EXPLORING EXTENT OF SERVITIZATION, ORGANIZATIONAL INNOVATIVENESS, AND CUSTOMER FOCUS IN MANUFACTURING FIRMS

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ABSTRACT

We propose a typology of extent of servitization for manufacturing firms. Cluster analysis and MANOVA on a large sample demonstrated the presence of very high and low servitizers, providing empirical support for our typology. Manufacturing firms can implement servitization strategies to improve their performance. Research implications are discussed.

KEYWORDS: Extent of servitization, Organizational innovativeness, Customer focus

INTRODUCTION

The sluggish growth of the U.S. manufacturing sector has been an ongoing point of public debate in the U.S. for quite some time but more so since the onset of the recession in 2008 (Bryant, 2011). The damage done to the U.S. manufacturing sector by the recent recession is very hard to ignore (ASM, 2009). It is not surprising that manufacturing is unable to compete in today's global economic marketplace, when U.S. manufacturers may need to cut the costs of their products by as much as 30% to compete with Chinese producers (Wu, Yue, & Sim, 2006); there are huge market opportunities offered by emerging economies; and most manufacturing firms have to deal with some adverse environmental law at home that is not applicable in emerging economies (Neely, 2008).

In extant literature manufacturing strategy has been described as consisting of four dimensions: (a) cost; (b) quality, in the form of superior products; (c) dependability of supply, in the form of high availability of product; and (d) flexibility, in the form of a willingness to offer product variations (Buffa, 1980, 1984; Swamidass & Newell, 1987; Wheelwright, 1984). The key to future success of manufacturing firms could be in their extending the product offering itself and almost always, including a component of service along with the product (Bowen, Siehl, & Schneider, 1989). In other words, servitization or the offering of services in addition to the product offering seems to be the key.

Vandermerwe and Rada (1988), argued that there are three reasons why manufacturing firms should servitize: (i) to lock out competitors; (ii) to lock in customers, and (iii) to increase the level of differentiation among them. Other authors have mentioned economic and environmental rationales for servitization (Wise & Baumgartner, 1999). From a supplier's perspective, servitization is a way of increasing sales revenues, while from a customer's perspective servitization offers a route of reducing risk and making predictable maintenance costs.

Extant literature has not clearly established all benefits and problems associated with servitization and the relationship between extent of servitization and firm performance. Most published research has used case study methodology or are consulting assignment report narratives; only a handful of empirical studies have been done (Baines, Lightfoot, Benedettini, & Kay, 2009; Fang, Palmatier, & Steenkamp, 2008; Neely, 2008). Table 1 presents a summary of the major issues related to servitization that have been discussed in operations and marketing literatures.

Table 1

Review of extant literature on servitization

Authors	Findings
Baines, Lightfoot, Peppard, et al. (2009)	The authors present a framework that could be used by manufacturing firms to configure their internal production and support operations to enable effective and efficient delivery of products and their closely associated services. The framework captures a set of operations principles, structures and processes that can guide a manufacturer in the delivery of product-centric servitized offering.
Baines, Lightfoot, Benedettini, & Kay (2009)	Servitization is defined as the innovation of an organization's capabilities and processes to shift from selling products to selling integrated products and services that deliver value in use.
Fang, Palmatier, & Steenkamp (2008)	The authors investigate the effectiveness of service transition strategies for generating shareholder value by evaluating secondary data pertaining to 477 publicly traded manufacturing firms during 1990 – 2005. The impact of a firm's transition to services on firm value remains relatively flat or slightly negative until the firm reaches a critical mass of service sales (20% - 30%), after which point they have an increasingly positive effect. The effect of service sales on firm value depends on both firm and industry factors. Service transition strategies are more effective at enhancing value when the service offerings are related more to the firm's core business and when firms have more resource slack. The impact of adding services to core products on firm value amplifies as industry turbulence increases but diminishes when the firm's core products are in high-growth industries.

Authors	Findings
Mathieu (2001)	This paper develops a typology of service maneuvers achieved by manufacturing firms, which is based on two dimensions: service specificity (split into customer service, product services and service as a product) and organizational intensity (tactical, strategic or cultural). The paper reviews the benefits and costs associated with service maneuvers and discuss their interplay with the typology.
Mont (2002)	A new trend of product–service system (PSS) that has the potential to minimize environmental impacts of production and consumption is highlighted. This paper builds a theoretical framework for PSS and serves as a background for identifying possible investment needs in studying them.
Morelli (2002)	The author defines servitization as the evolution of the product identity from one based on its material content to a position where the material component is inseparable from the system of services.
Neely (2008)	The paper presents an analysis of the data which suggests that manufacturing firms in developed economies are adopting a range of servitization strategies - 12 separate approaches to servitization are identified. These 12 categories can be used to extend the traditional three options for servitization - product oriented PSS, use oriented PSS and result oriented PSS, by adding two new categories Integration oriented PSS and Service oriented PSS. Manufacturing firms that have servitized are larger than traditional manufacturing firms in terms of sales revenues they also generate lower profits as a % of sales. The above findings are moderated by firm size. In smaller firms servitization appears to pay off while in larger firms it proves more problematic.
Vandermerwe & Rada (1988)	Authors defined servitization as "the increased offering of fuller market packages or "bundles" of customer focused combinations of goods, services, support, self-service and knowledge in order to add value to core product offerings." (p.314). Giving many real-life examples, the authors assess the main motives driving corporations to servitization, and point out that its cumulative effects are changing the competitive dynamics in which managers will have to operate. The special challenge for top managers is how to blend services into the overall strategies of the company.
Wise & Baumgartner (1999)	Now that providing services is more lucrative than making products, the old foundations for success in manufacturing are crumbling. Smart manufacturers are creating new business models to capture profits at the customer's end of the value chain.

Neely (2008) has empirically demonstrated that in smaller firms servitization appears to pay off while in larger firms it proves more problematic; and there are some hidden risks associated with servitization. However, he did not examine other variables like organizational innovativeness, and customer focus while considering relationships with firm performance. There are no other empirical studies clearly establishing when servitization could be beneficial to manufacturing

firms. In order to fill this gap we asked the following research question: Would highly servitized firms have high organizational innovativeness, be high customer focused and perform better on quality performance and financial and market performance than low servitized firms?

In this paper we first propose a conceptual framework that manufacturing firms may use to decide the extent of servitization, depending upon the scores on two dimensions – the degree of their customer focus and organizational innovativeness - with the aim of improving overall firm performance. Second, using a large sample of 328 manufacturing firms we use cluster analysis and MANOVA to empirically demonstrate support for our predictions related to the typology. The paper contributes to operations literature by empirically establishing a framework that could be used by manufacturing firms to evaluate whether it is beneficial to servitize highly. As our study demonstrates, highly servitized manufacturing firms could focus on the customers externally and internally encourage a culture of organizational innovativeness that encourages risk-taking on the part of its members in implementing innovative approaches to problems.

THEORETICAL FRAMEWORK

Customer contact model

A strategic choice for a manufacturing firm is whether it should emphasize substantial or limited contact between customers and the organization. Customer contact in manufacturing can include customers being present within the physical plant, employees being present at a customer's facility, the number of contacts between customers and employees with functions other than marketing and sales, and the number of levels in the organization that have phone or face-to-face contact with customers. Customer contact constrains the potential operating efficiency of the system, but it also yields sales and marketing opportunities (Chase, 1978; 1981; Chase & Tansik, 1983; Kellogg & Chase, 1995; Soteriou & Chase, 1998). Additionally, customer contact allows the manufacturing firm to share some of the labor and information required for production and delivery with the customer, but this customer contact and participation is associated with greater input uncertainty (Mills, 1986). Thus business unit strategy will reflect a customer service orientation to the degree to which the firm chooses to emphasize goals of customer responsiveness, more than standardization, and high customer contact, rather than low customer contact.

Organizational innovativeness

Innovation adoption includes the generation, development, and implementation of new ideas or behaviors (Damanpour, 1991). An innovation could be a new product or service, a new production process technology, a new structure or administrative system, or a new plan or program pertaining to organizational members. Thus, innovation is defined as adoption of an internally generated or purchased device, system, policy, program, process, product, or service that is new to the adopting organization (Daft, 1982; Damanpour & Evan, 1984; Zaltman, Duncan, & Holbek, 1973). Organizational innovativeness is generally measured by the rate of the adoption of innovations, although a few studies have used other measures. Examples are the number of awards won by architectural firms (Blau & McKinley, 1979) and the number of patents acquired by firms (Hull & Hage, 1982). Most studies have defined rate of adoption as the

number of innovations adopted within a given period (Daft & Becker, 1978; Damanpour, 1987; Ettlie et al., 1984), but some other scholars have used the percentage of innovations (Baldridge & Burnham, 1975). As discussed in strategic management literature the concept of "threat-rigidity effects" (Staw, Sandelands, & Dutton, 1981: 501) predicts that conservative, status-maintaining decisions would mostly be taken in firms rather than radical, high-risk decisions in order to mitigate risks to organizational performance. Organizational innovations are caused, among other factors, by risk taking in organizations; innovations can often result from successful risk taking (Singh, 1986). In the context of servitization of existing products by manufacturing firms, we suggest that firms that encourage a culture of organizational risk taking and reward employees who are willing to take innovative solutions in order to solve problems would be highly innovative.

Customer focus

Customer focus refers to degree of customers' involvement in product or service design and focuses on achieving greater customer satisfaction (Ahire, Golhar, & Waller, 1996; Powell, 1995). The customer focus dimension is a part of eight QM practices that includes top management leadership, training, employee relations, customer focus, quality data and reporting, supplier quality management, product/service design, and process management – have been documented extensively in QM research (Kaynak, 2005; Kaynak & Hartley, 2005, 2008). Customer focus is of utmost importance to servitizing firms; and they could use their close contact with customers as a source of competitive advantage by quickly offering services and products that the customer really needs (Servitizer, 2011).

Firm performance

Based on the finding that for smaller servitized firms the combined effect of increased employment costs and increased working capital requirement per employee outweigh the revenue generated per employee when compared to pure manufacturing firms that did not servitize at all, Neely (2008) suggested that servitization makes business sense only for large firms. However his study did not consider the effect of either the customer focus or the organizational innovativeness. We suggest that focus on the customer's needs would help all manufacturing firms to know of quality issues in its products and services thereby helping it to focus on improving them quickly. Organizational innovativeness would further help employees of all manufacturing firms to better focus on quickly finding new and acceptable solutions to customers' problems that are brought to their notice. Therefore we argue that greater extent of servitization would be positively related to better financial and market performance as well as to better quality performance.

Typology of extent of servitization

Using the above dimensions of organizational innovativeness and the customer focus of the firm as two independent dimensions, we propose a typology of extent of servitization that manufacturing firms may consider for improving their performance. As shown in Figure 1 below, the typology is divided into four quadrants; two of which are misfit for manufacturing firms. We suggest that no manufacturing firm can exist in either the second quadrant (Q2, which

has high degree of customer relationship but low organizational innovativeness) or the third quadrant (Q3, which has low degree of customer relationship but high organizational innovativeness). This is because most manufacturing firms would be forced to match the degree of organizational innovativeness with their customer focus, as there is always pressure on manufacturing firms to cut costs/produce better and more interesting products that satisfy customers. Figure 1 presents the proposed typology of extent of servitization.

Figure 1

Proposed typology of extent of servitization

	Low Customer Focus	High Customer Focus
High Organizational Innovativeness	**Q3** Misfit	**Q4** H1: S: High
Low	**Q1** H2: S: Low	**Q2** Misfit

Customer Focus

Notes**:** S: Proposed extent of servitization; each dimension is measured on a continuous scales

RESEARCH HYPOTHESES

When a firm's customer focus is very strong (thereby indicating that the firm is most responsive to its customer's needs and tracks changes in customer needs), and the firm is highly innovative, which encourages an organizational culture of risk taking in thinking about new ways of solving a problem, it would put significant effort to bring out new products in time that satisfy the customer's changing needs and tastes (Damanpour, 1991). Further, such firms would also be proactive in making changes to the product features. Even with existing products, such firms would like to keep its customers satisfied by offering a plethora of customer-related services that proactively solicit from the customer what types of problems he/she might be facing with the product and pass that customer feedback to its own product teams for action (Damanpour, 1991; Utterback & Abernathy, 1975). Highly innovative automobile firms like ABB, Caterpillar, GE, IBM, and Xerox (Cohen, Agrawal, & Agrawal, 2006) may be good examples of firms fitting this category, which is shown as the fourth quadrant in the proposed typology. Thus our first hypothesis notes:

> **H1**: *Highly servitized firms have characteristics of high organizational innovativeness and customer focus.*

On the other hand, when a firm's customer relationship is very weak (thereby indicating that the firm is not at all responsive to its customer's needs) it does not bother about changes in customer needs and tastes that may also be few and far between, and the firm is not at all innovative. Thus,

it would not put much organizational effort to servicing the customer needs either by introducing new products and services or by making modifications to its standardized set of products. Such firms only produce a very few set of standardized products that have a mature constant demand and such firms are easily satisfied with just meeting the current customer demand. United States Steel Corp. that has been producing the major chunk of the U.S. steel for the last 100 years is a good example of firms that produce well-known standardized products having a mature demand; hence they do not offer many services to their customers. These firms would fit the first quadrant in the proposed typology. Thus, our second hypothesis mentions –

> *H2: Low servitized firms have characteristics of low organizational innovativeness and customer focus.*

In this paper drawing from an established mid-range operations theory of the Customer contact model (Chase, 1978; 1981; Chase & Tansik, 1983; Kellogg & Chase, 1995; Soteriou & Chase, 1998), we presented a typology of extent of servitization suggested for manufacturing firms, which is based on the two dimensions of customer relationship and organizational innovativeness. Next, we empirically test the predictions with a large sample of manufacturing firms that implement QM practices.

RESEARCH METHODOLOGY

The data for this research were drawn from a cross-sectional mail study conducted to investigate quality management (QM), just-in-time purchasing (JITP), organizational effectiveness, and the business performance of firms operating in the 48 contiguous states of the U. S. that have implemented QM and JITP techniques. Issues pertaining to the construction of the instrument and measures, the survey procedure, the sample, and the tests for reliability and validity were discussed in the previous published studies; overall, validity and reliability of the measures were found adequate (e.g., Kaynak, 2006; Kaynak and Hartley, 2008). Table 2 below presents a list of all the measures as well as their sources used in the study along with the reliability coefficients for each construct.

Table 2

Measures used in the study

Construct and sources	Measured by items	Reliability (Cronbach's α)
Following items were marked on a continuous scale from None through Very High		
Organizational *Innovativeness* (Garvin, 1993; Mahoney and Weitzel 1969)	Extent to which organization members take risks in trying out innovative methods and approaches. Extent to which organization members willingly try out new ideas and suggestions.	.88

Construct and sources	Measured by items	Reliability (Cronbach's α)
Customer focus (Powell, 1995; Ahire et al., 1996; Morrow, 1997).	Extent to which customers are involved in the product or service design. Extent to which customer satisfaction surveys are used in determining/identifying customers' requirements. Extent to which managers are aware of the results of customer satisfaction surveys. Extent to which managers have access to a summary of customer complaints. Extent to which the organization actively seeks ways to improve the primary product/service in order to achieve greater satisfaction. Degree of employees' understanding who their customers are.	.86
Extent of servitization (created based on the literature review)	Marked according to how respondents classified their service operations on a continuous scale from LDCC (low degree of customer contact) through HDCC (high degree of customer contact)	NA

Following items were marked on a continuous scale from worse than competition (WTC) to better than competition (BTC) relative to the firm's competitors in the same industry for the last completed fiscal year end. Industry is defined based on the principal SIC industry classification in which the firm organization is normally placed.

Financial and market performance (All items in this scale were developed based on a literature review (e.g. Dröge et al., 1994; Swamidass and Newell, 1987; Venkatraman and Ramanujam, 1987; Ward et al., 1994).	Sales growth Market share Market share growth	.87
Quality performance (All items in this scale were developed based on a literature review (e.g. Ansari and Modarress, 1990; Deming, 1986, 1993; Engelkemeyer, 1990; Garvin, 1988; Shetty, 1988; United States General Accounting Office, 1991)	Product/service quality Productivity Cost of scrap and rework as a percent of sales Delivery lead time of finished products/services to customers	.81

DATA ANALYSES AND RESULTS

Clustering on the extent of servitization is the appropriate data analysis for testing the hypotheses. Our sample had 371 responses obtained from respondents who held a high rank in their firms, and thus could report on performance and were likely to be familiar with the implementation of QM. First, we performed hierarchical cluster analysis using the Ward method and the extent of servitization as the clustering variable. Since 43 observations had missing data on the extent of servitization question, these were excluded in the cluster analysis, thereby leaving a final sample of 328 for all further analysis. Based on theory, we expected either two extreme clusters – high servitizing, and low servitizing clusters, or at most, three clusters – high servitizing, average servitizing, and low servitizing – to emerge. Therefore, we computed both two and three cluster solutions. An examination of agglomeration schedules of both solutions revealed that three groups emerged as the optimum number of clusters. To fine-tune the results from the hierarchical procedure, the K-means cluster algorithm was used (Hair, Anderson, Tatham, & Black, 2009) to obtain a three cluster solution. The next step in cluster analysis is validation of clusters (Hair et al., 1995). The industries of the respondents (represented by their two-digit SIC codes) are given in Table 3 below. Mean values (centroids); presented in Table 4, show that Cluster 1 represents highly servitized firms whereas Cluster 2 and Cluster 3 both together represent firms that have servitized to only a very low degree. Furthermore, the univariate F-ratio presented in Table 5 shows that group means for the extent of servitization is significantly different among the three clusters.

Table 3

Industries of the respondents

SI code		Percent of respondents		
		Cluster 1 (n =200)	Cluster 2 (n = 49)	Cluster 3 (n = 79)
20	Food & kindred	2.50	6.12	5.06
21	Tobacco		2.04	
22	Textile mill	0.50	2.04	1.27
23	Apparel		6.12	
24	Lumber & wood	0.50		1.27
25	Furniture & fixtures	1.50		1.27
26	Paper & allied	2.50	2.04	2.53
27	Printing & publishing	6.00	2.04	1.27
28	Chemicals & allied	3.00	2.04	10.13
29	Petroleum refining	0.50	2.04	2.53
30	Rubber & miscellaneous plastics	11.00	10.20	13.92
32	Stone, Clay & glass	2.00	4.08	1.27
33	Primary metal	4.50	4.08	1.27
34	Fabricated metal	12.00	18.37	8.86

SI code		Percent of respondents		
		Cluster 1 (n =200)	Cluster 2 (n = 49)	Cluster 3 (n = 79)
35	Machinery & computer	4.50		3.80
36	Electrical & electronic	17.00	8.16	17.72
37	Transportation equipment	3.00	2.04	7.59
38	Instruments	2.50	2.04	1.27
39	Miscellaneous manufacturing	8.00	12.24	7.59
45	Airlines	1.50		
80	Health care	1.50		1.27
Missing		15.50	14.29	10.13

Notes. Total sample size N=328 used in clustering since out of a total of 371 observations, 43 observations had missing data on extent of servitization item

Table 4

Final cluster centers

	Final Cluster Centers		
	Cluster		
	1	2	3
SO	85.64	17.22	54.23

	Distances between Final Cluster Centers		
Cluster	1	2	3
1		68.42	31.41
2	68.42		37.00
3	31.41	37.00	

Notes. SO = Extent of servitization

Table 5

Univariate test of difference between cluster means

	ANOVA					
	Cluster		Error			
	Mean Square	df	Mean Square	df	F	Sig.
SO	101770.23	2	81.49	325	1248.95	.00

ANOVA

	Cluster		Error			
	Mean Square	df	Mean Square	df	F	Sig.
SO	101770.23	2	81.49	325	1248.95	.00

Notes. The F tests should be used only for descriptive purposes because the clusters have been chosen to maximize the differences among cases in different clusters; The observed significance levels are not corrected for this and thus cannot be interpreted as tests of the hypothesis that the cluster means are equal; α=.05; SO = Extent of servitization.

Next, in order to test whether there are significant differences between the clusters on parameters like organizational innovativeness, customer focus and the two dimensions of performance – financial and market performance, and quality performance - we performed a MANOVA analysis using the cluster membership variable as the fixed factor. The multivariate F-ratio (using Wilks-Lambda) was significant; Levene's test indicated that the assumptions of equality of error variances for all clusters were met; and the tests of between-subject effects were all significant as indicated in Table 6.

Table 6

Multivariate test of fitness of the MANOVA model

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power [b]
Corrected Model	Avg_Innovativeness	7759.63 [a]	2	3879.82	7.69	.00	.06	15.37	.95
	Avg_Cust_Rel	9566.01 [c]	2	4783.00	10.83	.00	.08	21.65	.99
	Avg_Fin_Mktg _Perf	4215.89 [d]	2	2107.94	5.56	.00	.04	11.11	.85
	Avg_Qual_Perf	3977.68 [e]	2	1988.84	7.03	.00	.05	14.07	.93
	Avg_Inv_Perf	2398.32 [f]	2	1199.16	3.35	.04	.03	6.70	.63

a. R Squared = .06 (Adjusted R Squared = .05); b. Computed using alpha = .05; c. R Squared = .08 (Adjusted R Squared = .07); d. R Squared = .04 (Adjusted R Squared = .03); e. R Squared = .05 (Adjusted R Squared = .04); f. R Squared = .03 (Adjusted R Squared = .02).

Post hoc pairwise multiple comparison tests were performed to determine which means differed among the clusters. The Bonferroni method was chosen as suitable for these tests because it adjusts the observed significance level for multiple comparisons. All the parameters had

significant differences on cluster means between either cluster 1 and 2 or between clusters 1 and 3. The differences between clusters 2 and 3 are not significant on any of the variables and therefore we consider both clusters 2 and 3 to be together. Finally, the profile plots for innovativeness, customer focus, and the two dimensions of firm performance – financial and market performance; and quality performance – clearly indicate that cluster 1 has a high loading while both cluster 2 and 3 have low loadings.

As the profile plots from cluster analysis and from MANOVA indicate, cluster 1 with its high loading on both innovativeness and customer focus dimensions, along with its high loading on extent of servitization and on both dimensions of firm performance represent quadrant 4 (Q4) in Figure 1. Because H1 had predicted high extent of servitization when customer focus and organizational innovativeness are both high, we argue that the fit of cluster 1 with quadrant 1 of our typology supports H1. Similarly, clusters 2 and 3 together with their low loading on both innovativeness and customer focus dimensions, along with their low loading on extent of servitization and on both dimensions of firm performance represent quadrant 1 in Figure 1, thereby supporting H2. H2 had predicted low extent of servitization when customer focus and organizational innovativeness are both low. Since none of the differences between clusters 2 and 3 were significant we argue that fit of Clusters 2 and 3 both with quadrant 1 (Q1) supports H2.

Considering both clustering and MANOVA results together we suggest that cluster 1 would fit the fourth quadrant (Q4) in our proposed typology, and clusters 2 and 3 would fit the first quadrant (Q1). We have argued earlier in the paper that the other two quadrants are theoretically misfit for modern manufacturing firms. None of the firms in our sample fit either of these two quadrants. Therefore, we suggest that our proposed typology has empirical support.

DISCUSSION

Currently many manufacturing firms have already included or are considering including service as a value-added activity and this movement is usually referred to as servitization. Servitization can provide improvements in revenue and profit margins, a closer customer relationship as well as better understanding of customer needs and requirements (Neely, 2008). As a consequence of servitization the customer may be more depending on the supplier and tends not to switch to a competing supplier unless the delivery is extremely poor. A few firms that have successfully done this transition towards servitization over the years are IBM, going from having a very high hardware focus to business solutions, and SKF, which today sells not only ball bearings but the entire technical solution including service and maintenance (Winroth & Johansson, 2011).

There have been multiple case studies and some consulting assignment narratives on servitization in extant literature which did not clearly establish a framework for servitization and conditions under which it is beneficial or problematic. Only one empirical study had suggested that servitization could be beneficial only for small firms (Neely, 2008) but it was not followed up by other independent empirical studies by other scholars. In this paper we have first proposed a typology of extent of servitization and then using a large sample of 328 manufacturing firms that are spread all across the county, demonstrated that all firms could benefit from servitization under certain conditions. Firms may need to focus on improving their customer relationship and they may need to be innovative in their approach to discovering and fixing problems related to

their process and products and they may need to encourage organizational risk taking in trying out newer approaches whenever problems occur.

Manufacturing firms may need to better integrate their production and operations department and their sales and marketing departments in order to get to know customer demands and changing tastes. Websites and online customer forums such as blogs could be maintained to know and keep track of expressed customer wants. Further, services that competitors offer and the prices that they charge for both products and related services need to be known so as to better design and benchmark their own offering of products and related services in the future (Reynolds, 2012).

FUTURE RESEARCH AND LIMITATIONS

Extant research on manufacturing firms have been focusing on different means to improve their competitiveness vis-à-vis pure service firms and increasing the extent of servitizing as proposed in the typology, seems to be key for future survival and growth. Future research could investigate the predictive relationships among the variables proposed herein, especially in a longitudinal research setting. Future studies could also investigate the effect of other variables like labor intensity, process structure, i.e., job shop vs. line flow layout on the ease of servitization and the impact that increased servitization may have on these variables.

This study, like most others, suffers from a few limitations. First, we used a surrogate one-item to measure the extent of servitization. A measure already used in extant literature is the percent of sales arising out of services offered by the firm (Fang et al., 2008), and another is asking managers to report number of services offered (Neely, 2008). We did not use either measure since there is a strong possibility that although firms may offer services yet such services may not contribute significantly to their revenues, in which case the first measure would not be able to accurately capture the true extent of servitization of the firm. Asking managers to report number of services that their firms offer also has issues; they may not be able to recall correctly. Further sometimes although firms may not offer many services, they may be able to satisfy more than customer need and taste with the same service, thereby indicating that number of services offered does not directly indicate the degree of servitization to serve customers' needs. Therefore, we decided to use a surrogate one-item measure which actually asked the respondent to report the degree of customer contact in their service operations, thereby implicitly forcing respondents to indicate zero or skip this question, if their firms offered very low or no servitization at all. Second, we used perceptual measures to test all our constructs and the possibility of common methods bias cannot be ruled out completely. Third, for organizational innovativeness we used a two-item measure; even though a three or more item measure might be ideal, we argue that this scale had reliability as indicated by the acceptable reliability coefficient (Cronbach's α) in Table 2. Finally, our cluster sizes are unequal - the first cluster being greater than the sum of the other two clusters put together. Cluster analysis with unequal sizes are frequently used in medical studies, e.g., to study the effect of a treatment on persons nested within clusters, for instance, patients within clinics or pupils within schools. It has been established in medical research that the loss of efficiency due to variation of cluster sizes rarely exceeds 10 per cent and can be compensated easily (van Breukelen, Candel, & Berger, 2007). Thus, unequal cluster sizes are not a major issue in interpretability of the above empirical results.

REFERENCES

Abernathy, W. J., & Townsend, P. L. (1975). Technology, productivity and process change. *Technological Forecasting and Social Change, 7*, 379-396.

Ahire, S. L., Golhar, D. Y., & Waller, M. A. (1996). Development and Validation of TQM Implementation Constructs. *Decision Sciences, 27*, 23-56.

Ansari, A. and Modarress, B. (1990*) Just-in-Time Purchasing*, The Free Press, New York, NY. ASM. (2009). *Annual Survey of Manufactures (ASM)*. Washington, DC: U.S. Census Bureau.

Baines, T., Lightfoot, H., Peppard, J., Johnson, M., Tiwari, A., Shehab, E., et al. (2009). Towards an operations strategy for product-centric servitization. *International Journal of Operations & Production Management, 29*, 494-519.

Baines, T., Lightfoot, H. W., Benedettini, O., & Kay, J. M. (2009). The servitization of manufacturing: A review of literature and reflection on future challenges. *Journal of Manufacturing Technology Management 20*, 547-567.

Baldridge, J. V., & Burnham, R. 1975. Organizational innovation: Industrial, organizational, and environmental impact. *Administrative Science Quarterly, 20*: 165-176.

Blau, J. R., & McKinley, W. 1979. Idea, complexity, and innovation. *Administrative Science Quarterly, 24*: 200-219.

Bowen, D. E., Siehl, C., & Schneider, B. (1989). A Framework for Analyzing Customer Service Orientations in Manufacturing. *The Academy of Management Review, 14*, 75-95.

Bryant, J. (2011). Can the U.S. manufacturing industry survive in the years to come? *Bizmology*.

Buffa,E . S. (1980)R esearch in operations management. Journal of Operations Management, 1, 1-6.

Buffa, E. S. (1984) Meeting the competitive challenge. New York: Irwin.

Chase, R. B. (1978). Where does the customer fit in a service operation? *Harvard Business Review*, 56, 137-142.

Chase, R. B. (1981). The customer contact approach to services: Theoretical bases and practical extensions. *Operations Research, 29*, 698.

Cohen, M. A., Agrawal, N., & Agrawal, V. (2006). Winning in the aftermarket. Harvard Business Review, 84(5), 129-138.

Daft, R. L., & Becker, S. W. 1978. *The innovative organization*. New York: Elsevier.

Daft, R. L. 1982. Bureaucratic versus nonbureaucratic structure and the process of innovation and change. In S. B. Bacharach (Ed.), *Research in the sociology of organizations*, 1:129-166. Greenwich, CT: JAI Press.

Damanpour, F. 1987. The adoption of technological, administrative, and ancillary innovations: Impact of organizational factors. *Journal of Management, 13*: 675-688.

Damanpour, F., & Evan, W. M. 1990. The adoption of innovation over time: Structural characteristics and performance of organizations. Paper presented at the annual meeting of the Decision Science Institute, San Diego.

Damanpour, F. (1991). Organizational Innovation: A Meta-Analysis of Effects of Determinants and Moderators. *The Academy of Management Journal*, *34*, 555-590.

Deming, W.E. (1986) *Out of the Crisis,* Massachusetts Institute of Technology, Center for Advanced Engineering Study, Cambridge, MA.

Deming, W.E., (1993) *The New Economics for Industry, Government, Education*, Massachusetts Institute of Technology, Center for Advanced Engineering Study, Cambridge, MA.

Dröge, C., Vickery, S. and Markland, R.E. (1994). Sources and outcomes of competitive advantage: An exploratory study in the furniture industry, *Decision Sciences,* 25, 669-689.

Engelkemeyer, S.W. (1990). An empirical study of total quality management practices in U.S. manufacturing firms, Unpublished Ph.D. dissertation, Clemson University, Clemson, SC.

Ettlie, J. E., Bridges, W. P., & O'Keefe, R. D. 1984. Organization strategy and structural differences for radical versus incremental innovation. *Management Science, 30*: 682-695.

Fang, E., Palmatier, R. W., & Steenkamp, J. (2008). Effect of service transition strategies on firm value. *Journal of Marketing, 72*, 1-14.

Garvin, D.A., (1988) *Managing Quality: The Strategic and Competitive Edge*. Free Press, New York, NY.

Garvin, D. A., Building a learning organization. Harvard Business Review, 1993, 71[4]: 78-91.

Hair, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (2009). Multivariate data analysis (7th ed.). Englewood Cliffs, NJ: Prentice Hall.

Hull, F., & Hage, J. 1982. Organizing for innovation: Beyond Burns and Stalker's organic type. *Sociology, 16*: 564-577.

Kaynak, H. (2005). Implementing JIT Purchasing: Does the Level of Technical Complexity in the Production Process Make a Difference? *Journal of Managerial Issues, 17*, 76-100.

Kaynak, H. (2006). Measuring Organizational Effectiveness and Business Performance in Firms Implementing Total Quality Management. *International Journal of Manufacturing and Technology Management, 8*, 355-381.

Kaynak, H., & Hartley, J. L. (2005). Exploring quality management practices and high tech firm performance. *The Journal of High Technology Management Research, 16*, 255-272.

Kaynak, H., & Hartley, J. L. (2008). A replication and extension of quality management into the supply chain. *Journal of Operations Management, 26*, 468-489.

Kellogg, D. L., & Chase, R. B. (1995). Constructing an empirically derived measure for customer contact. *Management Science, 41*, 1734-1749.

Mahoney, T.A., Weitzel, W., (1969) Managerial models of organizational effectiveness, *Administrative Science Quarterly,14*, 357-365.

Mathieu, V. (2001). Service strategies within the manufacturing sector: benefits, costs and partnership. *International Journal of Service Industry Management, 12*, 451.

Mont, O. K. (2002). Clarifying the concept of product-service system. *Journal of Cleaner Production, 10*, 237-245.

Morelli, N. (2002). Designing Product/Service Systems: A methodological exploration. *Design Issues, 18*, 3-17.

Morrow, P.C., 1997. The measurement of TQM principles and work-related outcomes. *Journal of Organizational Behavior, 18*, 363-376.

Neely, A. (2008). Exploring the financial consequences of the servitization of manufacturing. *Operations Management Research, 1*, 103-118.

Powell, T. C. (1995). Total quality management as competitive advantage: A review and empirical study. *Strategic Management Journal, 16*, 15-37.

Reynolds, M. (2012). 7 ways manufacturing companies can increase sales. In M. Reynolds (Ed.). Indianapolis, IN: Spinweb.

Servitizer. (2011). Servitization Defined from http://servitizer.com/servitization-defined.html#

Shetty, Y.K. (1988) 'Managing product quality for profitability', *SAM Advanced Management Journal*, *53*, 33-38.

Singh, J. V. (1986). Performance, Slack, and Risk Taking in Organizational Decision Making. *The Academy of Management Journal, 29*, 562-585.

Soteriou, A. C., & Chase, R. B. (1998). Linking the customer contact model to service quality. *Journal of Operations Management, 16*, 495-508.

Staw, B. M., Sandelands, L. E., & Dutton, J. E. (1981). Threat Rigidity Effects in Organizational Behavior: A Multilevel Analysis. *Administrative Science Quarterly, 26*, 501-524.

Swamidass, P.M. and Newell, W.T. (1987) 'Manufacturing strategy, environmental uncertainty and performance: a path analytic model', *Management Science, 33*, 509-524.

United States General Accounting Office, 1991. Management practices: U.S. companies improve performance through quality efforts. GAO/NSIAD-91-190, Washington, D.C.

Utterback, J. M., & Abernathy, W. J. 1975. A dynamic model of process and product innovation. *Omega, 3*: 639-656.

van Breukelen, G. J. P., Candel, M. J. J. M., & Berger, M. P. F. (2007). Relative efficiency of unequal versus equal cluster sizes in cluster randomized and multicentre trials. *Statistics in Medicine*, *26*, 2589-2603.

Vandermerwe, S., & Rada, J. (1988). Servitization of business: Adding value by adding services. *European Management Journal, 6*, 314-324.

Venkatraman, N. and Ramanujam, V. (1987) 'Measurement of business economic performance: an examination of method convergence'*, Journal of Management, 13*, 109-122.

Wise, R., & Baumgartner, P. (1999). Go downstream: The new profit imperative in manufacturing. *Harvard Business Review, 77*, 133-141.

Ward, P.T., Leong, G.K. and Boyer, K.K. (1994). Manufacturing proactiveness and performance, *Decision Sciences*, *25*, 337-358.

Wheelwright, S. C. (1984) Manufacturing strategy: Defining the missing link. Strategic Management Journal, 5, 77-91.

Winroth, M., & Johansson, G. (2011, Apr. 29 – May 2). A lean perspective on servitization of manufacturing. Paper presented at the *22nd Annual POM Conference*, Reno, Nevada, USA.

Wu, L., Yue, X., & Sim, T. (2006). Supply chain clusters: A key to China's cost advantage. Supply Chain *Manag Rev, 10*, 46–51.

Zaltman, G., Duncan, R., & Holbek, J. 1973. *Innovations and organizations*. New York: Wiley.