

Full Length Research Paper

# Mass customization in design of service delivery system: A review and prospects

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The paper intends to present clear pictures of research evolution in two research domains based on a thorough literature review: The service system design and mass customization areas. It identifies a necessity for integrating these two areas, which adopted the concepts of mass customization to guide the service delivery system design to cope with the traditional operation dilemma. This could lead to a new research area for exploration with both great industrial and academic significance. The paper finally presents brief research suggestions to stimulate further research efforts in application of mass customization in the service delivery system design at both macro and micro level from an integrated product/process view.

**Key words:** Mass customization, service delivery system, modularity, postponement.

## INTRODUCTION

Mass customization (MC) refers to the ability to produce customized goods and services enmasse. It has been regarded as one of the most advanced operation models in the 21st century, thus, leading to a great academic concern in recent years. However, the majority of the studies on MC are mainly manufacturing based and “The lack of studies dealing with mass customization in service operation is perhaps one of the main gaps in the current mass customization literature” (Silveira et al., 2001) against the context that the importance of service sector in a nation’s economy has been commonly recognized.

In services management domain, the service design is among the least studied and understood topics although, it has been identified as “perhaps the most crucial factor for quality” (Gummesson, 1993) . Most of the existing literatures about service design have been conducted within the domain of traditional operation and could not jump out of traditional restrain of either customization or efficiency.

Hence, putting together these two academic areas, namely; examining the service delivery system design from the standing point of mass customization (MC) will perhaps be of both great academic and industrial significance. The remainder of the paper is structured as follows. It begins with the review of the service delivery system design followed by the issues of MC. Then, the very limited literatures related to MC in service context are examined. Finally, future research directions and questions in this new domain are proposed.

## REVIEW OF SERVICE DELIVERY SYSTEM

### DESIGN Clarifications of related terms

There have been many terms that might cause confusion in literatures in relation to service system design. These were identified and clarifications were given to their meaning before the review. Those terms include: service design, service process design and service delivery system design.

The meaning of service design in literatures could be identified and understood from two prospective. Service design, on one hand, refers to “what should be delivered”, which is service-content-based design. On the other hand, it means “how should the service be delivered”, which is service-system/process-based design.

The related literatures also spell out that service process design and service delivery system design are always synonymous and have been always interchanged in previous literatures. The term “service delivery system design” used in the paper could be defined

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as “the arrangement of service facilities where the service is provided and the processes through which the service operations are structured and delivered” (Ramaswamy, 1996).

### ***Understanding of service systems***

Design of the service system relies on the understanding of the system which could be found in two aspects: the classification and construction of service system.

### ***Classifications (typology) of service systems***

Numerous authors have made efforts to develop a coherent classification scheme of service system (process) upon which to conduct future service marketing/operations research. Classification schemes are important because they help bring parsimony and mental order to the objects under consideration. The evolution of the classification schemes reflects the logic path of understanding the service system. This evolution could be revealed by examining the variables that had been adopted to conduct the classifications from early Thomas (1978); Chase (1981) to recent Johnston and Clark (2001) classifications. These variables cover a wide range from operation to marketing such as tangibility, customer relationship, customer contact, customer intervention, customization, standardization and distinguishing of front and back stage. In addition, Tinnilä and Vepsäläinen (1995) recognized the relationship between the service organization and the outside organizations necessary for service delivery and gave an open system view of the service organizations.

### ***Construction of service system***

Two important points will be reviewed: First is the division of the service system into service assembly and service provision (Booms and Bitner, 1981; Harrington, 1991). This indicates the tasks of the service system design that should be put on the service assembly. Secondly, the comprehensive view of system construction of the service logic (Kingman and Brundage, 1995) which presents a conceptual model of relationships in between various soft and hard elements in service management. The model delineates the organizing principles that govern a service system, and presents a way of fostering integrated design of service system.

The researches mentioned above reflect a comprehensive understanding of the service system which is related to various factors in both operation and marketing domain.

### ***The general approaches to service system design***

There have been generally three approaches to conduct or guide the service system design. The earliest is the production line (industrial) approach proposed by Levitt, (1972; 1976), focused on improving system efficiency by applying manufacturing principles into the service delivery process. Secondly, in order to deal with the feature of customer contact in service delivery, Chase (1981) suggested the customer contact approach which divided the service system into front and back stages, aiming to improve both service quality in front offices and efficiency in the back. It is in essence trying to alleviate the operational contradiction between efficiency and customization (Kellogg and Chase, 1995). The third is the empowerment approach by Wathen and Anderson (1995); Fitzsimmons and Fitzsimmons (2001) who put emphasis on improving responsiveness to customers' requirements in front stage. It could be said that these approaches are in nature trying to strike a balance between two operation extremes: efficiency and

customization (flexibility). However, none of the approaches above could provide solutions to this operation dilemma.

### ***The description and modeling method for service system***

Blueprinting had been the traditional and dominant method for describing and modeling service system since its invention by Shostack (1987). Service blueprinting was developed as a flow chart to systematize the description, documentation, and analysis of service process. Based on this, Ramaswamy (1996) suggested a flow chart for service design integrating other modeling constructs. Besides, there are also some system-based approaches such as Dynamic-EPC (electronic product code) (Kim and Kim, 2001).

### ***Summary for the review of service system design***

Based on the review, four characteristics in previous research could be clearly identified. Firstly, customer contact has been commonly agreed to be the key feature of service delivery comparing to manufacturing, which leads to an understanding that “for services the product is the process” (Fitzsimmons and Fitzsimmons, 2001). Secondly, the degree of customization and standardization had been the most important variables in classifying service systems, indicating the core roles of these two issues in service system design. Thirdly, the basic concepts and approaches for service system design remained still in the domain of traditional operation and could not provide effective keys to cope with the contradiction between customization and efficiency.

Finally, most of these literatures focused only on the issues inside the service system and demonstrated a close-system view with only exception of works by Tinnilä and Vepsäläinen (1995).

## **REVIEW OF MASS CUSTOMIZATION**

### ***The concepts of mass customization***

The notion of mass customization (MC) dates back to 1970 when it was anticipated by Alvin Toffler in *Future Shock*. The visionary concept of MC was first coined by Stanley (1987), who promotes mass customization as the ability to provide individually designed products and services to every customer through high process agility, flexibility and integration. The concept of MC was first fully expounded by Pine (1993) who implied a view of MC as in some sense of a historically inevitable successor to mass production, the principal in which to complete in the future. It is essentially an oxymoron since it puts together seemingly contradictory notions of the production and the distribution of customized goods and service on a mass basis (Åhlström and Westbrook, 1999; Jiao et al., 2003).

### ***The two-dimension view on mass customization***

To overcome the operation dilemma and achieve mass customization (MC), Duray et al. (2000) proposed that, this lies in two important aspects: firstly, to find the ways to integrate the customers' individual needs into the design of products and secondly, to achieve high productivity by adopting certain production methods. This view actually implied that, the keys to achieving mass customization could be found in the two dimensions of the production: the objects (products) and the process. The former referring to 'what to be produced' while the latter referring to 'how to produce'. Also, based on the two-dimension view, Li et al. (2003) explained the general principle to realize MC as shown in Figure 1. They proposed that optimization should be conducted along the two dimensions of production for the purpose of MC. In

the object dimension of production, optimization can be achieved by striking a balance between the customization and commonality based on the thorough analysis of the relationship among the products and their elements (basic parts, parts, modules, etc.). While in the process dimension, re-arrangement of production process and resource utilization in each stage in the process could be helpful for optimization purposes. The two-dimension view is in nature that is very similar to the two prospective in service design: the content-based (product) and system-based (process) design.

### ***The approaches to mass customization***

The approaches to mass customization (MC) had been proposed along the two dimensions. In the object dimension, most of the literatures agreed that modularity would be the key. Both Pine (1993); Duray et al. (2000) held that modular design in product and process could facilitate the MC since it is the way to achieve both scale and scope economy required by MC (Baldwin and Clark, 1994). Besides, modularity within the organization of some studies proposed that the optimization in the object dimension could be achieved in broader operation scope, not limited in the domain of a single organization, namely; lower-cost modules or parts can be attained from the outside of the organization for the MC purposes (Qi and Gu, 2000). This is actually a broader or open system view and brings about more approaches for MC such as outsourcing and supply chain management (Gupta and Zhender, 1994). In the process dimension, postponement provides effective way (Feitzinger and Lee, 1997). Postponement means delaying activities in the production process until customer orders are received (Van Hoek, 2001). This helps to achieve more scale of economy without affecting the level of customization since the customizing activities can be "postponed" until orders coming in while the common parts of the products can be mass-produced in advance.

### **Mass customization literatures in service context**

Most of the MC literatures are mainly manufacturing based and the researches relating to service sector remain inadequate. The existing relevant literatures could be found in two areas: one is the general discussion about the MC in service context, such as the significance and dynamics of the MC application; the other is about MC application in service design.

### ***Significance and dynamics of the mass customization in service organizations***

Those researches realized both the academic and practical significance of applying the MC related concepts into the service operations. Hart (1995) in the early time pointed out that MC would be an opportunity for the development of service industry. Taylor and Lyon (1995) distinguished the MC and mass production in fast-food services and forecast the new MC model would take the place of mass production used by McDonald. Mok et al. (2000) introduced the concept and the four approaches of MC and call for application of those to the hospitality services. Menor et al. (2002) pointed out that application of product structure and modularity into the service product innovation would be an important research domain.

### ***Mass customization in service design***

The application of MC in service design from two standing points as mentioned previously will be checked: the service content-based (product) and service system-based (process) design.

### ***Mass customization in service design from the service-content-based prospective***

Instead of using directly the term "mass customization", lots of the papers in this domain have applied some concepts similar to MC into the service design such as product structure, product platform and agility, etc. McLaughlin (1996) discussed the issues of variables in service product design. Bitran and Pedrosa (1998) mentioned the design of parts in services and product structure. Menor et al. (2001) proposed the service model of agility reflecting on higher flexibility in operations. Meyer and DeTore (2001) applied the manufacturing-based principles of product platform into the new product development in service context. A "real" application of mass customization in services was conducted firstly by Peters and Saidin (2000) who analyzed the structure of modularized service products based on a case study in Malaysia. Besides, Li (2005) proposed a service product innovation strategy based on MC with special concern in modularity.

### ***Mass customization in service design from the service-system-based prospective***

Sundbo (1994) introduced the modularity into the service design and discussed the modular behaviours in service organization based on a case study in Denmark. Jiao et al. (2003) pointed out the important factors that should be taken into account when conducting a service system design for mass customization. Papathanassiou (2004) discovered the factors leading the success of MC in financial services, namely; the management approaches, staff involvement and application of network system. Shao (2005) proposed the general principles for modularization of logistic services. Chen and Hao (2005a) briefly reviewed the DFMC (design for mass customization) literatures in services. Chen (2005b) also suggested a framework for designing the service system for mass customization in the context of catering industry and made some primitive discussions on the issues of MC system for catering services including the layout planning (Chen and Hao, 2006), outsourcing (Chen and Hao, 2007) and system decoupling of front and back stages (Chen and Hao, 2008).

### ***Summary for the review of mass customization in services***

MC has received great concern from both academia and industry and been hotly discussed recently. But most of the MC-related works mainly focused on manufacturing operations. The research effort based on service sector remains still sporadic and inadequate. The existing literatures related to service design were more content-based rather than system-based since the latter are either industry-related or general discussions or just focusing on single aspect of system design. Systematic and in-depth research could scarcely be found. This could not match the most important feature of service product, which is "the product is the process" described by Fitzsimmons and Fitzsimmons (2001).

## **NEW RESEARCH DOMAIN**

There exists spacious room for research on the application of MC theory into the design of service system according to the previous review. Further research should be done in the service area since the need to develop this sort of research is even greater if the differences between manufacturing and service operation, and the implications these differences may have

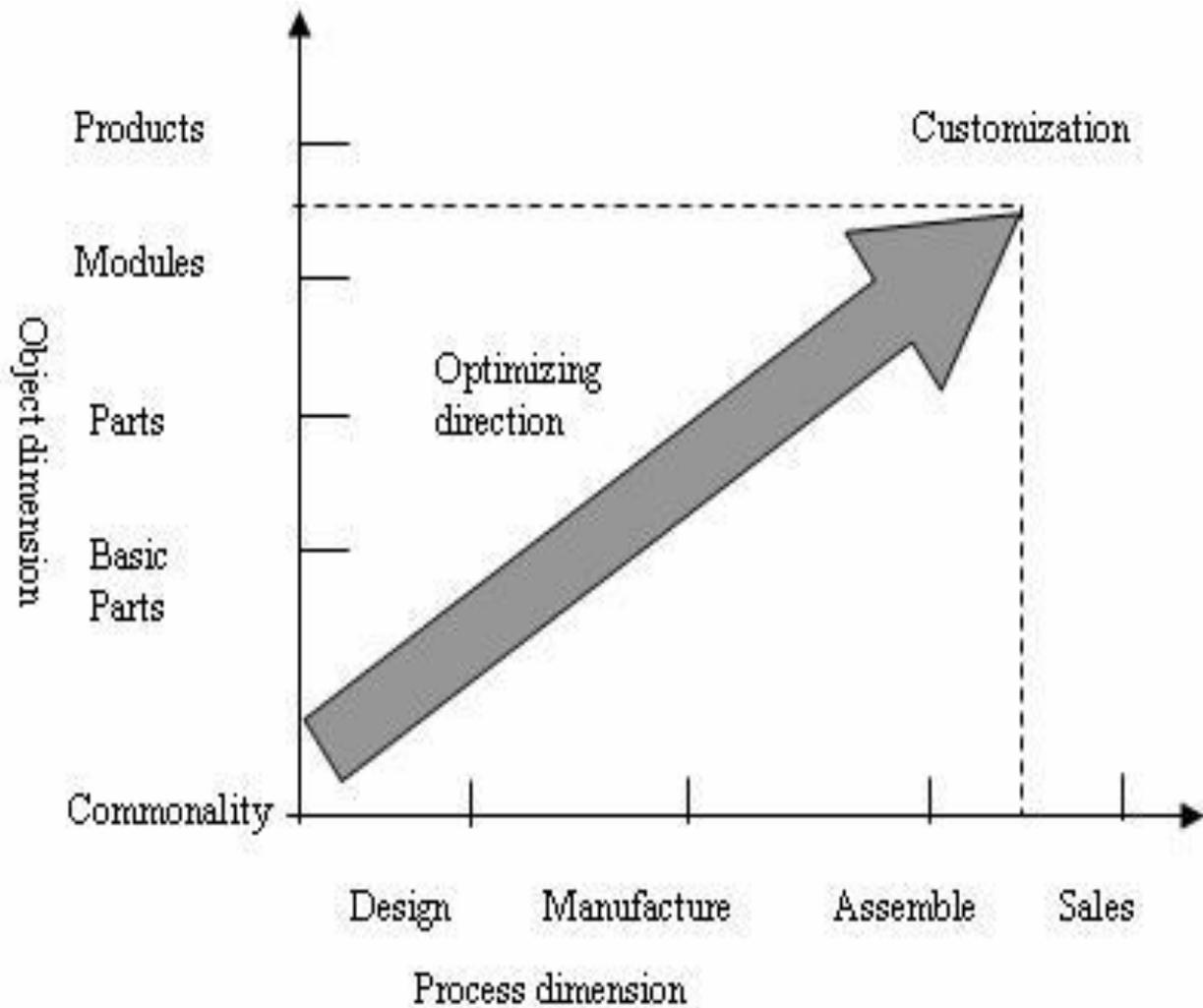


Figure 1. Two-dimension view on mass customization (Li et al, 2003).

in applying MC to service systems is considered critically. By comparing with manufacturing, the service operations may have greater customer involvement (participation), perishable, intangible, tighter delivery time, and are more dependent on information reliability (Fitzsimmons and Fitzsimmons, 2001). All these features can pose challenges to MC implementation in service operation, which will lead to a different understanding of the mass customization theory based initially on manufacturing.

Following the open system view, service system could be understood at two levels. First, it refers to the inner system (micro level) made up of all the functional elements inside in the service organization necessary for delivery of the services. Secondly, it refers to the open system (macro level) which includes not only the inner system but also, all the outside partners who contribute to the provision of services to customers.

The concept and core approaches to MC, especially

the modularity, postponement outsourcing and supply chain management could be very beneficial to the service delivery system design at both levels. There should be some interesting research points in applications of MC in the service sector when the key features of services are taken into account as shown in Figure 2.

#### **Two-dimension view in service sector**

Optimization along the two-dimension of production is the basic logic in MC in manufacturing. However, the division of product and process can not fit the important service feature since “for services the product is the process” (Fitzsimmons and Fitzsimmons, 2001). Therefore, we could not just put the two-dimension view directly into the service MC and should find a new logic for its application. This will lead to a new understanding of the basic

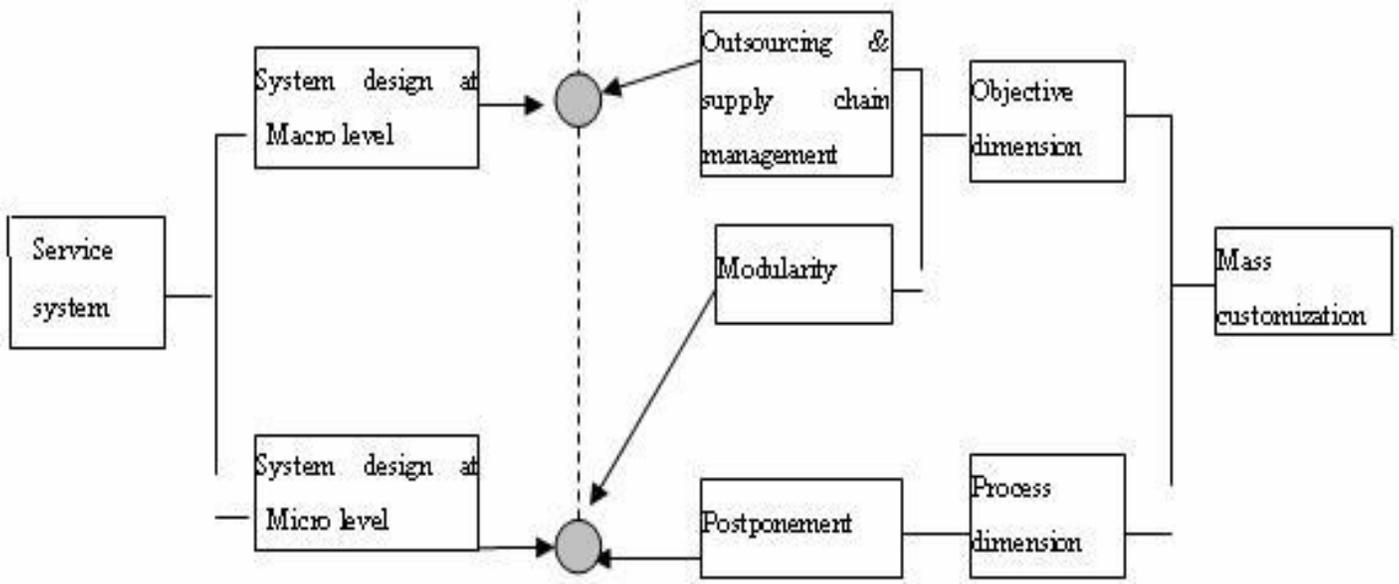


Figure 2. The research prospects.

framework for the service MC, including the integration of the service content (product) and process for MC, which could not be found in the manufacturing sector.

### **Modularity, postponement and micro service system design**

#### **Application of modularity in the product-dimension design**

Modularity is the use of standard modules to facilitate assembly and configuration of finished products. It is regarded as the core approach to MC because it could help to achieve both economy of scale when producing large volume of standard modules and customization by providing various final products by configuration of various modules according to customers' needs. Modularity could be applied to the design of service system for MC mainly in the product dimension. The micro service system includes various sub-systems conducting certain functions. To design the inner system efficient enough for MC by using the concept of modularity, further research could be conducted by answering the following questions:

- (i) What is the meaning of the building blocks (modular units) in a modular service system especially when the intangible nature in service is considered? What are the differences between modular units in service and manufacturing?
- (ii) How are the building blocks divided? And what are the relationships in between those building blocks?

- (iii) How does customer contact affect the division of building blocks and relationship among them?
- (iv) How does the organizational structure fit the modular service system?

#### **Application of postponement in the process-dimension design**

Postponement tries to delay activities in the production process until customer orders coming in. The customizing activities and mass production activities are decoupled by the CODP (customer order decoupling point). Postponement can be applied in both micro and macro service system for MC in the process dimension. Future studies should answer the following questions:

- (i) How to pre-produce the services for postponement since the services are always regarded as perishable?
- (ii) Which point is suitable to be the CODP in service delivery if the key features of service (for example, customer contact) are taken into account, the point of reservation or the point of customer contact or else?
- (iii) What factors will affect the decision of CODP in service system?
- (iv) How to model the decision of CODP in service system for MC?

#### **Integration of the modularity and postponement**

The feature of "the product is the process" means that MC in service context should take an integrated two

dimension view of product and process, thus, leading to a greater research challenge which requires efforts in integration of the modularity and postponement. The research questions could be:

- (i) What is the relationship between the modular service structure and the postponement process?
- (ii) How could the service modular units be arranged according to the postponement principles?

### ***Supply chain management, outsourcing and macro service system design***

Efficient supply chain management including outsourcing strategy is one of the key success factors in MC system. Outsourcing helps organization to get lower-cost modules or more efficient resources from the business partners while supply chain management concerns the co-ordination of resources and the optimization of activities across the value chain to obtain competitive advantages. These two concepts thus, give us a broader view of service system involving outside organizations into the provision of services. Hence, we should design a "bigger" system including both the inner system (the service organization) and the outsider partners and construct an efficient supply chain. Research questions could be raised as followings:

- (i) How to decide what to be self-made and what to be outsourced if MC is supposed to be achieved in service organizations?
- (ii) How to maintain a healthy relationship with the suppliers for a stable and fast-speed supply?
- (iii) How to maintain the quality and responsiveness of services when they are outsourced since the service operation has tighter delivery time than the manufacturing?
- (iv) How to apply postponement into the design of macro service system? How to make the CODP decision?

### **Conclusions**

The paper conducts a review of two research domains, the service system design and mass customization. Based on this, it presents a clear picture of research evolution in both areas, and identifies the necessity for integrating these two areas, namely; applying the concepts of MC into the design of service delivery system for solution to the traditional operation dilemma: either efficiency or customization. Finally, a new research domain is proposed for future efforts, which is the systematic application of MC principles and approaches into the service delivery system design at both macro and micro level from an integrated product/process view.

### **REFERENCES**

- Ahlström P, Westbrook R (1999). "Implications of mass customization for operations management," *Int. J. Oper. Prod. Manage.*, 19(3): 262-275.
- Baldwin CY, Clark KB (1994). "Modularity-in-Design: An Analysis Based on the Theory of Real Options," Working Paper, Harvard Business School, Cambridge, MA.
- Bitran G, Pedrosa L (1998). "A Structured Product Development Perspective for Service Operations", *Euro. Manage. J.*, 16(2): 169-189.
- Booms B, Bitner M (1981). "Marketing strategies and organization structures for service firms", In Donnelly J and George W, (eds), *Marketing of services*, American Marketing Association, Chicago, IL.
- Chase RB (1981). "The Customer Contact approach to services: theoretical based and practical extensions", *Oper. Res.*, 29(4): 698-705.
- Chen J (2005). *Catering service system design for mass customization*, Liaoning Science and Technology Press: Shenyang.
- Chen J, Hao YH (2005). "DFMC in services: Review and research directions", *Science and Technology Progress and Policy*, 22(9): 198-200.
- Chen J, Hao YH (2006). "Layout Design For Service Operation of Mass Customization: A Case of Chinese Restaurant", *Proceeding to the Third IEEE International Conference on Services Systems and Services Management*, Troyes, France.
- Chen J, Hao YH (2007). "Outsourcing for achieving mass customization in service operations: lessons from the "smaller kitchen" strategy in Chinese catering services", *Proceeding to the IEEE International Conference on Engineering Management and Service Sciences*, Shanghai, China.
- Chen J, Hao YH (2008). "Research on Key Issues in System Decoupling for Service Mass Customization", *Proceedings of the IEEE International Conference on Engineering Management and Service Sciences*, Beijing, China.
- Duray R, Ward P, Milligan G, Berry W (2000). "Approaches to Mass Customization: Configurations and Empirical validation". *J. Oper. Manage.*, 18: 605-625.
- Feitzinger E, Lee H (1997). "Mass customization at Hewlett-Packard: The power of postponement", *Harv. Bus. Rev.*, 75 (1): 116-121.
- Fitzsimmons JA, Fitzsimmons MJ (2001). "Service Management", 3rd ed, McGraw-Hill, Boston.
- Gummesson E (1993). "Quality Management in Service Organizations". Stockholm, Stockholm University.
- Gupta M, Zhender D (1994). "Outsourcing and its impact on operations strategy", *Prod. Inven Manage. J.* 35(3): 70-75.
- Hart CWL (1995). "Mass Customization: Conceptual Underpinnings, Opportunities and Limits", *Inter. J. Serv Manage.*, 6(3): 36-45.
- Jiao J, Ma Q, Tseng MM (2003). "Towards High Value-added Products and Services: Mass Customization and Beyond", *Technovation*, 23(10): 809-821.
- Johnston R, Clark G (2001). "Service Operations Management", Prentice Hall: Harlow.
- Kellogg DL, Chase RB (1995). "Constructing an empirically derived measure for customer contact". *Manage. Sci.*, 41(11): 1734-1749.
- Kim HW, Kim YG (2001). "Rationalizing the customer service process", *Bus. Process Manage. J.*, 7(2):139-156.
- Levitt T (1972). "Production line approach to service", *Harv. Bus. Rev.* September-October: pp. 41-52.
- Levitt T (1976). "The industrialization of service September/October", *Harv. Bus Rev*, 54: 63-74.
- Li JH (2005) "Strategy of mass customization based service product innovation", *Stud. Sci.*, 23(2): 283-288.
- Li SC, Liang GQ, Liu CG (2003). "The Theory of Mass Customization Operation", Science Publishing House: Beijing.
- McLaughlin CP (1996). "Why Variation Reduction is not Everything: a New Paradigm for Service Operation", *Inter. J. Serv Ind. Manage.* 7(3): 17-30.
- Menor LJ, Roth AV, Mason CH (2001). "Agility in Retail Banking: A Numerical Taxonomy of Strategic Service Groups", *Manufact. Serv. Oper. Manage.* 3(4): 273-292.
- Menor LJ, Tatikonda MV, Sampson SE (2002). "New Service

- Development: Areas for Exploitation and Exploration". *J. Oper. Manage.*, 20(2): 135-157.
- Meyer MH, DeTore A (2001). "Perspective: Creating a Platform-based Approach for Developing New Services". *J. Prod. Inno. Manage.*, 18: 188-204.
- Mok C, Stutts AT, Wong L (2000). "Mass Customization in the Hospitality Industry: Concepts and Applications", 4th International Conference "Tourism in Southeast Asia and Indo-China: Development, Marketing and Sustainability", pp. 24-26.
- Papathanassiou EA (2004). "Mass customization: Management Approaches and Internet Opportunities in the Financial Sector in the UK", *Inter. J. Inform. Manage.*, 24: 387-399.
- Peter L, Saidin H (2000). "IT and the Mass Customization of Service: the Challenge of Implementation", *Inter. J. Inform. Manage.*, 20: 103-119.
- Pine II BJ, Victor B, Boynton AC (1993). "Making mass customization work Sep/Oct", *Harv. Bus. Rev.*, 108-119.
- Qi GN, Gu XJ (2000). "Research on mass customization and model", *Computer Integrated Manufacturing Systems*, 6(2):41-45.
- Ramaswamy R (1996). "Design and Management of Service Processes", Addison Wesley, Reading, MA.
- Shao BJ, Shi YF, Chen CY (2005). "Modularity Design in Customization Marketing of Third Party Logistics (natural science edition)". *J. Chongqing University*, 28(4): 146-149.
- Shostack GL (1987). "Service positioning through structural change". *J. Mark.*, 51(1): 34-43.
- Silveira GD, Borenstein D, Fogliatto FS (2001). "Mass Customization: Literature Review and Research Directions", *Inter. J. Prod. Econ.*, 72(1): 1-13.
- Sundbo J (1994). "Modulization of service production and a thesis of convergence between service and manufacturing organizations". *Scandinavian. J. Manage.*, 10(3): 245-266.
- Stanley DM (1987). "Future Perfect". Reading, Massachusetts: Addison-Wesley.
- Taylor S, Lyon P (1995). "Paradigm Lost: The rise and fall of McDonaldization". *Inter. J. Contemporary Hosp Manage.*, 7(2/3): 64-68.
- Thomas DRE (1978). "Strategy is different in service business July-August". *Harv. Bus. Rev.*, pp. 158-165.
- Tinnilä M, Vepsäläinen A (1995). "A model for strategic repositioning of service processes". *Inter. J. Service Ind. Manage.*, 6(4): 57-80.
- Van Hoek RI (2001). "The rediscovery of postponement a literature review and directions for research" *J. Oper. Manage.*, 19: 161-184.
- Wathen S, Anderson JC (1995). "Designing services: an information-processing approach", *Inter. J. Serv. Ind. Manage.*, 6(1): 64-76.