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Product Design for Mass-Individualization

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Abstract

This paper suggests that Mass-Individualization, which is based on a consumer product that consists of an open hardware platform and multiple modules that are interfaced with the platform, will constitute the next paradigm in product design. Customers will be able to adapt the open platform to their needs by integrating modules of their choice into the platform, thereby constructing individual products that fit their exact needs. Large manufacturers will produce the platforms, and small companies will invent and produce modules that could be interfaced with the open-platform products. Smartphones is an example of an open-platform product, and the Apps that are designed to run on smartphones are examples for modules. Each customer downloads certain Apps that fit his/her needs, thereby creating an individual smartphone. The Apps, however, are software modules. The modules that are considered in this paper are hardware modules. Open-platform products will create a new paradigm in product design and utilization that we call the Mass-Individualization paradigm. The Mass-Individualization paradigm will boost the economy by (1) creating many new jobs in module production companies and (2) increasing the level of sales of consumer products.

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1. Introduction

An open product is a product designed so that hardware components (i.e., modules) can be easily added to its original structure in order to adapt the product features to the desire of the individual user. For example, PCs are open products – new hardware components can be easily interfaced with a PC to allow new utilizations. The smart iPhone has an open architecture that allows the addition of Apps that are adding features to the original phone.

In Mass Customization the product architecture is closed, and the manufacturer designs all the components that can be integrated into the product. The buyers choose the components and options that fit their desire and requirements, but often the availability of options limits the customers' needs (e.g., audio systems for cars).

A product with an open hardware platform provides potential module developers access to the architecture without many proprietary constraints. The original equipment manufacturer (OEM) of an open-platform product (1) builds a product that enables adding external modules, and (2) publishes explicit standards and instructions that allow potential developers to integrate their innovative modules into the main product, adding thereby new features to this product.

Examples of open-platform products may be the interior of automobiles, kitchen cabinets, refrigerator interior, office chairs, smart houses, industrial machines, and hospital beds. For example, modules may be added to open-platform hospital beds to facilitate individual patient's limitations and the type of his/her disease. The open-platform interfaces in all these products should be publically defined to enable module integration that enables adapting the product to uses desired by customers.

We define an open-platform product as follows: *An open-platform product is one with a platform that allows easy integration of modules from different sources into the product in order to fit its functionality exactly to the user's individual desire and needs.*

We believe that numerous innovative hardware modules may be invented for integration into common open-platform consumer products. To estimate the potential market of such modules and their impact on the economy let us look at the

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Apps market. According to the market research firm Gartner [1], 102 billion Apps were downloaded in 2013. Although 90% of them were free, they still generated $26 billion sales.

The European App economy employs 1 million developers and 800,000 people in marketing & support posts [2], and it created revenues of €8.1 billion in 2013 [3].

Although that each hardware module for futuristic open products will have just a small market share, the total market for hardware modules for a variety of open-platform consumer products will be by far larger than the Apps market, and it will create more jobs. These jobs will include also simple production and assembly jobs, and not only jobs that require high education as needed for Apps development. Of course hardware modules will not be free as many Apps are, and hardware modules will be more expensive than downloading Apps, but that means that the market potential for hardware modules will be probably by far larger than the Apps market reported above. Furthermore, when more buyers will demand open products, it will extend the scale and scope of modules, which, in turn, will expand the number of module manufacturing companies, and this will provide even larger boost to local economies.

We believe that an economy that encourages open hardware products will flourish. The large corporations will manufacture the main product platforms (equivalent to smartphones) and numerous small businesses will invent and produce hardware modules. As people learn of the potential advantages of open products, the society will demand additional such products. Public demand for them will grow and they will become widespread across societies and nations. This, in turn, will lead to the establishment of many new module design companies, resulting in a massive expansion of the economy.

The interior of private airplanes is designed and built to meet the needs of the individuals that buy the plane. Similarly assume that customers were offered the opportunity to design the interior of their new cars. Such a scenario would include a variety of modules (e.g., storage compartments, microwaves, mini-refrigerators, beds, dog baskets) that customers could choose from and arrange in their car according to their individual preferences. (Of course, subject to safety and manufacturing constraints.) As a result, the interiors of cars, of the exact same model, will differ greatly from one another, creating thereby a large mass of individual, unique cars. The OEM of the open platform product, usually a big firm, will not develop and produce these modules. However, to ensure safety constraints the firm will have to approve the modules before their integration into the main product.

We call this new paradigm "Mass-Individualization" because a large mass of products is produced, but each one is tailored to the needs of the individual buyer. It is a paradigm in which products are built with their critical functions by large companies (as with smartphones), and include an open platform that enables the integration of hardware modules. The selection and fit of these modules requires consumers to be involved in the design of their final individual products. In mass-individualization the creative act of the buyer yields the final product, and the number of options depends on the creativity and ingenuity of many companies that produce modules.

2. Comparing Product Design Paradigms

We would like to observe the transitions from Mass Production, to Mass Customization, and to the new paradigm of Mass Individualization. In all these three paradigms there are three basic actions: Design the product, Make the product, and Sell the product. The differences are (1) in the sequence of the three operations, and (2) in the customer's role and involvement in buying the product.

In ***Mass-Production*** the product architecture is unified. Products are designed and built by the manufacturer and then offered for sale, hopping that customers will buy them. The sequence of actions is simple: Design –>Make –>Sell.

In ***Mass Customization*** the product architecture is modular. All modules are designed by the product manufacturer, and offered to customers as optional product choices. The customer selects the modules that s/he wishes (sometimes from a very large variety), and then pays for the product. Only then the product is made and delivered. (A good example is Dell computers.) The sequence of actions is: Design –>Sell –>Make. This sequence is illustrated in Figure 1.

In mass-customization even if some customers feel as if they are designing their product, the truth is that they are NOT involved in the design of their products. They are simply selecting an option.

In ***Mass Individualization*** the sequence of the three operations is more complex, and is depicted in Figure 1 [4]. The sequence is as follows:

1. The manufacturer designs the product platform with a large variety of possible interfaces for new modules, and defines the interfaces.
2. The customer selects a platform and searches on the Internet for desired certified modules that fit the selected platform. Different vendors may produce the modules. Then the customer designs his/her final personal product with all the selected modules.
3. The customer orders and pays for the platform (the main product; equivalent to the smartphone) as well as for the selected modules.
4. The modules are sent to the manufacturer and the final product is made.

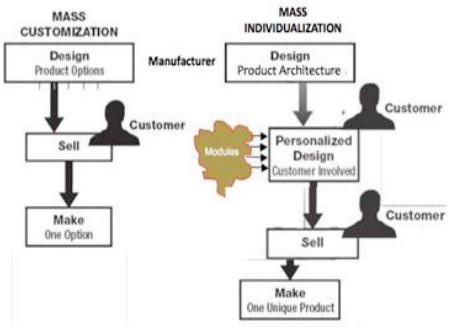

Fig. 1. Flow-chart of mass-customization and Open Products