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MADE TO SERVE: A MODEL OF THE OPERATIONS PRACTICES AND TECHNOLOGIES THAT DELIVER SERVITIZATION

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ABSTRACT

This paper explores how successfully servitised manufacturers deliver advanced services and proposes a model that describes how they configure their operations. A case study methodology is applied across four manufacturing organisations successful in delivering advanced services. A descriptive model is then formed based around six popular technologies and practices.

Keywords: Servitization, Product-service systems, case study.

1 INTRODUCTION

Servitization is the process of transforming manufacturers to compete through Product-Service Systems (PSS). The commercial and environmental benefits of PSSs are compelling and well documented; Rolls-Royce earning over 50% of their revenue from services is cited almost to exhaustion. But below the economic success stories of large multinational companies, what does it really take for a manufacturer to succeed through a servitization?

Advanced services are a special case in servitization. Sometimes known as capability or availability contracts, here the manufacturer delivers services (coupled with incentivized contracting mechanism) that are critical to their customer's core business processes (i.e.: Power-by-the-hour). Successful delivery of such services demands particular organisational principles and relationships which differ to those applied in production operations (Chase and Garvin, 1989; Oliva and Kallenberg, 2003). A lack of the necessary capabilities within operations explains why some manufacturers fail to realise the anticipated benefits of servitization. The research described in this paper has therefore set out to question: *What are the distinctive practices and technologies, within the broader operations of servitized manufacturers, which are employed to successfully deliver advanced services?*

In this study we have investigated four manufacturing organisations that are leaders in the delivery of advanced services. In each, data has been collected across the organisation, service-delivery partners, and key customers. Analyses has then identified the popular technologies and practices used within their operations, and then used this understanding to create a descriptive model that helps to explains their adoption. This model summarises how these practices and technologies combine to provide the key capabilities that underpin the successful delivery of an advanced services offering.

2 METHODOLOGY

This study set out to build our understanding of how the operations of manufacturers are impacted as they servitize. In particular, to extend our understand of *What* practices and technologies are commonly deployed by successful organisations, and also better explain *how* and *why* these combine to deliver advanced services. The exploratory work of Baines *et al*. (2009) offered a valuable starting point.

The propositions in this earlier paper are a synthesis of both production and services operations literature. Consequently they provide the basis for a comprehensive set of '*guiding questions'* to orchestrate data collection around *'why'* and 'how' practices and technologies support the delivery of advanced services. Also, this earlier study found that a case study methodology was invaluable for exploring and gaining insight into the detailed workings of an organisation and so a case study methodology was again favored.

Critical to the success of this study was the identification and engagement of manufacturers that had a demonstrable record of successful delivery of advanced services. Financial success was considered within a broad set of indicators. These included citations from other researchers (i.e., references made in publications), indicators of innovation (i.e., patents registered), and general reputation within the business community for delivering advanced services (i.e., conversations with practitioners).

A short-list of companies was formed and prioritised, and then companies were approached in that order. This relied on informal networks for introductions to key personnel. During the process, care was taken to avoid approaching competing companies since this would inhibit willingness to participate. In all, four cases were identified and preliminarily engaged by mid-2009; they were visited, and negotiations concerning access and confidentiality were undertaken. All cases were in progress by early 2010. On average, it took 18 months to complete each case study. A data collection protocol was developed as guiding questions around the work of Baines *et al*. (2009) In particular data was collected for (1) the typical characteristics of the service offering and (2) the technologies and practices popular across the case companies.

Analyses sought to identify from the data those practice and technologies that are common to all the cases, to explain these, and to understand how they supported advanced services. Systematically we examined the records of each interview, identified the practices and technologies being discussed, and captured these as branches of the mind-map. As each set of additional data was added, the mind-map was adjusted (eg: branches were grouped together), and broad themes began to emerge. The mind-maps for all four cases were then compared and combined.

The results themselves are in two parts, the first dealing with the characteristics of the advanced service offering and the second summarising the popular practices and technologies exhibited within the operations of the case companies. Six policy areas have been directly derived through the analysis. They represent the six areas where the practices and technologies at the case companies commonly differed to those in production.

3 DISCUSSION OF RESULTS

In this section we examine the practices and technologies for each policy area, and rationalise how these impact the successful delivery of an advanced service.

Performance measurement: Measures in the delivery of advanced services focus on outcomes aligned to individual customers, which are then cascaded in (1) customer facing measures, (2) internal macro-measures, and (3) localised measures of contract fulfilment. The manufactures translate these customer facing measures into their own internal metrics. These are then further deconstructed into local measures and indicators. These are used by the manufacturer to control all the sub-processes involved in the management of service delivery. For example, they may capture the number of faults recorded on a train or aircraft between scheduled maintenance activities. Alternatively, these might be standard times for carrying out maintenance activities, and indicators such as variance from these times.

Facilities and their location: In all cases the delivery of advanced services is accompanied by the manufacturer developing or adopt facilities, co-located and distributed throughout customers operations'. This practice was given to exist for two principal reasons: (1) localised facilities enable faster fault diagnostics and rectification. Largely because staff are physically closer and more likely to be available when a failure occurs, possibly witnessing an incident, and taking corrective actions more quickly and precisely; and (2) localised facilities sustain strong relationships between the manufacturer and customers at the level of day-to-day operations.

Micro-vertical integration and supplier relationships: As expected, all our servitized manufacturers have extended their operations forwards, to undertake a range of activities such as condition monitoring, maintenance, repair, overhaul and management of their own products on behalf of their customers. In all cases there is also clear retention of design and production capabilities to support services deployment (rather than product manufacture). These activities are under the direct control of the business function that holds the responsibility for supporting services (sometimes referred to as the front-office).

Such micro-vertical integration occurred across all the cases and was given to exist because it enables: (1) reduced exposure to excessive stockholding delays and costs from acquiring components remanufactured in the supply chain; (2) components can be more easily redesigned, removing design flaws, and so reducing chances of future failures and associated costs; and (3) a route for transferring good practices developed in production into service operations (e.g., case 1 exploits Lean techniques through-out their service operations, and the route for this has been through their earlier adoption within the production operations of this organisation).

Information and communication technologies: Across our case companies there was a common architecture for such ICT systems. Such ICT provide remote insight into the condition and use of a product, and advanced warning of impending failures. For example, all cases use ICT systems to register and diagnose faults on their products, and use the information to schedule preventive maintenance. Cases 1, 2, and 3 incorporate in these systems a GPS capability which provides information on product location. These are mobile assets, and much time is saved by knowing where they are located when a fault occurs. Cases 2 & 3 also gain significant value from knowing how their products are being used by customers. This information is used for: (1) contract monitoring (eg: monthly negotiations about equipment usage); (2) to enhance productivity and reliability (eg: Incentivise and guide operator training so reducing consumables such as fuels and tyres); and (3) ultimately feed through to the design process for future products.

People deployment and their skills: Our investigation focused largely on skill-sets that underpin the ‘behavior’ of the people in the front-line of service delivery. Analysis and synthesis of our case data using mind-mapping techniques led us to identify six principal behaviors that collectively led to a positive customer experience and the skill-sets that underpinned these, namely; (1) flexibility, (2) relationship-building, (3) service-centricity, (4) authenticity, (5) technical adeptness, and (6) resilience. The justification given for these skills is that they facilitate and sustain positive relationships with customers. However, the extent to which these skills are demanded of individual staff does vary according to role. For example, a Condition Monitoring technician will need stronger technical skills relative to an Account Sales Manager, who will correspondingly need to be stronger at relationship building.

Business processes and customer relationships: Our cases revealed that processes are integrated into a wide range of customer ‘touch-points’, and set out to be proactive in the way they deal with issues. With advanced services processes are formed to deliver desired outcomes from products. At the outset of the contract, policies are established which agree the condition of the product and the actions necessary to maintain these. The interactions between the customer and manufacturer are then around communication rather that negotiating an action. Here, the customer will be informed so that contingencies can be executed. The outcome of the whole process is that the product is returned to be available for use rather than simply repaired. The manufacturer is incentivised to achieve this by penalties associated with the customer facing performance measures. In the example above, where the truck is not available for use, the manufacturer will be penalized.

4 MODEL OF THE DELIVERY SYSTEM FOR ADVANCED SERVICES

The popular practices and technologies only go part way to explaining the operations that case companies put in place to deliver advanced services. These act as a system, *interacting* with each other, to collectively provide the manufacturers with the *capabilities* to successfully deliver the desired advanced service. Our analysis has enabled a model to be created that captures the principle structure of this system (see Appendix 1). This shows how the generic characteristics of an advanced service are supported by the practices and technologies in each of the six policy areas. This linkage is explained by introducing two *foundational capabilities* and, also, the mediating factors across the system. The elements of this model are as follows.

Foundational capabilities: There are two capabilities that underpin the successful delivery of advanced services. Running through our findings are two particular capabilities; (1) An ability to respond cost effectively, and (2) An ability to improve cost effectiveness.

Many of the practices we have presented enable the manufacturer to respond. Case 1 illustrates this well. They are penalised financially by their customers if their high-speed trains are unavailable, un-reliable, or do not perform to standard. Responsiveness is key. Case 1 has developed the people, systems and processes to ensure any failures are dealt with rapidly, and indeed proactively, so the customer experience is unaffected. The same is true for Rolls-Royce holding a Power-by-the-hour contract with Singapore Airlines, or Xerox providing printing capability for Reuters.

In addition, the capability to improve designs and systems begins to explain why manufacturing organisations, with their design and production expertise, are well suited to deliver advanced services. The driving motivation, here, appears to be a desire to improve the financial productivity of an advanced services contract once operational. Improvements can be made to both products and processes. Products can be re-designed so that they are more reliable, easier to maintain, and faster to repair should they fail. Similarly, processes can be re-designed to deal better with failures, ensure a rapid response, and minimise the manpower and materials necessary should a failure occur. Overall, the extent to which an organisation holds these capabilities begins to suggest how successful they are likely to be in delivering advanced services. Those that have both the knowledge and capacity as an organisation to be responsive, whilst also being able to improving their efficiency in delivering their response, are likely to be most successful. These underlying capabilities perhaps indicate the DNA of successful servitization.

System interactions: Many of our findings suggest such connectivity, for instance the need for facilities to be co-located with customer operations is affected by ICT capabilities and vice versa.

While all these cases exhibited this connectivity, the extent to which practices and technologies were adopted did vary. For example, case 3 is sophisticated with its use of ICTs; in some instances having as many as 200 sensors on vehicles and significant investments in prognostics. By contrast, case 1 has a lesser ICT capability to monitor high-speed trains, but here maintenance and repair facilities are more extensive.

A dynamic (time dependent) interplay occurs across all the factors given in Figure 2. Advanced services are adopted, in part, by customers who want to avoid the negative outcomes associated with an asset failing to perform its service. Since such responsibilities are taken on by the manufacturer, there is a natural incentive to create designs that are more reliable and easier to maintain. Consequently, this relaxes the motivation for the customer to adopt such services.

This is apparent, for example, with case 4 in which the asset has the capability to conduct self-diagnoses and healing, along with a modular design that enables faulty sub-systems to be replaced easily in the field. As a consequence, case 4 engages in the least sophisticated services contracts, practices and technologies. As this trend continues and equipment becomes more reliable, it is likely to be more difficult to sell services. This cycle is perhaps, only disputed when a new technology is introduced that offers advances in performance, but its newness also increases the risk of failure.

The extent to which a physical presence is needed is relaxed by a number of factors. Case 4 has a policy of modular equipment design with built-in back-up systems. These modules are relatively small and portable, and information and communication technologies are used to remotely diagnose problems and chose corrective actions. This built-in redundancy, portability and remote monitoring, means that a maintenance technician can cover several customer sites from a single maintenance hub.

The extent of this micro-vertical integration is moderated by a range of factors. This 'tail' of design and production activities appears shorter where strong links exist with a production facility and partners in the supply-base. Highly significant across all cases was the contractual relationship with these suppliers. Integration is relaxed where suppliers are willing and able to provide capabilities, that mirror the commitments given by the servitized manufacturer to their customers. Likewise, this integration is less for lower-value sub-systems where stock-holding is more affordable.

The sophistication of ICT capabilities is relaxed by a number of factors that help to reduce risk exposure, in particular: (1) assets are stationary and so don't require tracking; (2) the proximity of the manufacturers facilities enable manual observation to be easily carried-out; (3) there are built-in back-up systems; and (4) there is easy access of conventional communication channels such as the Internet.

5 CONCLUSIONS AND FUTURE WORK

This paper contributes to both the theory and practice of servitization. It explains that the successful delivery of advanced services is achieved by a tightly coupled delivery system that features; (1) facilities that are collocated and distributed throughout customers operations, (2) integrated both forwards and backwards in their supply chains, and (3) staffed by personnel who are flexible, relationship-builders, service-centric, authentic, technically adept, and resilient. These people work with, (4) business processes that are integrated into their customer's operations, (5) supported by Information and Communication Technologies that enable remote product monitoring, with (6) the entire system being controlled by measures that reflect outcomes aligned to individual customers, and then cascaded down into various forms throughout the service delivery system.

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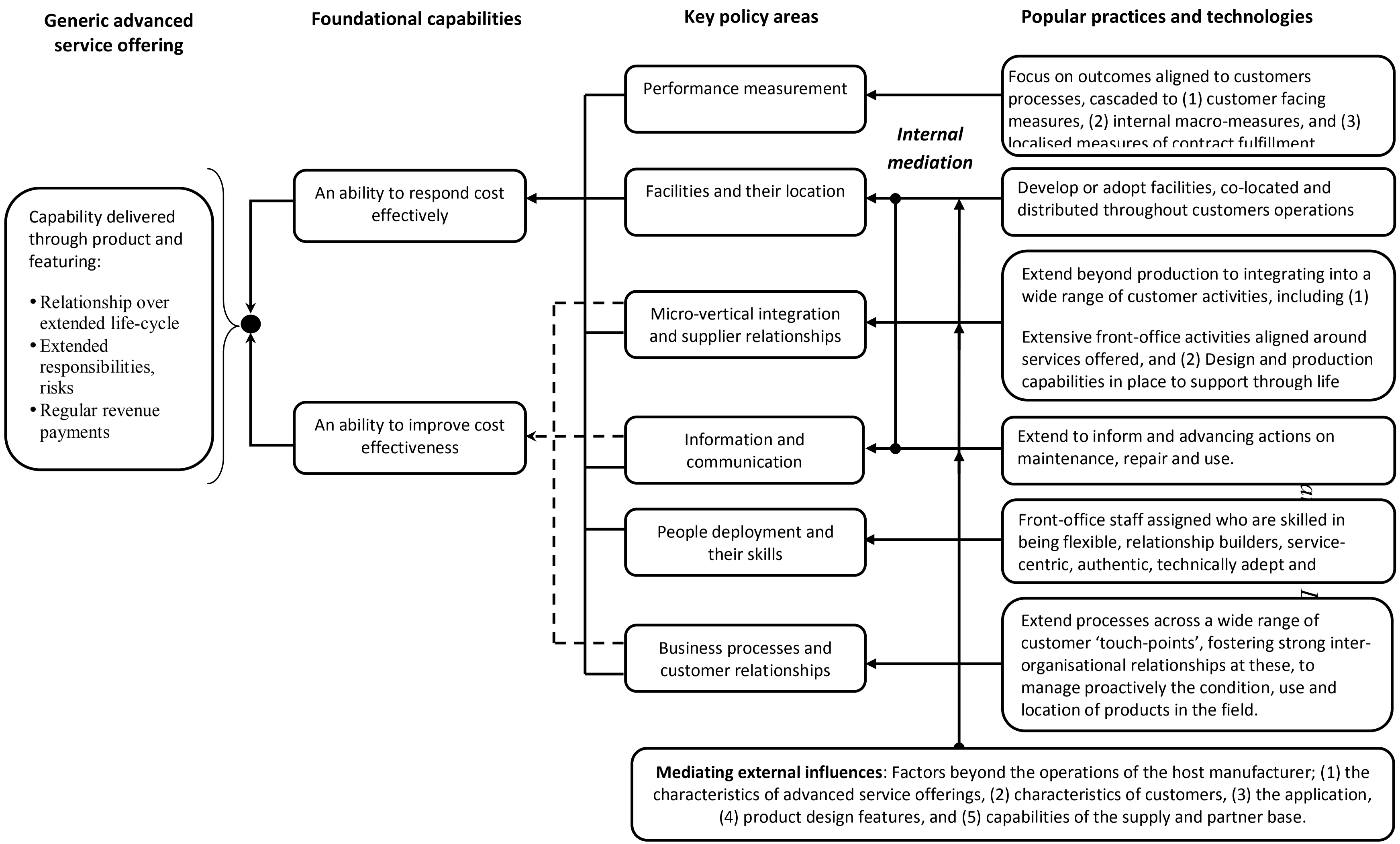
Generic advanced service offering
Foundational capabilities
Key policy areas
Popular practices and technologies
Capability delivered through product and featuring:
• Relationship over extended life-cycle
• Extended responsibilities, risks
• Regular revenue payments
An ability to respond cost effectively
An ability to improve cost effectiveness
Performance measurement
Facilities and their location
Micro-vertical integration and supplier relationships
Information and communication
People deployment and their skills
Business processes and customer relationships
Internal mediation
Focus on outcomes aligned to customers processes, cascaded to (1) customer facing measures, (2) internal macro-measures, and (3) localised measures of contract fulfillment
Develop or adopt facilities, co-located and distributed throughout customers operations
Extend beyond production to integrating into a wide range of customer activities, including (1)
Extensive front-office activities aligned around services offered, and (2) Design and production capabilities in place to support through life
Extend to inform and advancing actions on maintenance, repair and use.
Front-office staff assigned who are skilled in being flexible, relationship builders, service-centric, authentic, technically adept and
Extend processes across a wide range of customer 'touch-points', fostering strong inter-organisational relationships at these, to manage proactively the condition, use and location of products in the field.
Mediating external influences: Factors beyond the operations of the host manufacturer; (1) the characteristics of advanced service offerings, (2) characteristics of customers, (3) the application, (4) product design features, and (5) capabilities of the supply and partner base.

Appendix 1: Advanced services delivery