

# Mass customization as a new competitive strategy for North American wood furniture enterprises

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# Mass customization of wood furniture: Literature review and application potential

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## Abstract

Imported furniture is increasingly threatening the US furniture industry.. Mass customization (MC) may be a strategy for US manufacturers to keep a competitive edge. This paper introduces a MC concept and uses four furniture industry sub sectors (wood household furniture, wood office furniture, upholstery furniture, and wood kitchen cabinets) to indicate a possible correlation between the level of customization offered by each of these four industry sub-sectors and their success in maintaining domestic market share. Observations indicate that the U.S. kitchen cabinet industry offers the highest level of MC of all furniture sub-sectors analyzed. The domestic kitchen cabinet industry is not losing market share to offshore imports. The wood household furniture industry sub-sector, on the other hand, offers little or no customization for consumers and suffers large market share losses from imported products. The study supports the notion that MC can strengthen the domestic furniture industry's competitive position relative to offshore producers.

Keywords: Mass Customization, Personalization, Furniture

## 1 INTRODUCTION

Increasing furniture demand in North America has been forecasted by Bullard and West [1]. Age and income structure of the American population give reason to estimate moderate but continuous increase of furniture sales in the USA. The main question for North American furniture manufacturers is "who will produce the furniture to satisfy the North American market". The domestic industry is facing competition from low labour cost countries, which increasingly export their products to the USA. Schuler and Buehlmann [2] stated that furniture demand is significantly influenced by demographics. The American population is characterized by the presence of about 60 million baby boomers. This group represents the most important market segment for the furniture industry. To satisfy their needs, price may not be the only sales argument. Schuler and Buehlmann [2] forecast an increasing market share of customized products for the decades to come (figure 1). The publication at hand then hypothesizes that the level of mass customization (MC) offered by an industry sub-sector is negatively correlated with the loss of market share of domestic furniture manufacturers.

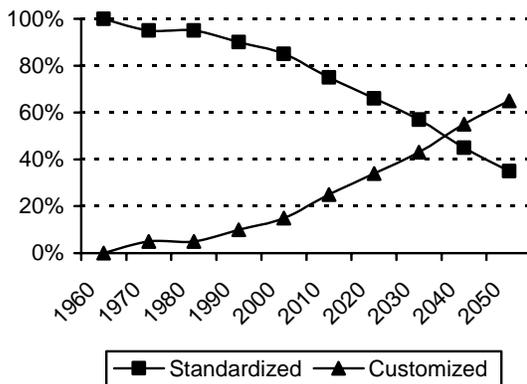


Figure 1: Market share of standardized, mass produced versus customized products [2].

The objective of the present paper is the discussion of the implementation of MC concepts by the US wood household furniture industry, the US wood office furniture industry, the US upholstery furniture industry and the US wood kitchen cabinet industry and its implications on market success.

## 2 MASS CUSTOMIZATION CONCEPT

Stanley M. Davis [3] in 1987 introduced the term « mass customization » in his book *Future Perfect*. He described mass customization (MC) as a trend towards the production and distribution of individually customized goods and services for mass markets. The idealized definition of the concept may be stated as a business strategy for profitably providing customers with anything they want, at anytime, anywhere, in any way [4]. Being an ideal, that definition can only be approached but never perfectly accomplished by a company. A more practical description of MC relates to the ability of a business entity to provide customized products or services in high volumes with short lead time through flexible processes at costs similar to standardized mass products [5] [4]. Pine [6] considers MC as the historical successor of mass production while Kotha [7] as well as Westbrook and Williamson [8] see it as a system that may co-exist with mass production. Products can be customized in many different ways but MC is always achieved without manufacturing products to stock. Taxonomies for MC and manufacturing without finished goods inventories are proposed by numerous authors [4] [9] [10] [11]. Montreuil and Poulin [12] proposed an eight options personalisation framework that is adapted to the furniture manufacturing industry by the authors of this publication:

1. Popularizing: A limited number of products match a wide variety of customer needs, for those who want off-the-shelf products. Focus on evolving the popular product mix in line with evolving customer needs.
2. Varietizing: Extensive mix of products to satisfy almost all customer needs. Retailers pick those they want to offer off-the-

shelf and rely on quick delivery from the distribution network for fast replenishment.

3. **Accessorizing:** A limited set of core products matched with a wide array of accessories. Final assembly of accessorized products performed to order either by the customer, the retailer or the manufacturer.
4. **Configuring:** Configuring means that customers define the desired product through the setting of parameters and the selection of options. He is guided through the specification process by the retailer or the manufacturer.
5. **Tailoring:** Product designed/engineered to customer needs. The customer is closely involved in the product specification and realization process.
6. **Servicing:** "Servicing", an option added by the authors refers to a design service provided by the manufacturer or the retailer. The customer is assisted to develop a complete living concept including furniture, accessories, mouldings, wallpaper etc.
7. **Adjusting:** Product adjusted to customer needs after usage. The product has to be adaptable to offer options to allow for adjustments. Distributed information systems capture customer feedback.
8. **Monitoring:** Product is replaced by more adequate product as the customer needs evolve, ensuring continually a best-fitting product. This involves ongoing, regular and interactive customer feedback.

Adapting MC is a strategic decision with impact on the organisational structure of a business. However, MC has the potential to uncover revenue drivers that might otherwise be forgone or be seized by competitors [4]. Kotha [13] also sees MC as a competitive advantage for a first mover, although this advantage may be fleeting. A company that finds itself and its competitors offering similar levels of MC, might discard MC as a competitive edge [9]. In such cases, MC is just a core characteristic of the business permitting it to stay at level with competitors. As discussed in more detail later, use of MC strategies in the furniture manufacturing industry vary from one sub-sector to another. MC might be considered as a competitive edge in one sub-sector and be part of the core characteristics of business practices in another.

Benefits of MC are more often related to customer and market impact than to costs and profits [14]. The example of the National Bicycle Industrial Company (NBIC) of Japan may be cited to confirm that statement [7] [13] [15]. NBIC produces three bicycle brands: while the National and the Hikari brands are mass produced, the Panasonic brand is mass customized and mass produced. The pilot plant for Panasonic MC bicycles was built in 1987, a period where the Japanese bicycle industry recorded decreasing sales. NBIC offered a hybrid of tailored and accessorized personalization. Bicycle frames were built as a function of customer anthropometrics, mechanical accessories were added upon request and a wide range of finishing options (including the printing of the customers' name on the frame) were available. In the first two years of operation, orders for personalized bicycles at NBIC increased by 20%. NBIC had the competitive edge to be the first bicycle manufacturer offering personalized

products. In 1992 personalized products at NBIC represented only 10% of their total production while 90% were still being mass produced. However, the introduction of MC bicycles had an important impact on customers' perception of NBIC's brand name and undoubtedly increased NBIC's core business – mass produced bicycles [7] [13] [15].

### **3 MASS CUSTOMIZATION AND THE WOOD FURNITURE INDUSTRY**

MC has been mentioned as one of the strategies for North American furniture manufacturers to stay competitive in a context of global competition [1] [2] [16] [17] [18]. It also has been widely noted that the four furniture industry sub-sectors (household casegoods, upholstered, kitchen and office) have widely differing levels of MC adaptation. These four industry sub-sectors are also characterized by different levels of competition from imported products. In 2001, the United States imported almost 50% of all wood household casegood furniture, while less than 5% of all kitchen cabinetry came from outside the country [17]. While those two industries do appear to have different levels of MC adaptation, the correlation between MC and level of imported product has never been established. Other factors, such as lean manufacturing practices or supply chain alliances are commonly expected to have an impact on the level of imports, too. However, it is interesting to note that all these manufacturing factors listed are precursors of successful MC adaptation.

An argument can be made that furniture, given its prevalence in human life and its use as a status symbol, is extremely suited for the concept of MC [2] [17] [19]. If customers pay premiums for customized computer, cars or clothes, furniture products would seem to present similar opportunities. From a manufacturing viewpoint, all furniture products, e.g. household casegoods, upholstered, office or kitchen cabinetry, follow similar processes and could be produced as MC products. Distribution and sales channels, while being different for the different sub-sectors, could support MC. Yet, it appears that the kitchen cabinet and office furniture industries have pursued MC strategies more extensively than did the wooden casegoods and upholstered furniture industries. The impression is that there may be a correlation between the level of imported furniture sold in the U.S. market and the level of MC adaptation. While no conclusive evidence can be offered due to the complexity of such industry-wide analysis, data is presented below to support this proposition.

#### **3.1 Wooden casegoods household furniture (NAICS 337 122)**

A typical wood casegoods household furniture plant may produce 10 or more different furniture collections. Each of these collections may count for about 15 furniture items. Design and construction are seldom standardized or modularized. Given that one collection represents 500 to 1000 components, the total number of components may reach 20,000. Production planning is centralized using MRP II type software based on market forecasts. The plant layout is often a mixture of job shop and flow shop layout and production operates in push mode [20]. Buffer stock is present at the input and output sides of each process resulting in a high level of work in progress (WIP). Finished furniture is inventoried and distributed from the factory to retail stores. Despite the high level of inventory that such a plant carries, customer order response time is generally between six and twelve weeks.

The wooden casegood household furniture industry is mainly operating in a ship-to-order mode. Little personalization is possible under such condition.

Personalization offered is limited to things that can be altered late in the production process, such as different numbers of shelves or different hardware. Often, a range of different colors is offered, however, collections in different colors are kept in inventory and thus do not necessarily classify as MC products. Wooden casegood furniture typically is bought by customers looking at models in a showroom, then selecting the items they like in the color they are most attracted to and take it off-the-shelf or wait for delivery. In regard to the previously presented MC model, the wooden casegoods household industry offers popularizing, varietizing and accessorizing options.

Figure 2 presents total wood household furniture imports over five years as well as from the two leading import countries, China and Canada [21] [22]. Total imports are presented in Billion US\$ and imports from the leading countries are presented as a percentage of the domestic production minus exports. The later indicates the presence of US manufacturers on their domestic market and may be considered as a measure of domestic market control. In Figure 2, domestic production – exports and total imports refers to the right axis (in Billion US\$), while imports from the leading countries refers to the left axis (as a percentage of U.S. domestic production - exports). According to Figure 2, domestically made and sold wood household furniture increased slightly from 1997 to 1999 and remained stable until 2002 at roughly \$12 billions. China replaced Canada as the number one wood household furniture exporting country to the U.S. in 2000. These numbers show that the U.S. domestic producers have not been able to take advantage of a growing domestic retail market which grew from \$14.2 billions in 1997 to \$19.6 billions in 2002. Imports are gaining market share reaching 63% of the US made – US sold casegoods with China gaining the most.

Typically, for a product offering little options for personalization, price, quality, and order fulfillment time are the main sales arguments [1] [4] [7]. As discussed previously, U.S. wooden casegood furniture manufacturers are not known to offer significantly faster order fulfillment than do off-shore manufacturers. Quality often is not different for products from different origins. Under those conditions, price becomes the most

important sales argument. However, as the statistics show, domestic manufacturers fare poorly in markets where competition is based on price [23].

### 3.2 Upholstered furniture (NAICS 337 121)

Upholstered furniture manufacturing consists of two distinct processes: the construction of an internal frame and the upholstery process. Components for construction of the internal frame are mainly produced from plywood. They are cut out with panel saws, band saws, or CNC routers after which components are assembled to a frame by using staples, screws and nails. In parallel to the frame production, foam and fabric or leather is cut to the required shape to fit the frame and installed. The upholstered furniture then is packaged and either put in inventory or shipped to retail stores.

In Figure 3, upholstered furniture imports to the U.S. are presented as a total and from the four leading import countries Italy, China, Mexico, and Canada between 1997 [21] [22]. Total imports are presented in Billion US\$ and imports from the leading countries are presented as a percentage of domestic U.S. production minus exports. The value of upholstered furniture produced and sold in the U.S. increased from \$8 billion in 1997 to \$10.5 billion in 2002. Overall imports are low (15% of US made – US sold products in 2002) compared to wooden casegood household furniture. The leading country of export to the US is Italy, but its share of the upholstered furniture market decreased from 6% in 2000 to 3% in 2002 (measured as a percentage of U.S. domestic production sold in the U.S.). China gained market share from almost no exports to the U.S. market in 1997 to 3% in 2002.

The U.S. upholstered furniture industry protects its market share much more successfully than does, for example, the wooden casegood household industry. It can be argued that upholstered furniture offers a higher level of personalization to customers. Customers generally have an impressive choice of fabrics and colors when buying upholstered furniture. Accessorizing is the prevalent option offered by that industry. The final assembly using the specified fabric option chosen by the customer is conducted in an assemble-to-order mode by the factory. Thus, logistics may represent a barrier for offshore imports. However, since communication is simple, reliable

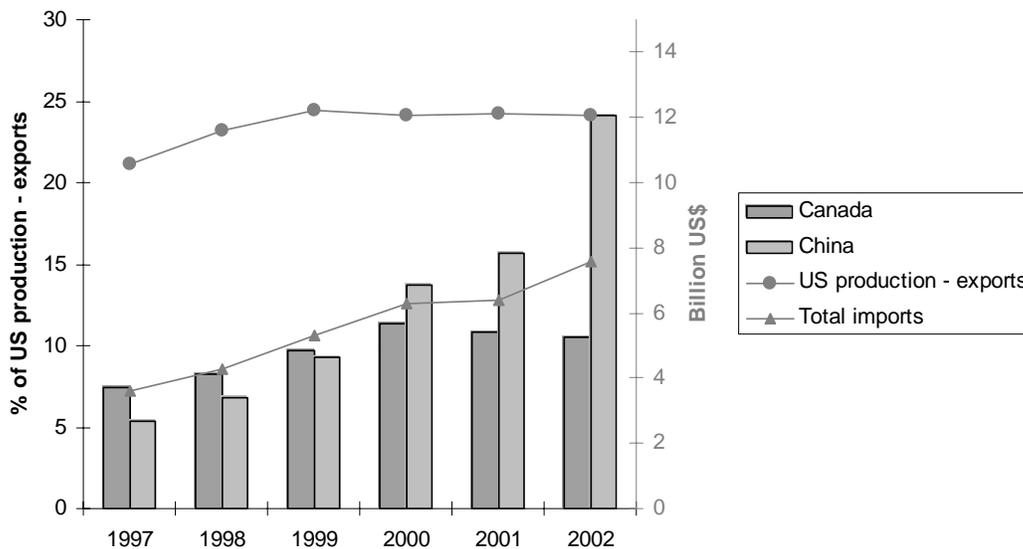


Figure 2: Total imports of wood household furniture in billion \$ and imports from the leading countries as a percentage of U.S.-made/U.S.-sold wood household furniture.

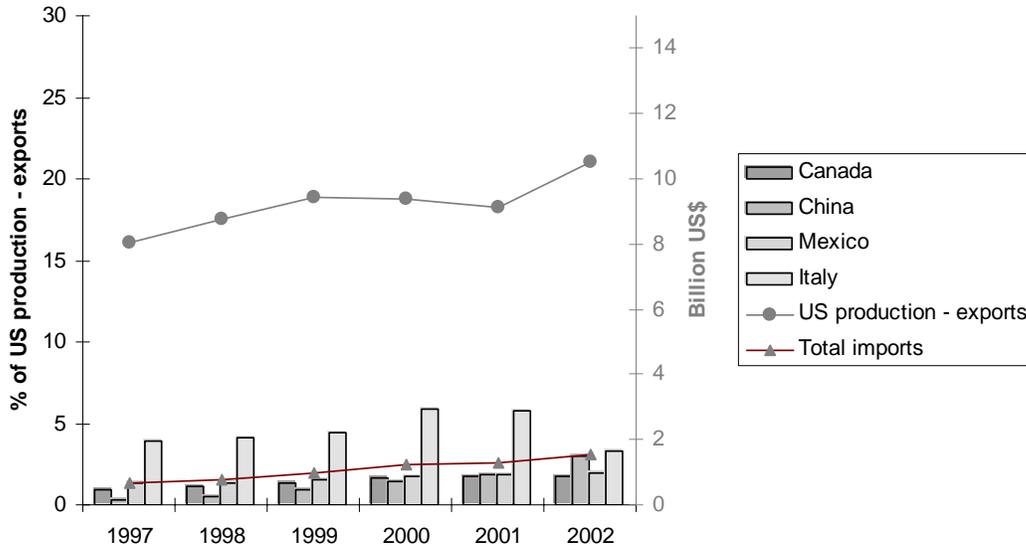


Figure 3: Total imports of upholstered furniture in billion \$ and imports from the leading import countries as a percentage of U.S.-made/U.S.-sold wood household furniture.

and inexpensive, thanks to the Internet, and air cargo transportation is becoming more prevalent, this competitive advantage is eroding. Only recently, a Chinese upholstery furniture company started to offer personalized furniture through the Internet ([www.shangrilachina.com](http://www.shangrilachina.com)). However, MC concepts for upholstered furniture industry can be advanced. An example would be to integrate ergonomics into a personalized piece of upholstered furniture (meaning a switch from accessorizing to configuring or tailoring). Such a strategy would make the manufacture and distribution of upholstery much more complex and may offer domestic producers a way to stay ahead of foreign competition.

### 3.3 Wood office furniture (NAICS 337 211)

The wood office furniture industry is a much more consolidated industry than is, for example, the wooden casegood household industry. However, with the emergence of the home office, the distinction between these two industries is somewhat blurred. Processes used to produce wooden office furniture are similar to the

casegood industry, with the difference that more wood composite boards are employed. Also, office furniture has to be seen more as a system, where different types of furniture (such as, for example, partitioning walls, desks and cabinets) have to correspond with each other in a modular system. Thus, the complexity of office furniture is higher for office furniture compared to casegoods.

Figure 4 presents wood office furniture imports over the last five years as a total of imports and also shows imports from the two leading import countries, Canada and China [21] [22]. Total imports of wood office furniture are presented in Billion US\$ and imports from the leading countries are presented as a percentage of domestic U.S. production minus exports. U.S. production sold domestically increased from \$2.9 billion in 1997 to \$4.1 billion in 2000. By 2002 it had decreased to \$2.7 billion due to the September 2001 events. Canada is the leading wood office furniture exporter to the U.S. market. Canada, traditionally having an import market share fluctuating around 10% of the production made and sold domestically in the U.S., it took a leap to nearly 25%

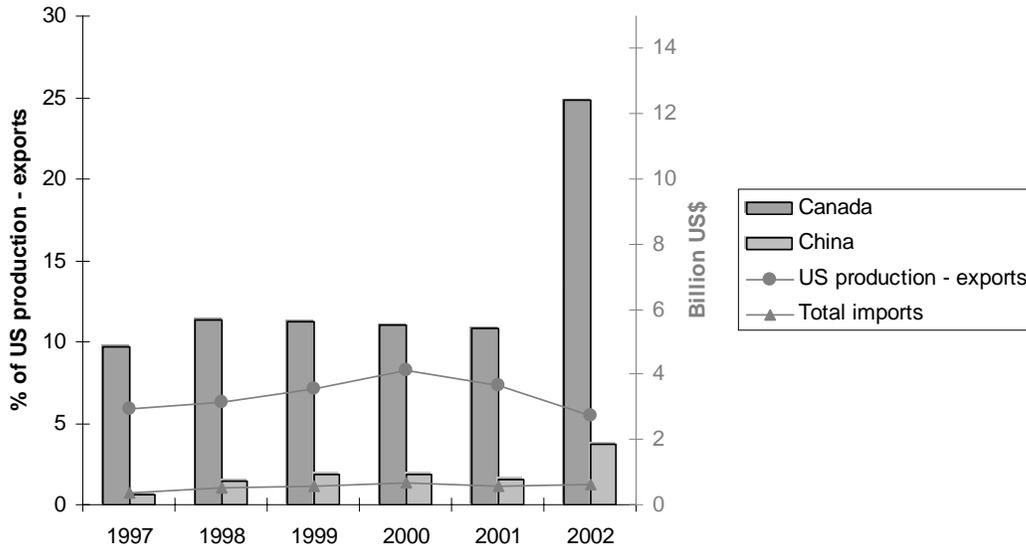


Figure 4: Total imports of wood office furniture in billion \$ and imports from the leading import countries as a percentage of U.S.-made/U.S.-sold wood household furniture.

in 2002. Due to the burst of the .COM bubble in 2001, US made office furniture sales decreased significantly from 2000 to 2002, particularly from 2001 to 2002. The dollar value of Canadian imports decreased from 2000 to 2001 but kept nearly stable from 2001 to 2002. Because Canadian imports are given as a percentage of US made – US sold products, it gained relative importance over that period. From 1997 to 2002, imports from China increased from 0.6 to 3.7%.

Wood office furniture manufacturers have taken advantage of MC to varying degrees. Modularized products (configuring) and accessorizing are the most common approaches taken. However, individual furniture modules are typically inventoried by the manufacturer. To create an office space, end users consult product catalogs or visit a store to make a selection based on their preferences. Generally, no guidance by sales representatives is necessary to conduct configuration.

It can be argued that the mixed module orders and the accessorization offered by office producers may be one of the barriers to off-shore imports. Canada has been able to take advantage of its closeness to US markets and the favourable Canadian dollar exchange rates over the 1997 – 2002 period . However, most companies have yet to discover and deploy the full potential of MC. Ship-to-order strategies result in high levels of inventory and limit options for customization. While the wood office furniture industry has begun to explore MC, it still has not taken yet advantage of the entire potential of MC.

### 3.4 Wood kitchen cabinets (NAICS 337 110)

Broadly defined, wood kitchen cabinets consist of cases with shelves or drawers and fronts. Cases and shelves are generally made from wood-based composite boards in rough, melamine laminated or veneered form. Fronts and drawers may be made from solid wood or composite boards. To ship a complete kitchen, all units of a given order are often processed as one batch. However, fronts, drawers, shelves and cases may be processed in different departments or even different facilities. The kitchen cabinet industry has some of the most advanced systems to facilitate such a dispersed production. The parts will join each other at the assembly lines. Appliances, however, may be shipped directly to the installation site.

Figure 5 presents wood kitchen cabinet imports between 1997 to 2002 as a total and from Canada and China, the

two leading exporters to the U.S. [21] [22]. Total imports are presented in Billion US\$ and imports from the leading countries, as a percentage of the domestic production minus exports. The value of U.S.-made-U.S.-sold wood kitchen cabinets increased continuously from \$9 billion in 1997 to \$14 billion in 2002. Overall import share is low at 4% of US made – US sold products in 2002. Canada, the leading exporter to the U.S. represents about 3% of the domestic U.S. production sold in the U.S. China, the second most important exporter of kitchen cabinets to the U.S., shipped less than 1% of the domestic U.S. production sold in the U.S in 2002. The U.S. kitchen cabinet manufacturers do not appear to be under pressure from international competitors. The U.S. companies were able to take full advantage of an expanding US market and have grown domestic sales by 56% from 1997 to 2002. Canadian imports are stable and Chinese competition is not a threat to US manufacturers.

MC is widely implemented in the kitchen cabinet industry. Configuring was implemented decades ago. Parts standardization and the use of sectional modularity to decrease variety in the manufacturing system is prevalent throughout the industry. IT implementation and the use of the Internet have nearly eliminated information transfer related delays. An argument can be made that this make-to-order manufacturing strategy of the kitchen cabinet industry presents an important barrier to offshore imports.

### 4 CONCLUSIONS

Reviewing domestic production and import data of furniture from 1997 to 2002, it appears that standardized, commodity-like products are more likely to loose market share to international competitors. Based on the data presented, this paper supports the proposition that more customized products are helping domestic manufacturers to successfully compete against imports. If so, MC would then appear to be a business strategy that can be successfully used to fend off fierce offshore competition, at least to a large extent.

The term MC was coined in 1987 by Stanley [3] who described the concept of MC as producing products and services that are tailored according to individual customer needs and preferences. The MC taxonomy adopted by this paper consists of eight personalization options: popularizing, varietizing, accessorizing, configuring, tailoring, servicing, adjusting, and monitoring. Each one of

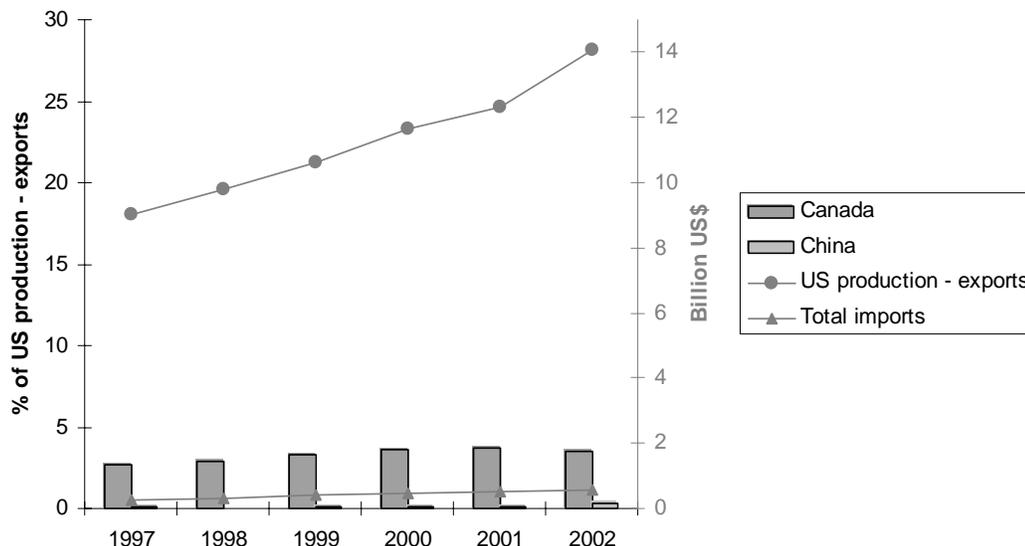


Figure 5: Total imports of wood kitchen cabinets in billion \$ and imports from the leading import countries as a percentage of U.S.-made/U.S.-sold wood household furniture.

these eight options entails a different degree of customization at different stages of a product's life cycle. Since customers do not pay an unlimited premium on MC products, MC requires manufacturers to control product costs. Since all MC products, by definition, are make-to-order, short lead time is required. Both goals can be achieved by product standardization, the involvement of IT, a lean manufacturing process and a dynamic network of suppliers.

To support the proposition that MC is a successful way to compete against international competitors, domestic production and import data for four furniture industry sectors were analyzed (wooden casegood household furniture, upholstered furniture, office furniture, and kitchen cabinetry). This evidence seems to indicate that the different levels of personalized products offered by the different furniture industry sub-sectors is correlated to domestic market success. The U.S. kitchen cabinet industry that offers the highest level of product customization, is not greatly affected by imports. Conversely, the wooden casegood household furniture industry that manufactures products with the lowest level of customization of the four industry sub-sectors researched is heavily affected by imports. Upholstered furniture and wood office furniture are in between those two sectors, with both sub-sectors offering a certain degree of MC implementation.

Clearly, based on the successes reported in other manufacturing industries such as PC's (Dell), bicycles (NBIC) or clothes (Land's End), MC promises large rewards for companies that can come up and implement a successful MC strategy.

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