Int. J. Production Economics 159 (2015) 76–87

Contents lists available at ScienceDirect

Int. J. Production Economics

journal homepage: www.elsevier.com/locate/ijpe

Contextual variety, Internet-of-Things and the choice of tailoring over platform: Mass customisation strategy in supply chain management ☆

Irene Ng [a,*], Kimberley Scharf [b], Ganna Pogrebna [a], Roger Maull [c]

[a] Warwick Manufacturing Group, University of Warwick, Gibbet Hill Road, Coventry CV4 7AL, UK
[b] Department of Economics, University of Warwick, Gibbet Hill Road, Coventry CV4 7AL, UK
[c] University of Exeter Business School, Streatham Court, Exeter EC44PU, UK

ARTICLE INFO

Article history:
Received 8 October 2013
Accepted 3 September 2014
Available online 30 September 2014

Keywords:
Contextual variety
Tailoring strategy
Platform strategy
Consumer choice

ABSTRACT

This paper considers the implications for Supply Chain Management (SCM) from the development of the Internet of Things (IoT) or Internet Connected Objects (ICO). We focus on opportunities and challenges stemming from consumption data that comes from ICO, and on how this data can be mapped onto strategic choices of product variety. We develop a simple analytical framework that illustrates the underlying mechanisms of a product supplier/producer's choice between (i) producing multiple product varieties as a way of meeting consumer demand (a "tailoring strategy"), and (ii) offering a flexible and standardised platform which enables consumers' needs to be met by incorporating personal ICO data into various customisable applications (a "platform strategy"). Under a platform strategy, the ICO data is independently produced by other providers and can be called on in both use and context of use. We derive conditions under which each of the strategies may be profitable for the provider through maximising consumers' value. Our findings are that the higher the demand for contextual variety, the more profitable the platform strategy becomes, relative to the tailoring strategy. Our study concludes by considering the implications for SCM research and practice with an extension to postponement taxonomies, including those where the customer, and not the supplier, is the completer of the product, and we show that this yields higher profits than the tailoring strategy.

1. Introduction

In Supply Chain Management (SCM), the trade-off between efficiency and effectiveness at satisfying consumers' needs may take place at different points in the production cycle and even along the supply chain, providing opportunities for Mass Customisation (MC). The objective of Mass Customisation (MC) is to meet the needs of the customer for personalised products whilst allowing the provider of goods or services to derive the benefits of mass production (McCarthy, 2004). In a review of MC research, Da Silveira et al. (2001) state that MC can be defined using two different approaches: one is narrow and practical and the other is broad and visionary. The practical view emphasises the role of technology, process and structures in meeting specific customer needs; while the visionary approach focuses on the use of MC to reach mass markets when customers are treated individually. Building upon the work of Da Silveira et al. (2001) and Fogliatto et al. (2012) identify a number of research directions for future MC research. These directions include but are not limited to: the increasingly important role of Rapid Manufacturing (RM) in MC; the dynamics of value implications to individual customers; the design of quality systems that can deal with single items, and issues associated with warranty on customised items.

In this paper we identify a broad visionary approach to MC development that focuses on the role of customer value, and provide some insights into how organisations can approach the challenge of both scalability and customisation. We identify two possible MC approaches – a tailoring strategy and a platform strategy – and specify conditions under which each of them benefit providers of goods and/or services, placing a particular emphasis on the importance of contextual variety of use and its impact on customisation.

Since the customised manner in which customers' needs are fulfilled is uncertain at the point of consumption, not only for the providers but also for customers, one important aspect of a successful MC strategy is to defer the customisation of a product,

☆The authors gratefully acknowledge the funding contribution of Research Council (UK) Digital Economy to the H.A.T project (http://hubofallthings.org) grant reference EP/K039911/1 and also NEMODE EP/K003542/1 which have contributed substantially to the research conducted in this paper. We are also grateful to two anonymous referees and the managing guest editor for many useful comments and suggestions.

* Corresponding author.
E-mail addresses: irene.ng@warwick.ac.uk (I. Ng), k.scharf@warwick.ac.uk (K. Scharf), g.pogrebna@warwick.ac.uk (G. Pogrebna), r.s.maull@exeter.ac.uk (R. Maull).

http://dx.doi.org/10.1016/j.ijpe.2014.09.007

in its form or place, until the last possible point (Fetzinger and Lee, 1997). For example, Dulux is able to offer a vast range of paint colours through in-store mixing of a relatively small number of basic paint colours; whilst Jigsaw uses its vehicles in different combinations to meet the different demands of consumer goods and general haulage (e.g., Mason and Lalwani, 2008).

The key to MC is to postpone, as late as possible, the point where the demand signal enters the supply chain, i.e., to postpone the point at which work in progress gets turned into specific end products (Forza et al., 2008). This leads to a resurgence of interest in *postponement* as a field of study. Postponement is therefore a supply chain management strategy where the manufacturer produces a standardised and generic (and often scalable) product, which can be modified at the later stages before it is finally delivered to the customer, thereby achieving some degree of customisation.

A number of typologies of postponement have been developed.[1] In Fig. 1 below, the framework proposed by Yang and Burns (2003), the focus is on the point of the process where the customer order enters the system and identifies a number of theoretically potential designs. At one extreme there is pure speculation (Shapiro, 1984) where all stages (design, purchasing, distribution, etc.) are forecast through intermediate stages such as 'make to order'. In other words, the design and purchasing are speculative but everything else is made according to customer order. On the other extreme is Engineering to Order (ETO), where the product's design, purchase, fabrication, etc. are all based on the customer order. In a later paper, Yang et al. (2004) characterise these extremes as pure standardisation through pure customisation, with mass customisation occupying various intermediate positions denoted by the dotted lines in Fig. 1.

Increased standardisation also helps the development and use of mechanisation, design optimisation, and simplified quality control, all of which result in high levels of capacity utilisation and declining average costs (e.g., Lee and Billington, 1992; Baker et al., 1986). Lee and Billington (1992) view the customer as an external input to the postponement system which requires careful redesign of products and processes to allow for simple postponement, such as labelling or bulk packing, or more complex postponement such as localisation or assembly tests. Baker et al. (1986) consider a stylised two-product, two-level inventory model, with the consumer as an outsider to the system, to calculate safety stock levels. Standardisation can also be cascaded through the supply chain to achieve the characteristics of Fisher's (1997) famous 'functional product' with, for example, a dampened Forrester effect and reduced transaction costs between parties.

The decoupling point in the postponement literature reflects the productivity-flexibility trade-off. In their discussion of the Customer Order Decoupling Point, Wikner and Rudberg (2001) characterise this as separating decisions made under certainty from those made under uncertainty. The positioning of the Customer Order Decoupling Point (CODP) balances the needs of the customer and the provider. The further the CODP is positioned downstream (closer to the factory), the greater emphasis is placed on productivity as more processes are subject to economies of scale. The provider may also gain from risk-pooling of inventory, reduced risk of inventory obsolescence, reductions in lot sizes for upstream (closer to the customer) activities, for example, through JIT (Just-in-Time) strategies (Forza et al., 2008). By placing the CODP further upstream a provider can achieve greater flexibility and give customers a greater input, but this greater variety impacts on efficiency as it may influence inventory management through stock outs and reduced operational productivity (Wan et al., 2012).

In much of the MC and postponement literature the product experience or consumption by the customer is explicitly outside the boundary of analysis. For example, Alford et al. (2000), in their consideration of MC in the automotive industry, see the customer as simply providing "needs" as a set of requirements (e.g., Alford et al., 2000, Fig. 2 in p. 102), rather than understanding the consumption activities that is antecedental to those needs. MacCarthy et al. (2003) identifies five fundamental modes for MC based on the consideration of the "*point at which customisation is undertaken*" (page 290), and emphasises the customer order as an input to the customisation decision. Salvador and Forza (2004), in their review of management issues of product configurators for MC, consider a configurable product as one where the "*company has rationalised ex-ante what it is going to offer the customer*" (page 275). In other words, the provider makes decisions about features that are available for the customer to configure, and customer chooses from the available set. Even those researchers who are expanding the systems boundary focus attention upstream by considering how postponement and different strategies around postponement affect providers. For example, Sun et al. (2008) consider the location of multiple decoupling points in the supplier network driven by the customer order, whilst Gosling and Naim (2009), in their analysis of issues of mass customisation in engineer-to-order companies, consider the production flow as being driven by actual customer orders.

Focusing only on orders as the starting point of the customer and not its antecedents implies that customer use/consumption activities are outside the boundary of the provider's activities. This has several drawbacks in considering an ideal MC strategy. It conforms strongly to what Vargo and Lusch (2004, 2008) would term 'Goods-Dominant Logic' (G-D logic), where the focus is on the exchange between two parties, provider and customer. From this perspective, customer consumption activities are outside the boundary since the provider's value proposition, and therefore what it is responsible for, is to ensure the product is satisfactorily transferred over to the customer in the form that the provider has promised, and the customer has accepted. For example, if the customer wanted blue paint and paid for it, the provider's duty is to ensure blue paint is given to the customer as efficiently as possible. If the customer opens the tin, begins to use it and subsequently realises that blue was not suitable, it would not be the provider's failure, but that of the customer to specify her need adequately. If the customer then returns the product as faulty then this is typically dealt with through returns processes, a topic that is usually considered under closed loop supply chain research.[2]

Yet, such customer failure is altogether very common. Indeed, one might not even call this a 'failure'. Since the product usage is in context of its own environment of use, the specific contexts of use may drive changes to the need and therefore the product specification that fulfills the need. In specifying the blue paint, the customer did not want to fail: there may have been insufficient information about the context beforehand and the customer took the risk to purchase and when the information became available later, the blue may just not be appropriate. This means that while both the customer and the provider are uncertain about the context of use at the point of purchase, the actual risk is borne by the customer, since it is she who agrees and pays for the product specified at that time.

An alternative conceptualisation of the customer within the system boundary is offered by Service-Dominant Logic or S-D logic

[1] See, for example, Lampel and Mintzberg (1996), Yang and Burns (2003), and Forza et al., 2008.

[2] For a detailed review of closed loop supply chain research see Guide and Van Wassenhove (2009).