

Life-cycle-Based (LCB) online acquisition framework for supporting Mass Customisation (MC) in practice

Shyh-Jian Tang, B. Tjahjono, John M. Kay

Department of Manufacturing
Cranfield University
Building 50, MK43 0AL, Bedford
UK.

E-mail: <tsjmark@yahoo.com.tw; s.tang.2002@cranfield.ac.uk>

Abstract:

Mass Customisation (MC) has been perceived in many articles as a strategy of choice for any company. However, Mass Customisation (MC) can be easily discussed at a strategic level; but it is rather more complicated to undertake it organisationally and operationally. The aim of this paper is to explore an effective framework that can support the development of Mass Customisation approaches. Two main contributions are addressed in this paper. One is to prove the insufficiency of current Value-Chain-Based (VCB) MC approaches by using empirical evidence; the other is to propose an online Life-Cycle-Based (LCB) acquisition framework which can be used for developing more comprehensive MC approaches.

Keywords:

Mass customisation, Evolutionary acquisition, Life-Cycle-Based, Acquisition framework

1. INTRODUCTION

The MC advocator Pine [13], asserted that "Mass customisation is the customisation and personalisation of products and services for individual customers at a mass production price". From a strategic point of view, Mass Customisation (MC) was proposed to link the three 'value disciplines' of strategic bases [18]. It is pursuing the cost leader, product leader, and the best relationship with customer simultaneously as a way of strategic aggregation. However, due to the vast differences in customer preferences, MC can also produce unnecessary cost and complexity. As asserted by Piller & Muller [12], "before managers adopt this new strategy, it is crucial for them to examine thoroughly what kind of customisation their customers would value". Therefore, in this paper, the problem background of the research concerns the issue that *"MC can be easily discussed at a strategic level; it is rather more complicated to undertake it organisationally and operationally"*.

2. THE INVESTIGATION OF CURRENT THEORICAL MC APPROACHES

2.1. The inadequacy of Value-Chain-Based (VCB) MC approaches

The theoretical model applied in developing MC approaches by many MC researchers is related to Porter's 'Primary activities' in the Value-Chain model [15]. There is a key prerequisite in the 'Primary activities' that either the customer requirements are defined or the product specifications are well developed. However, several piece of literature indicates that customers are not able to describe their needs precisely and are therefore unable to translate their wishes into product specification that allows the company to build a customised product or deliver a customised services [1],[11],[19]. It reveals that portions of important Mass Customisation activities occurred

before product definitions and so that cannot be covered by the Value-Chain-Based (VCB) model. Since most of the theoretical MC approaches are developed explicitly based on the Value-Chain model and further to address the stages or the ways to customise the products such as Pine [14], Lampel & Mintzberg [7], Ross [16], Graca & Linda [4], Duray et al. [3] and Silveira et al. [17], these approaches are not able to support MC activities comprehensively. The similar argument asserted by MacCarthy et al. [8], “the earlier taxonomy of MC approaches based on the Value-Chain or product customising extent is inadequate to reflect the complexity of the customisation process such as Lampel & Mintzberg [7]”. Therefore, there is a need to validate this argument and further propose a proper initiative to complement the weakness. In this regard, a survey research strategy is adopted to undertake the investigation in order to identify the evidence in a solid base. The purpose of survey is to describe the current situation happen in several Mass Customisation (MC) key enablers. Those enablers are based on the literature study in the areas of MC success factors and limitations. They are MC needs, MC competence, Adoptability of Information & Communication Technologies (ICT), and Company change intentions. In the survey, a detailed investigation into how customers can dictate their MC needs is conducted. Figure 1 shows the statistical results that 66.1 % of customers (The levels of Wish, Operation and Function) are not product experts. Because of an existing lack of technical competence, non-expert customers often do not know what they really want and are also often not aware of their real preferences until they see them physically. Furthermore, even if they are capable of identifying their real needs, they will have problems in communicating them to suppliers, especially at a level of product specification. Based on this sampling logic, the first piece of primary data provides the evidence that the Value-Chain-Based (VCB) model cannot address necessary MC activities comprehensively which resulted from its key prerequisite that the product definitions are well defined before any MC activities take place.

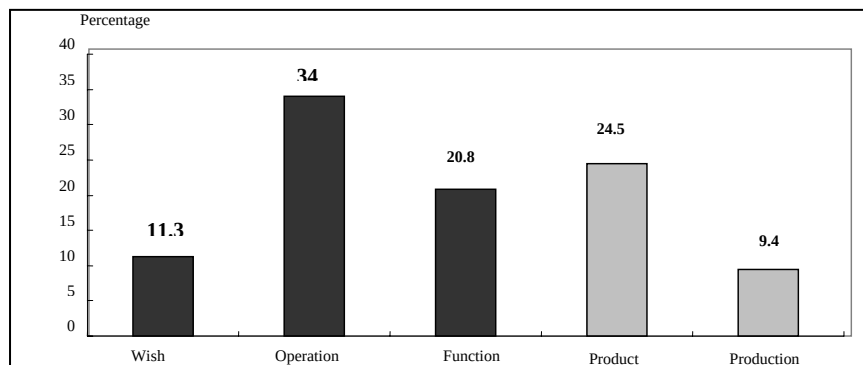


Figure 1 : The dictation level of MC needs

Another survey results in terms of a statistical analysis of ‘the distribution of MC activities’ (see Figure 2) show that 67.9 % of MC activities occur at the concept phase and 64.2 % occur at the design phase, only 30.2 % allow customers to perform customisations in the engineering phase; 24.5 % companies is in the manufacturing phase; logistics phase is 39.6 %; and recycling phase is 20.8 %.

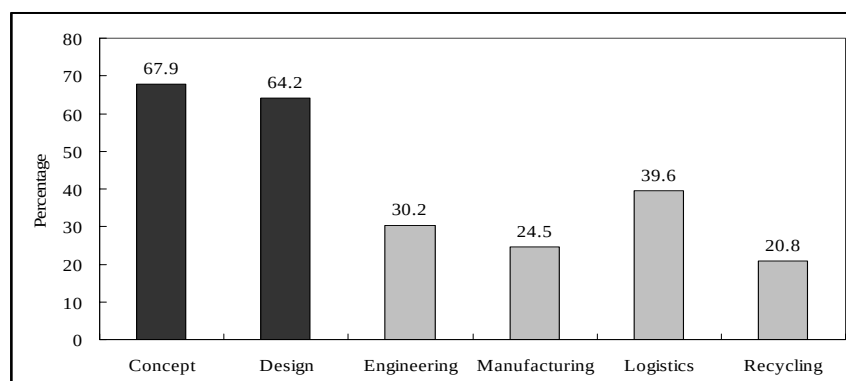


Figure 2: The distribution of MC activities

The results of this survey data conform that most of the customising activities occur before the product definition (Concept phase and Design Phase), which implies that a considerable effort is spent on the requirement customisations and design customisations. Thus, explicitly, the Value-Chain-Based MC approaches cannot cover all the possible customisation activities, which in practice occur in the phases of defining the requirements/product specifications and the phases of after product usage. Therefore, the second piece of primary evidence is also identified. According to the evidence collected from the secondary data and primary data, the argument that “*Value-Chain-Based (VCB) MC approaches do not support MC comprehensively*” is validated.

2.2. The Life-Cycle-Based theoretical model

The conventional Value-Chain-Based model focused on the supply activities. It was not greatly concerned with the customer's activities. Therefore, it set out the hypothesis that the customer's requirements have been clarified or the product's specifications have been well defined, and as a result, the customer requirements are unlikely to change. However, several experts [7],[8] have asserted that the MC products also vary in the degree of their customisation, and the number of transactions, by which buyers come to agreements with the sellers. Therefore, mass customisation will entail many interactive operational scenarios corresponding to different transaction procedures. As such, an MC business model requires a dynamic operation environment and a quick response to change. Therefore, a more comprehensive model, which can be easily adapted to define the coupling and decoupling points between seller and buyer, must be considered. Therefore, based on an in-depth literature study, a Life-Cycle-Based theoretical model is put forward as a substitute for the Value-Chain-Based model in the development of an MC approach. The Life-Cycle-Based model is a modification and combination of several government and international standards, such as IEEE, ISO and USA/UK Military Standard [5],[6],[9]. In comparison with the Value-Chain-Based model, the benefits of a Life-Cycle-Based model for developing MC approaches are (1) more in-depth analysis of the degree of product customisation, (2) more effective analysis of the degree of customer involvement and integration, and (3) clear definition of the coupling and decoupling point.

2.3. The ICT ADOPTABILITY

As a significant conclusion of the literature review [10],[17], the ICT adoption can increase customer involvement and information efficiency to overcome the drawbacks of information overflow and further enable an effective and efficient MC approach to be achieved. Therefore, a survey of ICT adoptability, based on the Internet online setting and focused on the online MC applications, was undertaken. The investigation collects data from the Internet based business applications about the level of customising activities. The activities range from basic one-way information advertising to full customisation capability. Figure 3 shows that the percentage of ICT adoption dramatically declines in MC applications offering design customisation(7.7%) and concept customisation(1.9%). However, a previous survey about ‘the distribution MC activities’ during the product development life cycle (see Figure 2) shows that a very high percentage of customisation activities is performed in the concept phase(67.9%) and design phase(64.2%); a moderate percentage in the engineering phase(30.2%) and only 24.5% in the manufacturing phase. The adoptability of Information & Communication Technology for MC applications does not seem to fit the right places in practice. This observation provides an interesting issue for further investigation.

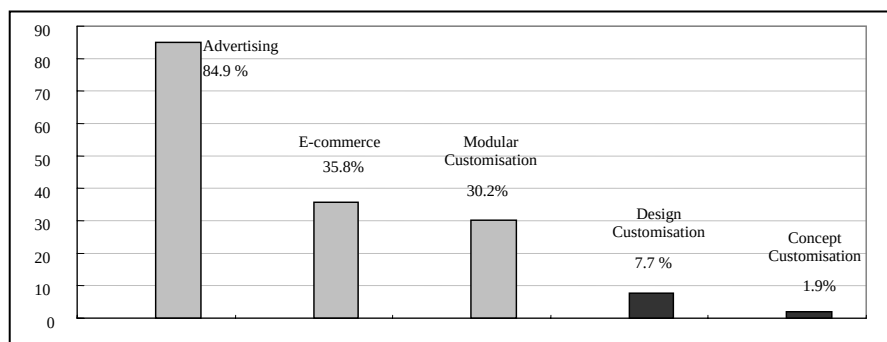


Figure 3: ICT adoptability in MC customisation

Following the survey, several companies were interviewed about the way they perform concept customisation and design customisation. Currently, most of the companies use face-to-face discussions, telephone or e-mail, as the chief means of performing customising work in these two phases. The customisation results are progressed by reports and proposals. The process involves a high overhead cost, resulting from the investments of labour, lead time, knowledge and communication during the pre-sale service. When the question “why does a company use manual methods to provide pre-sale service” is asked, most of them say that the majority of customers still prefer one-to-one consultancy services. Some of them express the view that the customisation activities at the requirement and/or design phases require intensive interactive actions. They think that face-to-face is a more reliable way to increase the effectiveness of interactive communications. In summary, the responses to this question are about customers who would like to have an expert-like service that can answer all their questions and sort out their needs in a timely manner. In an implicit way, customers can observe and judge the company's ability in order to consider further commitments. When the question about the feasibility of expanding ICT adoptability to provide pre-sale services is asked, most companies reply that they have thought about it but that it is still at the exploratory stage. Some of the companies respond very straightforwardly and indicate that the online tools are not yet mature enough in their business sector. A few of the companies have subcontracted software companies to develop online configuration tools for product customisation but these do not cover the requirement phase. According to the follow-up interviews, there is uncertainty about how easily ICT can be applied across the whole MC life cycle process. To try to understand this better, a linear regression analysis is used to investigate the relationship between the five variables which are the context of the survey questions i.e. MC needs, MC competence, Information & Communication Technology adoptability, Change intentions, and Company size.

Among these five variables, the change intentions are related to the transformation of the organisational structure towards MC or reinforcement of the MC capability in the future. Logically, higher Change intentions depend on higher MC needs, Higher MC competence, and comprehensive ICT adoptability and lower company size. Therefore, the regression model is constructed as below. In this model, the dependent variable is presented by the Change intentions and independent variables are presented by MC Needs (Needs), MC competence (Competence), Information & Communication Technology adoptability (MC_IT) and Company size (Size) (see Figure 4).

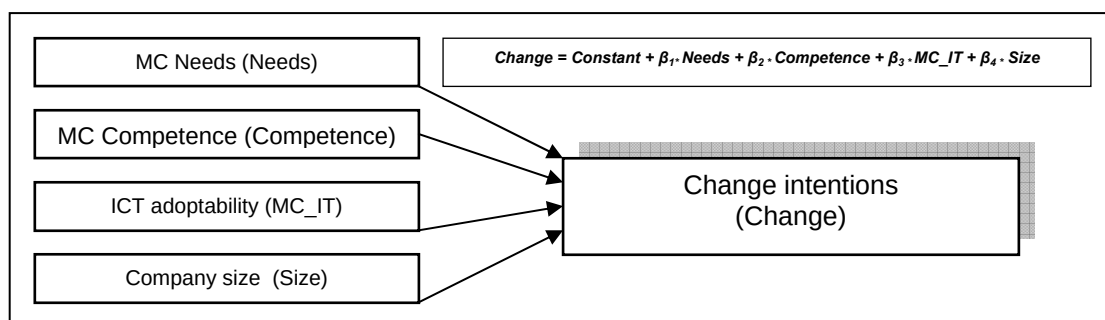


Figure 4: The regression model

The results show that the Change intentions are positively influenced by the adoptability of ICT in a highly statistical significance (see Table 1).

Regression model	Standardised Coefficients
Needs	0.223
Competence	0.015
MC_IT	0.354**
Size	0.033
R ²	0.18
Adjust R ²	0.11
F	2.57**
Durbin-Watson	1.73

P<0.1 * p<0.05 ** (Dependent variable is Change intentions)

Table 1: Linear regression stastical results

According to the regression analysis, it can be inferred that the ICT adoptability is a key consideration for companies to transform their organisational structure towards MC or reinforce the MC capability in the future.

3. THE EXPLORATION OF A ONLINE LCB ACQUISITION FRAMEWORK

Since Life-Cycle-Based (LCB) model is more comprehensive for developing MC approaches than the Value-Chain-Based (VCB) with regard to comprehensively supporting MC activities, an online Life-Cycle-Based (LCB) MC acquisition framework is proposed, (see Figure 5). This framework also includes considerations of the acquisition process concept, Interactive strategy and ICT adoptability which are suggested in the literature review and the survey study.

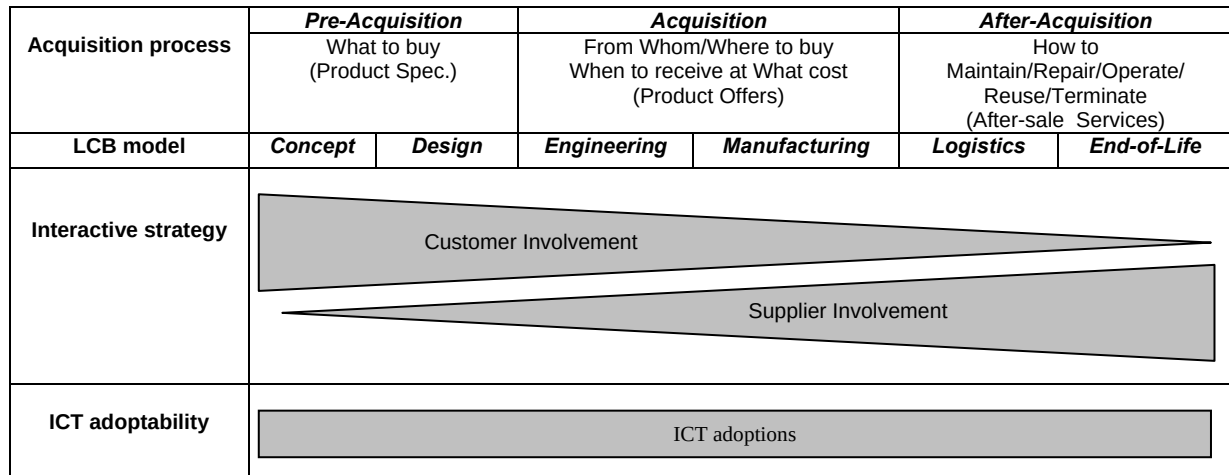


Figure 5: Online LCB acquisition framework

The acquisition process. The concept of the acquisition process is based on recent emerging schemes in defence system acquisition management, which were adopted in the USA and UK defence industries such as USA DOD 5000-2 [2] and UK smart acquisition [20]. According to Figure 5, the first stage is the pre-acquisition process, to decide what to buy; it concerns the product specifications. The second stage is the acquisition process, to decide who to buy it from /where to buy it from, when to receive and at what cost; it concerns the product offerings. The third stage is the after-acquisition process, to decide how to maintain/repair/operate/reuse/terminate the goods; it concerns the after-sale services. This acquisition process can effectively portray the customer purchasing behaviour in MC cases.

Interactive strategy. According to survey study, most of the customer knowledge levels of product customisation are located before the functional level (see Figure 1). Therefore, MC in the manufacturing industry addresses a wide range of customers that goes far beyond the scope of product experts. Considering the fact that the order fulfilment responsibility should be clear and the manufacturing disturbance should be mitigated, the degree of customer involvement should decrease throughout the product life cycle. Conversely, the degree of supplier involvement should increase along the product life cycle span because of the customer's expectations for a quick delivery and excellent after-sale services.

Information and Communication Technology (ICT) adoptability. According to the survey study focusing on the adoptability of ICT, two findings are identified which are (1) the greater the degree of information-richness in the transaction process, the greater the benefits of matching the customer's sacrifices in mass customisation tradeoffs; and (2) the adoptability of ICT is a key factor that can increase the company's willingness to transform the organisational structure towards MC or reinforce the MC capability in the future. Therefore, In order to implement an MC transaction process with a greater degree of information-richness, it is necessary to apply a high leverage of ICT adoptability. Therefore, for integrating all the customisation and acquisition activities effectively

and efficiently, the adoption of ICT should be extended to encompass the whole acquisition process (see Figure 5).

4. CONCLUSIONS

There is no short cut to building the company's MC capability in a very flexible way. Companies must learn mass customisation through a continuous improvement process before commencing the MC business model. In this paper, through a survey study in practice, it showed that current Value-Chain-Based MC approaches were perceived to be inadequate to support all possible MC activities. In this regard, an online Life-Cycle-Based (LCB) acquisition framework was proposed to overcome this weakness. This online LCB acquisition framework provides a comprehensive approach which MC researchers can use as a base for developing more effective MC processes and schemes.

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