Available online at www.sciencedirect.com

ScienceDirect

Procedia Engineering 107 (2015) 223 – 236

Procedia Engineering

www.elsevier.com/locate/procedia

Humanitarian Technology: Science, Systems and Global Impact 2015, HumTech2015

HUMANIT3D for disaster response: an assessment of mass customization on organizational performance under turbulent environments

Abdo Shabah, MD MSc MBA*

Universite de Montréal, C.P. 6128, succursale Centre-ville Montréal (Québec) CANADA H3C 3J7

Abstract

Mass customization aims to produce customized goods (allowing economies of scope) at lower cost (to achieve economies of scale) using multiple strategies (modularization and postponement). Mass customization in software and hardware design is becoming more popular for users and researchers. Through a simulation experiment of emergency response organizations under turbulent environment, we aim to compare standardization and mass customization of services and assess the impact of different forms of mass customization (early and late postponement) on performance, quality and consumer satisfaction, on the use of modular dynamic ecosystem based on HUMANIT3D, an integrated collaborative ecosystem composed of UAV management system, data collection system, and 3D Geographic Information System. Our hypothesis is that mass customization performs better and achieves better quality in turbulent environment than standardization, but only when using early postponement strategies. Using mixed methods study, we try to confirm our hypothesis.

Peer-review under responsibility of the Organizing Committee of HumTech2015

Keywords: mass customization; postponement; experiment; performance; quality; satisfaction; 3D GIS; UAV; mobile ecosystem

* Corresponding author. Tel.: +1-514-803-0920; fax: 1-866-664-6285
E-mail address: abdo.shabah@umontreal.ca; info@abdoshabah.com

Peer-review under responsibility of the Organizing Committee of HumTech2015
doi:10.1016/j.proeng.2015.06.077

1. Mass customization and turbulent environments

The concept of mass customization, born in 1980's, aims to produce customized goods (allowing economies of scope) at lower cost (to achieve economies of scale). This production method allows companies to gain access to new markets and approach customers whose personal needs are not met by available standardized products [1]. Mass customization relies on a "common adaptive platform with capabilities about combining and mixing-and-matching modules to achieve different product specifications" [2]. Mass customization requires three fundamental capabilities:

- a solution space for development, where product attributes are aligned to specific divergent customer needs,
- a process design where product components combinations correspond to these customer needs, and
- a navigation aid tool to support customers in identifying their own solutions while minimizing complexity and burden of choice called "mass confusion" [2].

Mass customization is part of a continuum of process adaptation ranging from pure standardization, to standardization segmented, to customized standardization, to tailored customization, and to pure customization [3].

Pure standardization permits no differentiation, while the segmented standardization targets different customer segments products. Custom standardization includes the final assembly of modules according to specific customer needs. Mass customization includes custom specific and individualized modules that are assembled for specific customer needs. Finally, there is the full personalization of the product, which is another way to illustrate crafting [3].

There are four different approaches to mass customization: collaborative, adaptive, cosmetic and transparent.

- Collaborative customization : tries to understand through discussions with customers their exact needs, while in the
- Adaptive Customization : the product is designed so that the customers are able to modify according to their specific needs.
- Cosmetic customization: the presentation of the product is different depending on the customer
- Transparent customization: the individual customers are offered unique products or services within a specific standard format [4].

A central aspect of mass customization is modularization. Modularization is an "approach for organizing complex products and processes efficiently by decomposing complex tasks into simpler portions so they can be managed independently and yet operate together as a whole" [5]. Modularization refers both to the "tightness of coupling between components and the degree to which the 'rules' of the system architecture enable **(**or prohibit**)** the mixing-and-matching of components" [6]. Through standardization of interfaces, modularization combines separate components inter-changeably [7] without compromising system integrity [8]. Mass customization tries to fill customer needs with unique assembly of modular components [9] [10] [11]. Configurable modular components can ensure product quality, while reducing the risk of obsolete inventory, thus reducing inventory costs [9] [12]. In addition, the capacity to co-design and co-produce with customers can enhance the potential for capturing new information from clients on actual and future market needs.

A second core feature of mass customization is postponement, which is defined as "an organizational practice of delaying the timing of the ending production or service processes, considering customers specific needs or requirements, allowing end products to assume their specific functionalities, features and identities" [1]. By delaying differentiation, the organization reduces the risk and the uncertainty related to the differentiation of products or services. This requires accurate and quick information capture from consumers.

1.1. Mass Customization through an integrated ecosystem (UAV, GIS, collaborative mobile data collection)

Mass customization is the new frontier in business for both manufacturing and service industries, providing an increase in variety and customization without a corresponding increase in costs. Compared to products, mass customization in the emergency response sector consists of team involvement in the process and in a new way that the emergency services and tools are used through the emergency management process [13]. Combining modularity and postponement in emergency response allows different degrees of customization. Information technology