium price.
- Customers influence part of the design and production process.
7.2. Impacts of Mass Customization

The approach that is the center of Mass Customization is that customized products are produced to meet specific customer requirements and needs. Companies that are pursuing a mass customization strategy must consider the cost of variety. Cost of variety is meant as the cost that derives from the amount of the possible alternatives by which the product can be assembled. Mass Customization will therefore have a strong impact on the internal processes of an organization.

There are two types of variety. The first one is *Internal Variety* and is experienced within the design, manufacturing and distribution operations. The second one *External Variety* and is seen by customers, the aim is to reduce internal variety yet maximize external variety. The cost of Variety is defined as the sum of the following:

- Inventory
- Setup
- Model Changeovers
- Materials
- Services
- Flexibility
- Quality
- Marketing
- Operations

In addition of considering the cost of variety it is also necessary to rationalize existing products in order to reduce non-value adding products and their complexity. These two steps are required to implement an effective mass customization strategy.
8. The collaborative customer co-Design

New products no longer come fully formed out of the laboratories alone, but arise through an interactive process of working directly with the market. Each customized product is a result of a co-design and production process of the customers and the firm. In other words, customers are integrated into value creation. Within mass customization, customers are integrated into value creation by defining, configuring, designing, matching, or modifying their individual solution out of a list of options and pre-defined components. These co-design activities are the necessary prerequisite of mass customization and acts in order to fulfil the needs of individual customers. When these activities are repeated across a number of customers, new insights emerge about customer preferences. Attributes and offerings that are not attractive can be dropped and those that are frequently requested can be enhanced. In this way, customer design choices may portend emerging trends and by consequence profitable opportunities for the company.

8.1. The mass confusion phenomenon

Those co-design activities are also a major driver for a combination of increasing complexity and perceived risk from the customers’ point of view limiting the success of a mass customization strategy. In 1994 Pine coined the term “mass confusion” to describe the burdens and drawbacks for the consumer coming out of the mass customization configuration process. A recent study\(^8\) identifies three types of “mass confusion problems” which may explain the slow adoption of mass customization by the customers:

- the burden of choice to find the fitting option from a large number of customization options;
- the difficulty to address individual needs and transfer them to a concrete product specification;
- uncertainties (based on missing information) about the behaviour of the provider.

In e-business literature, virtual communities are often mentioned as a potential solution to overcome information gaps and uncertainties of online buying. In fact communities can support an individual or collaborative design process, at the same time minimizing the mass confusion problem. The study mentioned above found out three community applications which can help to overcome the mass confusion phenomenon.

- generation of customer knowledge to provide a better starting (pre-) configuration;
- support of collaborative co-design fostering joint creativity and problem solving;
- building of trust and the reduction of the perception of risk.

---

9. Mass Customization in action

9.1. NIKE ID – www.nikeID.com

The mass customization project has experienced a great response from customers. The Nike iD program allows customers to customize their own footwear or equipment. The size and the color scheme of a model can be chosen.

Nike iD offers more than 43 models of footwear for customization. To remain competitive, Nike entered the customization world and, as usual, decided to remain one step ahead of its competitors with the innovative and interactive Nike iD project. Despite the increased cost of making customized goods as opposed to mass-produced goods, Nike hopes this program will build customer loyalty and increase the customers satisfaction. Mass customization also saves money by lowering inventory costs and eliminating overhead costs of retail outlets.

After testing the waters of mass customization Nike has expanded its iD program to meet the needs of teams that desire custom uniforms. All these factors and the integrated management systems available because of the cutting edge Information Technology give Nike higher revenues.⁹ Perhaps the ultimate expression of design consciousness, it is unsurprising that individuals would be happy to replace the role of the designer in the process of developing their own products. Two NikeID’s screenshot are available on the appendix 2.

⁹ http://web.syr.edu/~cshim/Report.html

At Lego Factory, users can create their own unique Lego models using interactive software that helps them to overcome the engineering problem of combining basic Lego bricks into a new creation. Also, compared to the conventional building sets of Lego, the users are not restricted to the distribution of bricks in a pre-fabricated kit.

This is where mass customization comes into play: With Lego Factory, the company manufactures the bricks necessary for the model and ships them to users so they can assemble their models. Customers can also buy the bricks necessary to build from other people's designs, which are posted on the site.

Lego Factory is based on a toolkit for user co-design, called Lego Designer, a free, downloadable, 3D modelling program that lets users choose from digital collections of bricks to compose their own unique models. But as in many cases, once a company offers its users an innovative, more interactive way to create new products, some users want even more.

The problem was that the Lego assembly Center has pre-packed packages of bricks, and matches a user's designs with these packages. The result is users got and paid for far more pieces than they really needed. At the same time, they were missing a few others that were integral to the creations, and had to purchase more packages. So the adult Lego community became innovative: they collected information about the exact combination of each brick package and compiled this information in a database that lists which bags must be purchased in order to collect specific bricks.

The Lego user community LUGNET is totally independent by the company and is one of the best examples of a community where users co-create and co-design based around a manufacturer's products. Here, users do not only swap parts or share pictures of their individual models, but also build together an open source based design software to create great expert constructions.

The Lego Factory seems to combine several trends and developments which were before invented in the user domain, and which are now incorporated into a business model of the company. This is also a form of open innovation. In addition, the site finally features real open innovation at Lego: It highlights the fact that the company is now selling Lego sets which are designed by other Lego users. Children can not only create their own unique designs, and order the corresponding bricks in a customized set with the help of their father's credit card, but can also submit these designs to the company. Lego may then produce an extraordinary design as a mass product for other children as well.

It is too early to share anything about the success of this new Lego mass customization venture. It is a great new application that makes a lot of business sense for the struggling toy manufacturer: It combines a number of trends, but still stays perfectly in the unique selling proposition of Lego: Enabling creativity of children and making them to co-designers of their dreams. A Lego Factory screenshot see appendix 3.
9.3. Barbie - Not all products may be good candidates for customization

In the late 1990s, computer technology boomed, and in 1996, Mattel launched www.barbie.com, the official Barbie website. In 1998, My Design was introduced on the site, allowing girls and collectors to decide what their Barbie doll friend would look like by choosing her hair/eye/makeup colours, fashions, accessories, and personality traits. Mattel used at that time to offer its Barbie dolls customizable on the internet. The firm stopped this offering due to supply chain and other manufacturing problems. Moreover, only 0.2 percent of the visitors who used the feature then bought dolls. There are some possible explanations non that led Mattel to their mass customization failure:

- Most of the users were too young to have credit cards;
- Mattel already offers hundreds of doll variations in stores, often at half the $40 price of a customized model;
- The cost could not be reduced because each customized doll was made by hand.

Currently visitors can still mix and match hairstyles, clothing, and eye colour, but just for fun.
10. Conclusion

We have seen that mass customization is best defined as a delivery process through which mass-market goods and services are individualized to satisfy a very specific customer need, at an affordable price. Based on the public’s growing desire for product customization and eventually personalization, it serves as the ultimate combination of “custom-made” and “mass production” and it is rapidly emerging as the organizing business principle of the 21st century.

Unlike mass production, which produces some variety of an item in high volumes, mass customization is characterized by small volumes - in many cases, lot sizes of one. It is also characterized by competitive cost, timely deliveries and a move away from centralized manufacturing to more distributed production. Consequently, when combined with the very latest digital technology, such as e-commerce and robotics, mass customization not only benefits the consumer, it offers the manufacturer significant benefits as well: a high degree of product/service flexibility, reduced inventory risk, and a competitive edge in the marketplace.

According to an eBusiness research study\textsuperscript{10} the next stage of evolution of mass customization is customerization, a buyer-centric company strategy that combines mass customization with customized marketing. Customerization begins with customers and offers them more control in the exchange process. However, companies can still decisively influence customer decision making and choice processes by providing relevant information, and by making it easier and cheaper for customers to deal with them than with competing firms. In fact, customerization is driven by a firm’s desire to redefine its relationship with customers. In some sense, a firm becomes an agent of the customer "renting" out to the customers pieces of its manufacturing, logistics, and other resources and allowing them to find, choose, design, and use what they need.

For customerization to work effectively there must be an exchange of information and knowledge between companies and customers. This requires the company to “open up” some of its internal processes and structures to its customers. It also requires customers to be willing to share their attitudes, preferences, and purchase patterns with the company on an ongoing basis. Currently, the “knowledge transfer” occurs because of the novelty of the new medium, and because to some extent both the customers and the company become better off with such knowledge transfer. However, with increasing online competition and concerns about privacy, companies need to carefully design privacy guidelines and incentive structures to facilitate the knowledge exchange between themselves and their customers.

Simply stated, mass customization is about choice; about giving consumers a unique end product when, where and how they want it. Emerging trends are challenges that firms have to seize in order to gain customer loyalty, customer satisfaction, to assure them a good future position on the market and to face global competition.

11. Bibliography


## APPENDIX 1: Classification of success factors

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Focus</th>
<th>Customer factors</th>
<th>Product factors</th>
<th>Market factors</th>
<th>Industry factors</th>
<th>Organizational factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pine (1993)</td>
<td>The need to make the move to mass customization can be determined by assessing the market turbulence. The more dynamic the market, the more appropriate the strategy of mass customization will be.</td>
<td>Demand factors</td>
<td>Demand factors</td>
<td>Structural factors</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Instability/unpredictability of demand levels</td>
<td>- Luxury level of the product</td>
<td>- Level of buyer power</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Heterogeneity of desires</td>
<td></td>
<td>- Dependency on economic cycles</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Uncertainty of consumer needs and wants</td>
<td></td>
<td>- Level of competition</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Price awareness</td>
<td></td>
<td>- Level of differentiation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Quality awareness</td>
<td></td>
<td>- Level of saturation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Fashion awareness</td>
<td></td>
<td>- Number of substitutes</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Level of pre- and post-sale service levels</td>
<td></td>
<td>- Shortness of product life cycles</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Rate of technological change</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hart (1995, 1996)</td>
<td>The attractiveness of mass customization can be determined by analyzing the five main pillars.</td>
<td>Customization sensitivity</td>
<td></td>
<td>Process technology</td>
<td>First mover advantage</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Customer sensitivity towards customizations</td>
<td></td>
<td>- Readiness of process technology</td>
<td>- Potential of creating deep customer relationships</td>
<td></td>
</tr>
<tr>
<td>Kotha (1995)</td>
<td>The likelihood of success for pursuing both mass customization and mass production can be assessed by checking whether the conditions in four areas of interest are met.</td>
<td>Customization sensitivity</td>
<td>Industry settings</td>
<td></td>
<td></td>
<td>Culture and organization design</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Existence of group of industry customers who can be persuaded to value customization</td>
<td>- High degree of product proliferation and new product introductions</td>
<td></td>
<td></td>
<td>- Focus on knowledge creation and development of manufacturing capabilities</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Focus on zero mistakes in all activities</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Each plant’s manufacturing tasks and competitive</td>
</tr>
</tbody>
</table>
- Priorities are matched to its product/market environment
- Fostering of interactions among focused plants instituted by top management
- Access to group of highly trained, disciplined and motivated workers
- Access to substantial in-house engineering expertise and manufacturing capabilities
- Long-term investment in advanced manufacturing and information technologies
- Existence of a marketing department that can excite consumers about individualized product offerings

*Intra-organizational coordination*
- Achievement of integration across function while maintaining excellence within each function

*Inter-organizational coordination*
- Access to supplier network in close proximity
- Development of interconnected information network with selected group of trained retailers

*First mover advantage*
- The absence of a well-entrenched mass customizer

APPENDIX 2: NikeID – Footwear end Equipment customization (30.06.2006)
APPENDIX 3: Lego Factory screenshot (24.05.2006)