

Measuring Servitization Progress and Outcome: The Case of ‘Advanced Services’

Ali Ziaee Bigdeli ^{a*}, Tim Baines ^a, Andreas Schroeder ^a, Steve Brown ^b, Eleanor Musson ^a,
Victor Guang Shi ^c, Armando Calabrese ^d

^a*Aston Business School, Aston University, Birmingham, B4 7ET, UK.*

^b*Southampton Business School, University of Southampton, Highfield, Southampton SO17 1BJ, UK*

^c*University of Sheffield, AMRC, Rotherham, S60 5TZ, UK.*

^d*University of Rome “Tor Vergata”, Via del Politecnico 1, 00133, Rome, Italy.*

*Corresponding author. Email: a.bigdeli@aston.ac.uk

Abstract

The purpose of this paper is to establish a framework for assessing the progress and outcome of a manufacturer’s transformation towards becoming a provider of ‘advanced services’ – a complex bundling of products and services, whereby manufacturers offer capabilities and outcomes instead of products alone. ‘Advanced services’ represent the most complex offering in the current servitization trend among manufacturers. However, current performance measures lack the breadth and focus to assess progress or outcomes, and so support research and practice of organisational transformation efforts required. To address this gap the paper investigates how a manufacturer’s efforts to become an ‘advanced services’ provider can be comprehensively measured, and develops a framework for assessing the transformation journey towards becoming an ‘advanced services’ provider. The research method is based on (1) a systematic literature review process to create a comprehensive set of service-related performance measures that are available to assess a manufacturer’s servitization efforts, followed by (2) an engagement with an expert panel to synthesise the identified measures and create a set of ‘advanced services’ performance measures. The proposed framework is presented as a scorecard that can be used in practice to assess the progress and outcome of a manufacturer’s transformation towards becoming a provider of ‘advanced services’.

Keywords: servitization, advanced services, performance measurement, manufacturing.

1. Introduction

Traditional product-manufacturers increasingly seek to shift their priorities towards their service-business, a strategic transformation termed ‘servitization’ (Raddats et al., 2016, Visnjic Kastalli and Van Looy, 2013). Servitization provides manufacturers with considerable opportunities to extend their customer-relationships and broaden their revenue streams. However, such a transformation not only requires manufacturers to develop new service-offerings, but also often requires the creation of a new service organisation and new capabilities for service delivery.

In particular, far-reaching transformation efforts are required by manufacturers seeking to offer ‘advanced services’¹ – a complex bundling of product- and service-offerings, which often includes: (i) revenue payments structured around product usage; (ii) performance incentives (e.g. penalties for product failure when in service); and (iii) long-term contractual agreements (e.g. spanning five, ten or 15 years) and cost-down commitments (Baines and Lightfoot, 2013). Well-known ‘advanced services’ examples include Rolls-Royce’s *Power-by-the-Hour* offering (Ng et al., 2012), where the product (jet engine) and the service (proactive engine health monitoring) are provided as a single offering and customers are charged for the extent of use of the product-service-bundle (i.e. numbers of passengers moved, or mileage travelled). Instead of offering its product in the form of a transactional equipment purchase, Rolls-Royce offers it in the form of an ‘advanced service’ covering a ten-year contractual service relationship with performance incentives (including penalties for the lack of engine uptime).

Other ‘advanced services’ examples include Xerox’s *Print Management* offering (Baines and Lightfoot, 2013), which bundles printing-equipment and maintenance-services whereby customers are charged for the use of the product-service-bundle (i.e. per print); or MAN’s *Pay-per-Kilometre* offering (Bustinza et al., 2015), which bundles truck, maintenance and driver-management services where customers are charged for the extent of the use of the bundle (i.e. distance driven). ‘Advanced services’ offerings tightly align the customer’s objectives (e.g. uptime, efficiency) with the objectives of the manufacturer.

The transformation efforts required by the manufacturer to develop and deliver such ‘advanced services’ is substantial. It requires establishing a service function that can design such product-service bundles as well as the relational sales capabilities that are essential to sell such complex service-offerings. It also demands the integration of the wider organisation, beyond the service function, to

¹ The term ‘advanced services’ differentiates from other manufacturing services which are focused on product support such as condition monitoring, maintenance, repair, overhaul and remanufacturing (‘intermediate services’) or discrete service interventions such as spare parts, warranty, etc. (‘base services’) (Baines and Lightfoot, 2014).

further develop products that are ‘designed for service’ to enable an effective service delivery (Gebauer et al., 2012a, Biege et al., 2012, Ceci and Masini, 2013, Baines et al., 2017). The manufacturer’s ability to assess and align these substantial and far-reaching transformation efforts is critical for a coordinated development towards becoming an ‘advanced services’ provider (Sharma et al., 2005).

Servitization research has already started to develop and apply individual measures to assess performance aspects of a manufacturer’s transformation efforts. Measures such as *service revenue growth* (Visnjic et al., 2012) or *service market share growth* (Fugate et al., 2012, Gebauer et al., 2012b) have been put forward to assess the overall outcome of a manufacturer’s servitization transformation. Although these measures are important, they provide only partial insights on the effectiveness of such efforts as they do not consider the overall management efforts and resources required to achieve these outcomes. Also, they do not identify the individual initiatives that have contributed to the achievement. Furthermore, research efforts to assess servitization outcomes make no distinction between different service types although manufacturers’ services differ significantly in their complexity and the kind of immediate outcomes they create. Hence, there is a substantial research gap in the ability to assess, compare and evaluate the progress and outcome of a manufacturer’s transformation towards becoming a provider of ‘advanced services’.

From a practical perspective, the need has emerged to develop a comprehensive measurement framework that can guide manufacturers in their complex and multifaceted transformation efforts towards becoming ‘advanced services’ providers (Baines et al., 2017). To date, many manufacturers still rely solely on traditional financial measures to assess the performance of their transformation (Rapaccini, 2015). Although these financial measures are important, the complex transformation efforts cannot be assessed exclusively from a financial perspective (Ziaee Bigdeli and Baines, 2017). Instead, a comprehensive measurement framework is required that enables manufacturers to not only assess the ‘progress’ they have made in their transformation towards becoming ‘advanced services’ providers but also to determine the performance ‘outcome’ of their ‘advanced services’ offering.

The present study sets out to address this gap directly, by investigating how the progress and outcome of the transformation towards ‘advanced services’ can be comprehensively measured, and developing a tool that helps manufacturers assess such transformation. To address these objectives the study follows a two-stage research process, which integrates both theoretical and practical aspects. The first stage focuses on a systematic literature review to identify the range of measures that are already available to assess the provision of services in the manufacturing context. The purpose here is to develop a pool of service-related performance measures that take the particular perspective of the manufacturer into context. The second stage focuses on drawing on the insights of an expert panel to appraise and select the relevant performance measures and adapt them to the ‘advanced services’

context. The panel devises additional measures to fill the gaps in the pool of service-related performance measures for manufacturers.

Before describing the details of the two-stage research process and its findings, the paper reviews performance measurement theory and the dedicated research on performance measurement in the servitization literature. The paper concludes with a discussion of the diverse theoretical and practical contributions the study provides.

2. Measuring Performance in a Servitization Context

2.1 Performance measurement and business transformation

Performance measurement research perspectives

Research on performance measurement is conducted in business research domains as diverse as operations management (Bhattacharya et al., 2014, C-C et al., 2006), strategic management (Artz et al., 2012, Bisbe and Malagueño, 2012), and accounting (Ax and Bjørnenak, 2005, Marr and Schiuma, 2003). Across these domains, Neely et al. (2002) definition of performance measurement as ‘*the process of quantifying the efficiency and effectiveness of past actions*’ (p. xiii) is widely adopted, specifically in the operations management domain (MacKerron et al., 2015, Büyüközkan, 2004). The range of studies across these different domains can be grouped into three research perspectives (Folan and Browne, 2005b): 1) the identification of performance measures, 2) the integration of measures into performance measurement frameworks, and 3) the operationalisation of performance measurement systems.

The research targeting the identification of performance measures has established important criteria for effective measure selection. Some of the research examines the link between performance measures and organisational objectives and highlights the importance of performance measures being consistent with organisational goals (Beamon, 1999), specific to the function of interest (Artz et al., 2012), and suitable as early warning signals that draw attention to problems before severely damaging consequences occur (Thakkar et al., 2009). A strong link between performance measures and organisational objectives is particularly critical as the performance measures selection essentially communicates the organisational strategy across the firm (Malina and Selto, 2004). Other studies explore the importance of data quality in measure selection and emphasise the need to consider measure reliability, precision (Artz et al., 2012, Beamon, 1999), verifiability (Malina and Selto, 2004) and robustness (Griffis et al., 2004). Ideally, measures should be selected that are useful under a variety of business conditions (Beamon, 1999) and provide a clear purpose under different circumstances (Kurien and Qureshi, 2011).

The research on the development of performance measurement frameworks investigates the effective integration of the diverse range of performance measures. Performance measurement frameworks

establish the relationship between the incorporated measures and clarify the boundary of the measurement focus. Corresponding research specifically highlights the importance of selecting and integrating diverse and complementary measures to create flexibility in performance measurement and enable diverse performance benefits (Malina and Selto, 2004). Recommendations point specifically to the importance of integrating financial and non-financial performance measures (Thakkar et al., 2009), but also measures that cover long- and short-term perspectives (Kurien and Qureshi, 2011), as well as leading and lagging performance attributes.

The research investigating performance measurement systems examines the methods and procedural aspects of the development, implementation and continuous refinement of performance measurement within organisations (Folan and Browne, 2005a). Some studies examine the challenges of translating corporate strategy into performance measures and creating consensus on the collection of performance measures that best reflect the organisations' strategic objectives (Neely et al., 2000, Lohman et al., 2004, Garengo and Sharma, 2014). Of interest are the two approaches organisations follow for eliciting and defining the specific range of performance measures to guide their efforts (Kueng, 2000): organisations either selectively draw on pre-defined sets of performance measures that capture a particular business domain or start the development of performance measures from scratch. Drawing on pre-defined sets of performance measures is considered 'more efficient as it does not reinvent the wheel' (p. 75) and may enable consistency in integrated value networks (Folan and Browne, 2005b) as long as the set of measures is sufficiently targeted. Starting the development of performance measures from scratch arguably generates higher levels of ownership, understanding and organisational specificity of the resulting performance measurement framework.

The focus of the present study is to investigate how a manufacturer's efforts to become an 'advanced services' provider can be measured comprehensively and to develop a set of measures that helps manufacturers assess their transformation journey towards becoming an 'advanced services' provider. Hence, the study is anchored in the first two of the performance measurement research perspectives (i.e. 1. performance measure identification, and 2. performance measurement framework development), while paving the way for the third research category (i.e. effective operationalisation of performance measurement systems).

Context-dependence of performance measurement

Performance measurement research further emphasises how a firm's particular business or operational context impacts on the performance measure identification and framework development. A firm's strategy, in particular, has been shown in several studies to affect the choice and relative importance of performance measures. Malina and Selto (2004), for example, identify how organisations that follow conservative business strategies favour the adoption of subjective performance measures. Widener (2006), in her research, shows that highly knowledge-intensive organisations put more

emphasis on the use of *non-financial* performance measures, whereas traditional manufacturers concentrate on *financial* measures. Organisational goals create specific information needs that determine the choice and selection of suitable performance measures (Griffis et al., 2004).

In order to help organisations identify performance measures that meet their particular information needs, studies have concentrated on organisational domains to identify the particular set of performance measures required. Supply chain management is an example of such an organisational domain, with several studies identifying particular performance measures organisations require to address their supply chain challenges (Cuthbertson and Piotrowicz, 2011, Beamon, 1999). Although such proposed sets of performance measures are not complete solutions, they help organisations recognise the range of available measures and consider their role in creating a balanced understanding across the diverse business demands (Bourne et al., 2003). The present research is adopting a comparable approach by developing a generic set of performance measures to support manufacturers with their specific challenges of transforming towards becoming an ‘advanced services’ provider.

A dynamic performance measurement perspective

Even though performance measurement research has traditionally focused on assessing performance in stable business environments, studies have recently started to assess the performance of dynamic business changes (Nudurupati et al., 2016, Bourne, 2005). Corresponding research hereby specifically explores the difficulty of assessing the performance of a business transformation². Hisano Barbosa and Andreotti Musetti (2011) capture these difficulties by differentiating between efforts to capture *transformation progress* and efforts to capture *transformation outcome*³.

Efforts to capture *transformation progress* seek to identify performance measures that determine the extent to which an organisation’s business transformation has advanced. Vollmann (1996), for example, captures transformation progress by measuring the extent to which the organisation has developed its necessary competencies, re-designed its processes, or has re-evaluated its customer’s expectations. Measurements across these diverse dimensions create a multi-dimensional view of an organisation’s transformation progress, provide opportunities for benchmarking organisational transformations or identifying transformation barriers.

Efforts to capture the *transformation outcome* focus on identifying performance measures that determine the outcomes that an organisation’s transformation has created. Jayashree and Jamal

² Other dynamic research perspectives explore the difficulties of updating performance measures to accommodate a transformed business context (e.g. Waggoner et al. (1999), or the impetus performance measures can have on business transformation (e.g. Bititci et al. (2006).

³ Hisano, Barbosa and Andreotti Musetti’s (2011) categories were re-labelled to provide additional clarity.

Hussain (2011) capture the transformation outcome of an organisation changing from a monopolistic to a competitive environment and focus on measures such as ‘enhancements in customer experience’, ‘brand image’, or ‘customer alignment’ to assess the impact the transformation has created. Capturing the transformation outcome helps to ensure that the strategic objectives of the transformation are not diluted in the transformation efforts.

2.2 Integrated performance measurement

Theory and practice of performance measurement over the last few decades have moved from a focus on individual measures to a focus on ‘integrated performance measurement,’ which captures an overall view of companies’ performance across multiple dimensions (Bititci et al., 2012). The earlier reliance on individual and mostly financial measures often led to short-termism and local optimisation in decision-making, and failed to capture aspects of the external environment in which the organisation operated (Neely, 1999). An integrated approach to performance measurement instead puts an emphasis on incorporating a diverse set of measures covering financial/non-financial, long-/short-term and internal/external perspectives to create a comprehensive understanding of an organisation’s progress and development (Bisbe and Malagueño, 2012).

The Balanced Scorecard (BSC) developed by Kaplan and Norton (Kaplan and Norton, 1992) is the most popular integrated performance measurement framework (Franco-Santos et al., 2012). Its defining feature is the integration of four distinct perspectives (represented by four underlying questions) and their corresponding performance measures (required to answer these questions), which together provide a comprehensive assessment of an organisation’s development. These four perspectives are:

- The *Financial Perspective*, which integrates financial performance measures to capture how an organisation is doing from a shareholder’s point of view (‘to succeed financially, how should we appear to our shareholders?’);
- The *Internal Business Perspective*, which integrates internal operations measures to capture an organisation’s outcome delivery performance (‘to satisfy our shareholders and customers, what business process must we excel at?’);
- The *Customer Perspective*, which integrates customer-focused measures to capture how an organisation is performing from its customer’s point of view (‘to achieve our vision, how should we appear to our customers?’);
- The *Innovation & Learning Perspective*, which integrates measures that indicate an organisation’s ability to create future value and improvements to capture its innovativeness (‘to achieve our vision, how will we sustain our ability to change and improve?’).

These four perspectives represent a framework template that organisations customise by carefully selecting performance measures, which together provide a comprehensive multi-dimensional assessment of its diverse performance objectives (Kaplan and Norton, 1996).

Arguably, the BSC's popularity can be attributed to the fact that its four perspectives balance both lagging and leading measures, and internal and external views of an organisation (Kaplan and Norton, 1996), a critical feature of a comprehensive performance measurement framework. Balancing lagging and leading measures allows organisations to pursue effectively their long-term strategic objectives, while being responsive to immediate challenges (often affecting the ability to achieve strategic objectives in the long run) (Figge et al., 2002). The balancing of internal and external measures allows organisations to obtain a comprehensive understanding of themselves and their position within their business environment to respond to diverse opportunities and challenges. The four BSC perspectives balance these divergent performance measurement priorities by integrating leading (internal, customer, innovation & learning perspective) and lagging (financial perspective) as well as internal (financial, internal, innovation & learning perspective) and external (customer perspective) measures (Ax and Bjørnenak, 2005). The BSC, through its integrated perspectives, has been shown to improve organisational understanding of the interdependencies between performance areas and to aid the development of common ground among the various decision-makers involved in shaping organisational development (Johanson et al., 2006).

The BSC framework has also been employed to help address the performance measurement challenge of dynamic business transformations (Jayashree and Jamal Hussain, 2011, Nightingale and Mize, 2002). Jayashree and Jamal Hussain (2011) emphasise that 'transformational changes must serve a strategic purpose' (p. 72) and explain how the BSC, with its integrated perspectives on strategy and the consideration of its diverse implications, provides a comprehensive framework to guide an organisation's transformation efforts. Other examples that integrate BSC-based considerations into a dynamic transformation context include Taskinen and Smeds (1999), who focus on the development and use of human resources-related, process-related and technology-related performance measures to guide business transformation efforts, particularly in the manufacturing context (Taskinen, 2003).

The BSC provides a conceptual avenue to overcome some of the critical challenges of capturing and integrating the diverse aspects required for the comprehensive assessment of organisational initiatives and transformation efforts. Despite numerous iterations and refinements of the BSC over the last two decades, its four perspectives continue to be its core feature and provide the basis for comprehensive performance evaluation across a diverse range of domains (Hoque, 2014). The BSC has become the most widely used performance measurement framework (Franco-Santos et al., 2012) with forty per cent of Fortune 1000 companies reported to make use of the BSC framework (Thompson and Mathys, 2008). Rigby and Bilodeau (2013) position it as the fifth highest-ranking management tool, with a particularly high level of popularity among manufacturers (Rigby and Bilodeau, 2009). In the course

of its widespread application, the BSC has been adapted to address performance measurement challenges across a wide range of industries (see (Banchieri et al., 2012) and service domains as diverse as healthcare services (Grigoroudis et al., 2012), waste management services (Guimarães et al., 2010) and financial services (Wu, 2012).

2.3 Previous ways of measuring servitization

A manufacturer's servitization efforts, similar to other transformation initiatives, need to be assessed against a relevant set of measures. As manufacturers seek to shift their priorities towards developing their service-business, managers need to be able to assess the new service-offerings, the development of their service organisation and capabilities for service delivery. For almost a decade, studies have discussed measures to assess the performance of a manufacturer's servitization efforts (Neely, 2007, Tuli et al., 2007, Gebauer et al., 2010a, Bustinza et al., 2010, Raddats et al., 2017).

The financial perspective has emerged as the most prominent standpoint perspective to assess a manufacturer's servitization efforts. Neely (2007) was the first to examine empirically the change in the balance of revenues from products and services among manufacturers. This assessment compared traditional product-focused and servitized manufacturers based on total turnover and employee numbers. Later studies extended this work by including additional measures: *sales revenue* and *net profit* (Neely, 2008); *market valuation* and the impact of the *local economy on service revenue* (Neely et al., 2011); *scale of service activities* and *customer proximity* (Kastalli and Van Looy, 2013); and *the level of environmental and internal risks* when offering services (Benedettini et al., 2013, Benedettini et al., 2015, Josephson et al., 2016). These studies are regularly cited and have been very influential in attracting attention to the servitization concept.

A range of authors has followed the route of using financial performance to measure servitization. For instance, Kohtamaki et al. (2015) empirically analyse a manufacturer's service orientation and the effect an increased service-offering has on *sales-related performance* (i.e. sales level and sales growth rate), as well as on *profit-related performance* (i.e. gross profit margin, net profit from operations, profit-to-sales ratio and return on investment). In a similar vein, Eggert et al. (2014) examined the financial performance implications of servitization strategies within 513 German mechanical engineering companies and confirm that such strategies can be assessed through both the level and the growth of manufacturers' *revenue streams*. A large number of other studies use similar financial measures to assess servitization, including *market share* and *service sales* (Fang et al., 2008), *revenue growth* and *market share* (Prakash, 2011) and *growth in revenue and profit* (Song et al., 2015).

Some servitization studies take into account performance measures that focus on a manufacturer's internal business perspective and the relationship with its customers. Gebauer et al. (2010a), for instance, examine the relationship between a manufacturer's *service culture* components and overall performance. Tuli et al. (2007) identify customer-related measures to assess servitization and

demonstrate that the manufacturers' service solutions effectiveness should be assessed through variables such as: the *ability to define customers' requirements*; *customisation* and *integration* of products and/or services; the *capacity of deploying* those solutions; and the level of post-deployment *customer support*. Other servitization studies in this regard focus on *customer specification* (Cousins et al., 2008), and the level of *customer satisfaction* (Bustinza et al., 2010).

Individual servitization studies have also employed measures that assess a manufacturer's ability to create future value through innovation and learning. Fugate et al. (2012), for example, propose a focus on *inter-organisational information sharing* levels to assess a manufacturer's innovativeness towards servitization. In a similar vein, Raddats et al. (2017) examine how a manufacturer's *openness to collaborate* with other companies facilitate the identification of capabilities required for servitization.

There are, however, three principal limitations to the measures proposed in the prior servitization research that limit their suitability for comprehensively assessing a manufacturer's efforts to become an 'advanced services' provider and serving as dedicated management tools:

- (1) *Narrow scope*. As discussed above, the prior research largely uses a single or selected financial-, internal- or innovation-related measures in isolation and even those studies that employ a combination of measures have handpicked indicators only relevant to a narrow field of study. To the best of our knowledge, the only exception is Chirumalla et al. (2013) who focus on indicators to measure the development of product-service systems rather than servitization or 'advanced services'. The use of single measures limits the extent to which the multifaceted nature and underlying complexity of a manufacturer's servitization effort can be assessed and risks short-termism and local optimisation in subsequent decision making (e.g. focusing on service sales without investing in service innovation) (Neely, 1999). Instead, a comprehensive and integrated set of measures is required that provides a wide view of the internal and external environment (e.g. internal business process, costing mechanism, supply and demand chain management, etc.).
- (2) *Limited breadth*. The prior research focuses on assessing only the 'outcome' of the servitization efforts, not its 'progress'. Hence, the implications of the established service-offering are captured, but there is no indication as to the extent to which the manufacturer's business transformation has progressed. An integrative approach would not only provide insights into the current success of a manufacturer's 'advanced services' but would also show how far the organisation delivering these services has progressed.
- (3) *Uncertain focus*. The prior servitization research does not consider the different types of services manufacturers may offer and how these types of services affect the range of assessment measures required. 'Advanced services' imply a particularly complex bundling of products and services which requires manufacturers to engage in significantly more intensive transformation efforts than needed for base or intermediate services (as outlined in the Introduction). The different types of services covered under the term 'servitization' are not necessarily comparable and a

clearer distinction between the different service types is necessary to devise effective performance measures that address their particular range of challenges.

The current ways of assessing servitization demonstrate a real gap when considering the particular case of ‘advanced services’. ‘Advanced services’ require manufacturers to engage in a wide range of interdependent, long-term transformation efforts to develop and deliver those complex product-service bundles. The present research, therefore, sets out to develop a comprehensive framework able to specifically assess a manufacturer’s transformation towards ‘advanced services’. The focus is to elicit systematically a balanced set of measures that captures a manufacturer’s complex and multifaceted transformation efforts, and to present managers with a tool they can adapt to their specific context. To guide this research, a principal question emerges as:

How can the manufacturer’s servitization efforts towards becoming an ‘advanced services’ provider be comprehensively measured?

3. Research Method

3.1 Aim and method

In order to answer the research question a careful consideration of its theoretical and practical implications is required. On the one hand, performance measurement research needs to build upon underlying theoretical perspectives and prior research findings to move beyond the description of idiosyncratic practices and increase cumulative research insights. On the other hand, performance measurement research requires substantial practical grounding to determine how performance measurement objectives are constrained by organisational practice and to analyse how these constraints can be overcome. Hence, a two-stage research method was adopted to address these implications and answer the research question.

The objective of the first research stage was to create a comprehensive set of performance measures that are available to assess a manufacturer’s service performance. A systematic literature review was conducted to elicit the range of service performance measures used in a manufacturing context. The second research stage sought to consider the particular requirements ‘advanced services’ produce for performance measurement and to create a set of performance measures that specifically target ‘advanced services’. An expert panel with representatives of leading manufacturers providing ‘advanced services’ was set up to develop a performance measurement framework to assess the progress and outcome of a manufacturer’s transformation towards ‘advanced services’.

The integration of a systematic literature review and an expert panel enables us to concisely address the objectives of this paper, as it not only captures the variety of measures proposed in prior research, but also facilitates the dialogue and engagement with professional experts in the field to validate and

adapt those measures to be relevant to practice. Such integration of methods (which is also well-established in marketing (Morgan and Krueger, 1998) and social sciences (Bloor, 2001), creates opportunities beyond what other research methods are able to offer in this context. Case research, for instance, with its focus on analysing organisational practice (Yin, 2003) may only provide insights on current performance measurement practices without capturing the experiences, possibilities and expectations for a future range of performance measures. Likewise, survey-based methods would limit the opportunity for creating a dialogue to capture experiences and stimulate reflection on the ideal range of performance measures to assess a manufacturer's 'advanced services'. The range of performance measures that organisations utilise often emerges organically through trial and error, negotiations and compromise (Baines and Lightfoot, 2013) and even leading manufacturers offering 'advanced services' may not have the ideal range of performance measures in place.

3.2 Stage 1. Systematic Literature Review

The systematic literature review method (Tranfield et al. (2003) was employed to identify the range of service-related performance measures used in a manufacturing context. The method's main purpose is the replicable and transparent elicitation, analysis and synthesis of a focal aspect across a specific literature domain based on standardised protocol (Boell and Cecez-Kecmanovic, 2015). The method differs from narrative or descriptive literature review forms which focus on summarising key literature themes or highlighting their breadth of coverage without systematically analysing and synthesising their key insights into a comprehensive integrated outcome (Paré et al., 2015).

The systematic literature review method involves three main steps (following Tranfield et al, 2003): (i) a detailed review planning and scoping process to create precise definitions of the review objectives and boundaries, (ii) a rigorous review execution to identify and select relevant studies, (iii) a detailed and transparent analysis and reporting of the review results (see Figure 1).

- *Planning and scoping* focused on the identification of relevant data sources, keywords and timeframes. As data sources the study focused on the widely used databases Web of Science, Scopus and ProQuest to cover a diverse range of relevant journal articles. Several keyword combinations that were directly associated with service in a manufacturing context were identified, for example: *manufacturing + services + performance*, *product + service + performance*, *PSS + performance*, *servitization + performance* and *advanced services + performance*. The initial scoping database search (including citation cross-checking with Google Scholar) returned 1872 journal articles that were published between 1968 and 2015, with varying degrees of relevance to the review objective.
- *Execution* of the main study focused on a narrower time-span (between 2000 and 2015) in order to (1) identify more recent and relevant publications (including a limitation to peer-reviewed English language articles), and (2) reduce the pool to a more manageable group of articles to be

reviewed and analysed (Kitchenham and Charters, 2007). This led to a total pool of 1612 articles. To ensure the article quality (Levy and Ellis, 2006) the Chartered Association of Business Schools' *Academic Journal Guide 2015*⁴ was used to narrow the pool to articles that were published in journals with worldwide distinctions (ABS 4* rated journals), top journals in their field (ABS 4 rated journals) and highly regarded journals (ABS 3 rated journals). A total of 201 articles were identified from the following 17 journals: *Journal of Operations Management* (JOM), *International Journal of Operations and Production Management* (IJOPM), *Production and Operations Management* (POM), *International Journal of Production Economics* (IJPE), *International Journal of Production Research* (IJPR), *Manufacturing and Service Operations Management* (MSOM), *Supply Chain Management* (SCM), *Production Planning and Control* (PPC), *Journal of Service Research* (JSR), *Journal of Marketing* (JofM), *Industrial Marketing Management* (IMM), *Journal of the Academy of Marketing Science* (JAMS), *Journal of Business Research* (JBR), *Academy of Management Journal* (AMJ), *British Journal of Management* (BJM), *Strategic Management Journal* (SMJ) and *Journal of Product Innovation Management* (JPIM).

- *Analysis of the articles* first sought to verify that each article focused on service performance in a manufacturing context and to exclude articles that focused explicitly on product performance measures (e.g. product quality conformance, product delivery time, new product introduction time) or pure service industries (e.g. tourism, policy, legislation). Two researchers first examined the abstracts of all the articles in the pool for suitability and excluded 103 articles. The researchers then examined the full text of the remaining 98 articles for suitability leading to a further exclusion of 55 articles. Hence, the analysis condensed the pool to 43 relevant articles that provided service performance measures for the manufacturing context. Overall, the articles were produced by 39 lead authors and published in 14 selected journals, largely from the operations management and marketing domain (no relevant articles were identified in AMJ, BJM or SMJ) (see Table 1).

Name of the Journal	ABS Ranking	Number of Selected Articles	Discipline / Community
<i>JOM</i>	4*	4	Operations Management
<i>IJOPM</i>	4	11	Operations Management
<i>POM</i>	4	1	Operations Management
<i>IJPE</i>	3	4	Operations Management
<i>IJPR</i>	3	1	Operations Management

⁴ *Academic Journal Guide 2015*, accessed: 21 June 2016.

<i>MSOM</i>	3	2	Operations Management
<i>SCM</i>	3	3	Operations Management
<i>PPC</i>	3	1	Operations Management
<i>JSR</i>	4	3	Marketing
<i>JofM</i>	4*	3	Marketing
<i>JAMS</i>	4	1	Marketing
<i>IMM</i>	3	6	Marketing
<i>JBR</i>	3	2	Marketing
<i>JPIM</i>	4	1	Innovation
Total		43	

Table 1: Selected publications from relevant journals

The 43 articles were further analysed to identify the service performance measures utilised. The further analysis created a pool of 164 service performance measures, which are presented in the findings section (Table 3). The pool of service performance measures provided the raw material for the subsequent engagement with the expert panel.

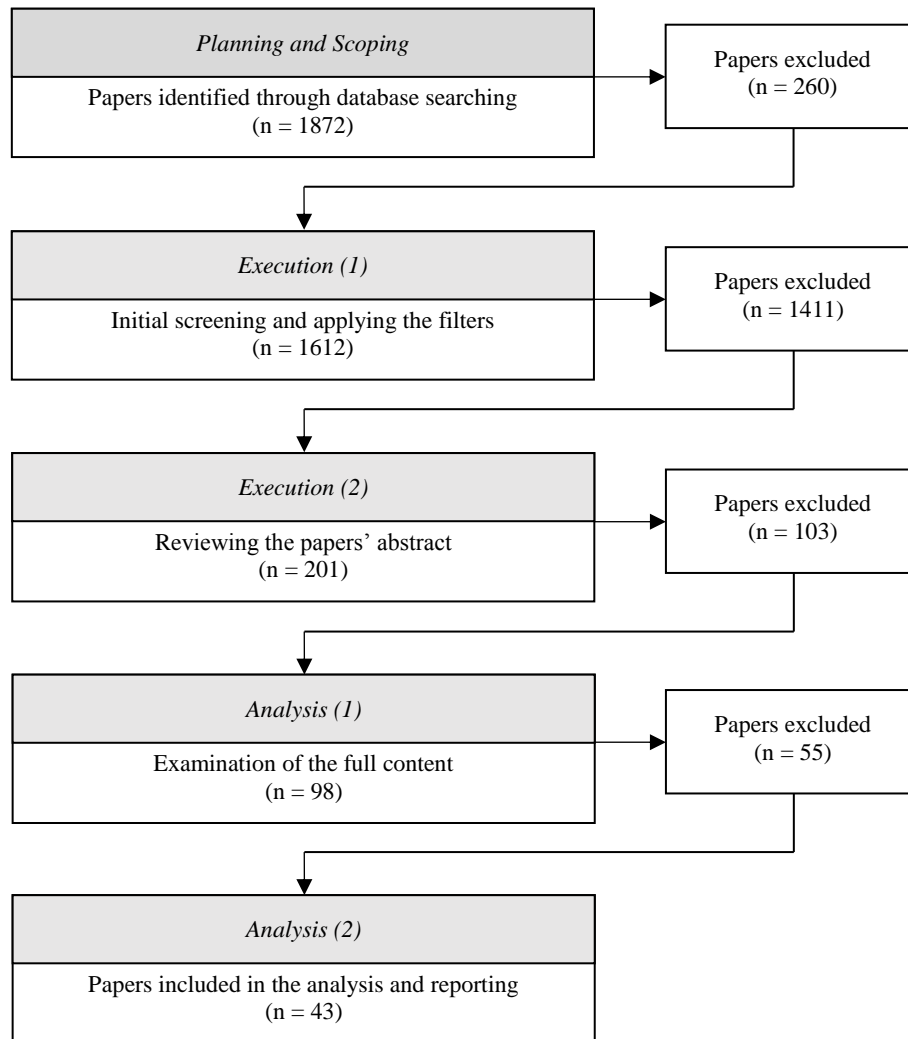


Figure 1: Systematic literature review process

3.3 Stage 2. Expert Panel

The objective of the second research stage was to develop a set of performance measures to assess the progress and outcome of a manufacturer's transformation towards 'advanced services'. The expert panel's critical role was to scrutinise the literature-based service performance measures (identified in Stage 1) and select or adapt those measures that are suitable for the comprehensive measurement of 'advanced services' performance. Expert panels are particularly suited to develop such insights as they enable individuals to apply their expertise while simultaneously providing a platform for discussion and integration of the insights created (Sutton and Arnold, 2013).

In order to take full advantage of the engagement with the expert panel and to allow its members to effectively scrutinise the literature-based measures, preparatory work focusing on the individual measures and their presentation was required. To ensure the rigour and reliability of the preparatory work all 164 measures were examined and debated by three researchers with the objective of consolidating similar measures that used divergent terminologies (e.g. customer satisfaction, customer feedback, post-sales customer feedback, customer complaints) and eliminate measures exclusively concerned with base and intermediate services (e.g. measures that could only be used to assess spare-part provision and warranty fulfilment). The consolidation led to a refined pool of 63 literature-based service performance measures.

Preparations also involved the presentation of the service performance measures to the expert panel to stimulate the recognition of the wider measure selection implication and facilitate the discussion. The researchers drew on the BSC performance measurement perspectives proposed by Kaplan and Norton (1995) to categorise the refined pool of performance measures based on the panel member's BSC familiarity, which could therefore provide a shared logical foundation for developing the 'advanced services' performance measurement framework. However, in order to utilise the BSC perspectives to categorise the performance measures and guide the expert panel engagement, it was necessary to first adapt the guiding questions that underlie the four BSC perspectives (see Section 2.2) to the particular 'advanced services' context.

- The question identifying financial measures was adapted to: *'how valuable are our "advanced services", to our shareholders?'*
- The question identifying internal business measures was adapted to: *'how well do our business processes support our "advanced services"?''*
- The question identifying customer-related measures was adapted to: *'how do our "advanced services" appear to our customers?'*
- The question identifying innovation and learning measures was adapted to: *'how can we continue to innovate and improve our "advanced services"?''*

The research team categorised each of the 63 literature-based service performance measures in terms of the BSC perspective they addressed and also reviewed the measures based on their scope (i.e. progress or outcome (see Section 2.1.) to ensure that the dynamic nature of the transformation context was represented in the pool of performance measures presented to the expert panel.

The assembly of the expert panel focused on bringing together the expertise that would allow an examination of the applicability of the literature-based measures and the experience to offer alternative suggestions for assessing ‘advanced services’ performance aspects. The eventual expert panel employed for the research included 12 executives who were selected based on three principal criteria in which they: (i) were from large manufacturers operating in different sectors in order to broaden the breath of the opinions, (ii) were actively building a portfolio of ‘advanced services’ and had already some on offer; and (iii) did not compete with each other, so as not to inhibit debate and the exchange of ideas. The selection of the manufacturers was partly dictated by opportunities to gain quality access to the senior executives of these organisations, and their availability to attend the workshop and contribute to the research. An overview of the types of organisations represented on the panel and the specific panel member roles is provided in Table 2.

	<i>Industry / Key Value Proposition</i>	<i>Turnover</i>	<i>No. of Employees</i>	<i>Position of the Two Executives Participating in the Expert Panel</i>
<i>Manufacturer A</i>	Tyre Manufacturer	~ £12bn	~ 70,000	<ul style="list-style-type: none"> • Chief Innovation Officer • Advanced Services Manager
<i>Manufacturer B</i>	Heavy Equipment Manufacturer	~ £4bn	~ 15,000	<ul style="list-style-type: none"> • President (Europe) • Customer Service Manager
<i>Manufacturer C</i>	Packaging Equipment Manufacturer	~ £600m	~ 3,500	<ul style="list-style-type: none"> • General Director for Europe • Technical Director for Europe
<i>Manufacturer D</i>	Aerospace and Defence Equipment	~ £16bn	~ 85,000	<ul style="list-style-type: none"> • Business Development Manager • Strategy Director
<i>Manufacturer E</i>	Lift Truck Manufacturer	~ £1.1bn	~ 12,000	<ul style="list-style-type: none"> • Director of Design • Director of Services (Global)
<i>Manufacturer F</i>	Film Manufacturer (for Packaging)	~ £200m	~ 1,100	<ul style="list-style-type: none"> • Chief Executive Officer • Chief Innovation Officer

Table 2: Companies involved in the expert panel

The categorised pool of performance measures was presented to the expert panel in the form of a two-day facilitated workshop organised by the research team. The facilitated workshop provided a platform for the panel members to review, scrutinise and adapt the proposed performance measures to the ‘advanced services’ context. One third of the workshop focused on explaining the background and objectives of the research, and the rest on three principal activities: (i) review how the proposed measures correspond with the actual ‘advanced services’ operations and the measurements already in place, (ii) scrutinise the applicability and value the measures have for the ‘advanced services’ context

and actual service operations undertaken, (iii) adapt these measures to the particular ‘advanced services’ context as required by the manufacturers.

After each activity, there was an intense group discussion to arrive at a shared set of measures that the expert panel members considered useful to advance their performance measurement. In instances where the panel suggested that data for specific measures (predominantly financial-related measures) was unlikely to be achievable – perhaps for reasons of company confidentiality – then surrogate measures were proposed. Also, when there was a tie in the prioritisation of different measures and no shared perspective emerged from the discussion a Pareto voting technique (Zeckhauser, 1973) was used to structure the priorities and establish which measure should be included in the final pool.

4. Findings

This section presents the initial pool of literature-based service performance measures identified in Stage one of the research followed by presenting the ‘advanced services’ performance measurement framework developed in Stage two.

4.1 Initial set of service-related measures

The systematic literature review conducted in Stage one identified 43 relevant articles which provided the 164 applicable service performance measures outlined in Table 3. The majority of these measures draw on objective business data that is empirically examined through different mathematical methods (e.g. principal component analysis, path analysis, simulation models), across different industries (e.g. truck and trailer manufacturing, automotive industry, logistics firms) and validated against targets set within those organisations (as opposed to only being used in benchmarking exercises). Also included are subjective measures which are used to capture conformance to customer requirements, agility and responsiveness (Baines et al., 2009a), or customer satisfaction (Holschbach and Hofmann, 2011) across several business contexts (e.g. speed of response and level of service support (Frohlich and Westbrook, 2002)).

Naturally, several of the measures draw on a manufacturer’s internal data to assess the economics of the manufacturing services offered (e.g. revenue and profit from services, return on investment, market share). In a few cases, that data is interrelated with external sources as required for benchmarking purposes (e.g. profit compared to major competitors (Gebauer et al., 2011), relative market share (Menor et al., 2002)). Other service performance measures draw on data sources external to the manufacturer when assessing aspects beyond immediate economic interests. Gebauer et al. (2011), for example, highlight ‘understanding customer needs’ as a key external measure of a manufacturer’s service development and service differentiation. In a similar vein, ‘customer adaptiveness’ (provided by Tuli et al. (2007)) emphasises how a customer’s willingness to change its internal processes serves as an important indicator of a manufacturer’s service solution effectiveness.

The first research stage provided a diverse set of measures that draw on different data sources and domains to describe assorted aspects of a manufacturer's service performance.

Author(s)	Service-related Measures
Antioco et al. (2008)	Relative service sales, Service volume, Source of revenues
Arias Aranda (2003)	Volume of services delivered, Percentage of use of service delivery capability, Frequency of errors in service delivery, Number of services not finally delivered, Number of services delivered by year, Number of customer claims, New service development, Ability of service customisation, Level of cooperation at interdepartmental level, Increased delivery due to IT usage
Baines et al. (2009b)	Conformance to customer requirement, System agility and responsiveness, Availability and service delivery performance
Baines and Lightfoot (2014)	Alignment with customer's requirements, Variance against standard times for product overhaul, Customer satisfaction
Bardhan et al. (2007)	Service project on-time completion rate, Reuse of information and knowledge assets across the enterprise, Decrease service development time through the use of IT
Bustinza et al. (2010)	Number of customer complaints, Customer satisfaction, General level of satisfaction, Degree of loyalty, Number of services initiated but not finalised, Time of service delivery
Closs et al. (2010)	R&D effectiveness
Cousins et al. (2008)	Conformance to specifications, Overall communication effectiveness, Information exchange quality and timeliness, Regular feedback from the supplier
Curkovic et al. (2000)	Responsiveness to customers, Pre-sale customer service, Post-sale customer service
Davis et al. (2002)	Advertising and promotion compared to competitors, Developing brand identification, Higher quality standards than competitors, Innovation in manufacturing/service processes
Dick et al. (2008)	Adoption of quality management system standard
Eggert et al. (2014)	Revenue, Profit, Service training, Cross-functional communication of service employees, Top management recognition, Corporate culture towards services, Type of organisational structure (integrated vs. separated service organisation)
Flynn et al. (2010)	Level of linkage with major customer/supplier, Level of computerisation, Level of communication, Follow-up with major customer/supplier for feedback, Level of strategic partnership with major supplier, Data integration among internal functions
Forslund (2007)	Reward structure
Frankenberger et al. (2013)	Net profit margin, Development focus (product vs. solution), Contact frequency, Commonness of solution customer interaction, Closeness to customers, Shared goal with customers (conflict/aligned)
Frohlich and Westbrook (2002)	Speed of response, Level of service support, Number of local partners, Threat from competitors
Fugate et al. (2012)	Return on investments, Market share growth, Face-to-face meeting with customers to understand their needs, Visiting suppliers to learn more about various aspects of their business, Inter-organisational information sharing, Decision-making process to solve customer problems, Staff readiness, Percentage of new product sales generated by new service
Gebauer et al. (2010b)	Profit, Number of services offered, Number of customers using the offered services, How strongly the services are emphasised
Gebauer et al. (2011)	Market share, Profit compared to major competitors, View of customers towards the innovativeness of the firm, Customer satisfaction, Consideration of customer's needs, Service as the main reason for customer selecting company
Gebauer et al. (2012b)	Customer satisfaction, Staff service knowledge, Use of IT to deliver services, Hard infrastructure for service delivery
Giannakis (2011)	Time and cost to identify requirements, Cost and time to negotiate agreements
Gotzamani et al. (2010)	Customer satisfaction, Competitive benchmarking, Quality inspections
He and Lai (2012)	Info system applied in service delivery, Customer input into corporate strategy, Cooperating with partners when developing projects, Additional service to loyal customers

Holschbach and Hofmann (2011)	Customer satisfaction, Number of service evaluations
Homburg et al. (2002)	Growth in profit, Number of services offered, Broadness of service offerings, Customer orientation (emphasis on services)
Jie et al. (2015)	Tech flexibility to solve complex problems, Infrastructure, Experience and knowledge, Customer satisfaction
Kastalli and Van Looy (2013)	Total profit margin, Service sales, Customer proximity, Number of service staff
Kohtamäki et al. (2013)	Growth in revenue, Slack resources, Number of service offerings, Network capabilities, Number of patents
Li (2011)	Customer satisfaction, Services to reduce logistic cost
Lin et al. (2006)	Repeat purchase, Market share, Profit margin, Customer satisfaction, Customer and employee productivity
Liu et al. (2013)	Return on investment, Profits as a percentage of sales, Net income before tax, The present value of the firm, Responding to market demand change rapidly, Entering a new market in a timely way, Bringing new service to market quickly
Martín-Peña and Díaz-Garrido (2008)	Customer cost reduction
Melton and Hartline (2010)	New service exceeds sales objectives, New service exceeds market share objectives, New service exceeds profit margin objectives
Menor et al. (2002)	Achieving higher overall profitability, Achieving important cost efficiencies for the firm, Exceeding market share objectives, Achieving high relative market share, Service outcome superior to competitors, Service experience superior to competitors
Oliveira and Roth (2012)	Increased number of new customers, Sales volume growth, Customer satisfaction
Prakash (2011)	Supplier satisfaction, Supplier loyalty, Supplier accommodation of changing requirements
Rosenzweig (2009)	Sales volume growth, Profitability, Customer retention rate
Song et al. (2015)	Revenue, Growth rate of profit, Stakeholder involvement, Customisation of solution, Service response speed
Stremersch et al. (2001)	Total cost
Tuli et al. (2007)	Well-defined customer's requirements, Services customisation, Services are deployed to address customer needs
Ulaga and Reinartz (2011)	Differentiation advantage, Cost leadership advantage
Kastalli and Van Looy (2013)	Total profit margin, Earnings before interest and taxes margin
Yang et al. (2010)	Reduce total cost, Increase the market share, Capability to responds to market changes

Table 3: Manufacturer's service performance measures identified

4.2. Development of the measurement framework

The expert panel in Stage two reviewed the consolidated set of the above measures (Appendix 1) and adapted them to the particular ‘advanced services’ context following the logic of Kaplan & Norton’s (1995) BSC performance measurement framework. The adapted measures are categorised into those that represent a *financial perspective*, an *internal business perspective*, a *customer perspective* and an *innovation & learning perspective* as presented in Table 4 and considered with regards to their transformation progress and outcome measuring objectives.

Financial perspective on ‘advanced services’ performance

16 financial performance measures (consolidated from the literature review) were proposed to the expert panel who scrutinised and adapted them to ensure they are suitable for helping manufacturers better understand the financial perspective of their ‘advanced services’ performance. The expert panel review process led to the development of thirteen financial performance measures, of which the majority (11) focus on the ‘advanced services’ outcome (i.e. the impact created by the advanced services).

The panel specifically focused on the proposed profit-related financial measures with the discussion focusing on (i) the importance of presenting financial *profit* using absolute measures (as opposed to relative measures) to convey a sense of proportion; (ii) the value of splitting and juxtaposing ‘product’, ‘overall services’ and ‘advanced services’ profits to understand the relative economic importance of the service business in general and the ‘advanced services’ in particular, and (iii) the importance of focusing on ‘gross profit’ rather than simply ‘profit’ to add more precision. The panel agreed on eight profit-related measures to assess the impact of ‘advanced services’ performance (see Table 4).

The panel also focused on the proposed *sales value or revenue* – related measures including *growth in revenue*, *growth in sales*, *volume of services delivered*. In the panel discussion it was argued that: (i) these measures should be termed ‘revenue from services’ as the term ‘sales’ is readily associated with products, and (ii) the use of absolute measures was recommended to provide the sense of scale for each case. The panel rejected the proposed *market share and growth measures* as the emergent nature of ‘advanced services’ makes its absolute assessment difficult. Instead it was suggested that business units simply rank their market share relative to their competitors (noting their position rather than absolute value).

Only the two investment-related measures included by the panel in the final set of financial performance measures focus on the progress of the ‘advanced services’ transformation. The panel rejected the proposed investment-related measures (i.e. *return on assets* and *return on investment*) arguing that these measures provide limited insights on their own. Instead the panel identified the

budget (as a proportion of revenue) as a valuable measure to determine the extent to which an organisation's business transformation has advanced.

It should be noted that the expert panel dedicated most of its attention to the financial perspective and also allocated the largest number of measures to it, although the number of financial measures originally proposed to the panel was on a par with the other BSC perspectives.

	Financial Perspective	Internal Business Perspective	Customers Perspective	Innovation & Learning Perspective
Principal Questions for 'Advanced Services'	How valuable are our services, and especially our 'advanced services', to our shareholders?	How well do our business processes support services, and especially 'advanced services'?	How do our services, and especially our 'advanced services', appear to our customers?	Can we continue to innovate and improve our services, and especially our 'advanced services'?
Measures for Assessing the Transformation towards 'Advanced Services'	<ul style="list-style-type: none"> Gross profit split between product sales and all services Gross profit split between all services and 'advanced services' Gross profit from all services as a percentage of the revenue Gross profit from 'advanced services' as a percentage of the revenue Gross profit as a percentage return on the investments Gross profit as a percentage return on the investments supporting 'advanced services' Gross profit growth over time for all services Gross profit growth over time for 'advanced services' Value of revenue from all services Value of revenue from 'advanced services' market positioning of all services Market positioning of 'advanced services' Budget as a proportion of revenue set aside for investment in all services Budget as a proportion of revenue set aside for investment in 'advanced services' 	<ul style="list-style-type: none"> Customer intimacy and understanding Service innovation process Performance measurement Facilities and structure People and culture Information and communication technologies Processes and procedures Network structure Legal systems (contracting) Financial systems 	<ul style="list-style-type: none"> Customer relationship Perceived size of our portfolio Attractiveness of our advanced services Perceived innovativeness of our offerings Perceived performance of our offerings 	<ul style="list-style-type: none"> Actively recognise the opportunity to innovate Actively committed to innovate Actively realising innovation Our customers recognise that we should innovate Our customers are committed to helping us innovate Our customers are beginning to adopt our innovation
	Transformation outcome focus	Transformation outcome focus	Transformation outcome focus	Transformation progress focus
	Transformation progress focus	Transformation progress focus	Transformation progress focus	Transformation outcome focus

Table 4: Framework for measuring the transformation towards 'advanced services' in a manufacturing context

Internal business perspective on ‘advanced services’ performance

22 consolidated literature-based measures were proposed to the expert panel capturing different aspects of the manufacturer’s internal business perspective (see Appendix 1).

The panel considered the proposed measures as too fine-grained sought to further consolidate the proposed measures to ensure effectiveness but also added selective measures to ensure the internal business perspective of the manufacturer’s ‘advanced services’ performance can be comprehensively measured. To further consolidate the proposed measures the panel decided to map them against a framework by Baines and Lightfoot (2013) which covers core aspects of a manufacturer’s service operations⁵. To ensure an even more comprehensive understanding of the internal business perspective the panel decided to move beyond this framework and account for three additional internal business aspects that are important for assessing a manufacturer’s ‘advanced services’ transformation: *legal system* (i.e. the capability to produce and structure outcome based contracts), *financial system* (i.e. the capability to develop and offer outcome based revenue models) and *service innovation process* (i.e. the capability of innovating the offering). Through this process the panel developed ten measures to assess a manufacturer’s ‘advanced services’-related internal business processes. The panel also developed specific scales to indicate the competency or proficiency for each of these measures as the internal business perspective cannot be sufficiently captured by quantitative values or ratios (unlike the financial performance perspective).

Two of these measures (and corresponding scales) focus on the internal outcome of the manufacturer’s advanced services (i.e. the internal impact the ‘advanced services’ have created): (1) *customer intimacy and understanding* (ranging from ‘distant relationship’ to ‘intimate relationship’); and (2) *service innovation process* (ranging from ‘lagging’ to ‘leading’).

The remaining eight measures (and corresponding scales) focus on the internal progress of the manufacturer’s ‘advanced services’ (i.e. the extent to which the internal business processes or systems have been put in place): *performance measurement* (ranging from ‘production-centric’ to ‘advanced services-centric’); *facilities and structure* (ranging from ‘centralised factory’ to ‘distributed facilities’); *people and culture* (ranging from ‘production’ to ‘humanistic’); *information and communication technologies* (ranging from ‘production control’ to ‘remote product sensing’); *processes and procedures*

⁵ Baines and Lightfoot (2013) identify: performance measurement system (e.g. measuring number of errors in service delivery), facilities (e.g. infrastructure for service delivery), people & culture (e.g. number of service staff), information & communication technologies (info sys applied in service delivery), established processes (e.g. decision-making process to solve customer problems), management of network (e.g. inter-organizational info sharing), and customer understanding & intimacy (e.g. alignment with customer’s requirements).

(ranging from ‘reactive’ to ‘proactive’); *network structure* (ranging from ‘supply chain’ to ‘eco-system’); *legal systems* (ranging from ‘warranty’ to ‘performance contracts’); and *financial systems* (ranging from ‘those supporting transactional’ to ‘relational’).

Customer-related measures for ‘advanced services’

The researchers proposed 15 customer-related performance measures for the expert panel to review how they could help manufacturers better understand the customer perspective of their ‘advanced services’ performance. Similar to the above, the panel sought to further consolidate the proposed measures into five over-arching measures and corresponding scales (as absolute values were identified as impractical to operationalise) to ensure effectiveness in the assessment of the customer-related perspective.

The five measures (and scales) agreed upon by the panel focus on the ‘advanced services’ outcome by assessing how the transformation effort has impacted on the *rational of the customer relationship with the manufacturer* (ranging from ‘based on the products’ to ‘based on the “advanced services”’); the *customer relationship mechanisms* (ranging from ‘transactional’ to ‘relational’); *attractiveness of the offering* (ranging from ‘satisfying their need for products’ to ‘taking away pain’); the *perceived performance of the manufacturer* (ranging from ‘lagging’ to ‘leading compared to the competitors’), and the *perceived innovativeness* (ranging from ‘focused on product features’ to ‘focused on business process’). It is of interest to observe that the expert panel has allocated the smallest number of performance measures to the customer perspective.

Innovation & learning-related measures for ‘advanced services’

The expert panel also scrutinised and adapted the nine innovation and learning-related performance measures that were consolidated from the literature to ensure their suitability for helping manufacturers understand the innovation & learning perspective of their ‘advanced services’ performance. The panel first grouped the proposed measures into the three overarching innovation & learning categories of: (i) *recognition* (i.e. top management recognition, constant learning from supplier/customer/competitors, financial potential of services); (ii) *commitment* (i.e. service training), and (iii) *realisation* (i.e. number of patents, intellectual capital and knowledge generated). The panel further highlighted that the manufacturer’s motivation to adopt ‘advanced services’ is either based on innovation and exploitation prospects (technology-push) or based on satisfying customer’s demands for obtaining product capabilities in a different way (market-pull). To accommodate these distinct motivations across the overarching innovation and learning categories the panel developed six performance measures which cover the progress and outcome of the innovation and learning-related ‘advanced services’ performance.

The measures that were selected to accommodate the technology-push motivation (actively recognising innovation opportunities, actively committing towards innovation, actively realising innovations) focused

on assessing the progress the manufacturer has made in developing the critical innovation and learning values and processes. The degree to which these values and processes are established indicates the extent of the ‘advanced services’ transformation. The measures selected to accommodate the market-pull motivation (recognition of the innovation by customer, customer commitment to co-innovation and innovation adoption) focus on assessing the manufacturer’s innovation reputation as an outcome of its ‘advanced services’ offering. The expert panel again established that absolute values would be impractical and instead suggested the use of scales to capture innovation & learning-related performance.

5. Discussion and Conclusion

The increasing adoption of servitization and the willingness of manufacturers to move towards the delivery of ‘advanced services’ as a core organisational strategy requires a focus on the management tools that can guide the transformation efforts. Turning a manufacturer’s focus from developing and selling products to bundling products and services into complex ‘advanced services’ offerings requires a substantial re-orientation of business processes, management capabilities and expertise (Gebauer et al., 2012a). In order to support these developments the present research sought to address the question of how *manufacturer’s servitization efforts towards becoming an ‘advanced services’ provider can be comprehensively measured* with the underlying objective of developing a tool that helps manufacturers assess and direct their transformation efforts.

To address the research question and its underlying objective a two-stage research process was carried out. Stage one was based on a systematic literature review process to identify the range of performance measures that are already available to capture service performance within the manufacturing context. Stage two drew on an expert panel of manufacturing executives to adapt the literature-based service performance measures to the particular ‘advanced services’ context and develop them into an integrated framework.

Evaluating the framework

The developed framework caters for the multifaceted nature of a manufacturer’s transformation towards ‘advanced services’ and the diverse activities that form part of it. Building up on the balanced scorecard logic (Kaplan & Norton, 1992) the framework directly addresses the *narrow scope* of previous studies which sought to measure servitization performance on the basis of single measures (see section 2.3). The framework captures and integrates financial, internal business, customer, and innovation and learning perspectives to form the basis for a comprehensive assessment of a manufacturer’s servitization efforts towards becoming an ‘advanced services’ provider.

The framework also caters for the dynamic nature of servitization as not only the ‘advanced services’ outcome is assessed but also the progress that has been achieved in transforming the organisation. Considerations of the dynamic nature of servitization directly addresses the *limited breadth* of prior

research which focuses largely on static outcome measures to evaluate a manufacturer's servitization efforts (see section 2.3). By developing a framework that captures servitization outcome and progress measures the expert panel has recognised the importance of assessing the extent to which a manufacturer has expanded its transformation effort in order to assess servitization performance in organisational practice.

Further, the framework specifically focuses on 'advanced services' as a bundling of product- and service-offerings that exceed manufacturer's base and intermediate services in complexity and involvement (Baines and Lightfoot, 2013). The framework hereby addresses the *uncertain focus* of prior servitization performance measurement efforts where little attention was paid to the nature of the manufacturer's service proposition (Ng et al., 2012). As the development and delivery of 'advanced services' implies a particularly wide range of activities throughout the organisation specific assessment tools are required to measure their wide-ranging and interdependent performance implications.

Research contributions

The paper creates three distinct contributions to servitization and performance measurement research. First, the study integrates a dedicated performance measurement focus into the servitization literature and theory-development. Servitization research is at the cusp of advancing from a predominantly exploratory focus (individual case studies to understand the phenomenon) to an explanatory focus (comparative or quantitative studies) to understand differential servitization approaches and their implications (Kowalkowski et al., 2017). The present study offers critical theorisation on servitization performance and provides tangible measures enabling research to determine the outcome or progress implications specific servitization initiatives create. A fine-grained understanding of the impact these diverse servitization initiatives create will help to advance the emerging explanatory objectives of servitization research.

Second, the study's specific consideration of the dynamic aspects of servitization contributes to the development of a process perspective of servitization (Pettigrew, 1992). Manufacturers that seek to extend their product offerings to include services engage in long-term strategic transformations involving a large variety of interdependent initiatives which need to be developed and maintained (Ziaee Bigdeli and Baines, 2017). The ability to measure the progress of these transformations is critical for research to assess the pace in which manufacturers are able to transform their activities and to explain the barriers and accelerators that determine the transformation dynamics.

Third, the study specifically introduces the notion of the balanced scorecard and its underlying theory-base to the servitization context. The balanced scorecard offers a substantial and readily available theory-base which can be drawn upon to advance and direct future servitization research efforts. Related research in particular explores the interdependencies between the balanced scorecard categories to understand the complexities of organisational developments (Johanson et al., 2006) and its impact on the

strategic alignment among related parts of the organisation (Hoque, 2014). The present study's adaption of the balanced scorecard to the servitization context and development of specific measures for each perspective paves the way for research to follow these research approaches and create a deeper understanding of the servitization complexities and its impact on the manufacturer's ability to align its diverse perspectives.

Managerial contributions

One of the study's most important managerial contribution lies in the provision of the performance measurement framework itself. By drawing on an expert panel of executives who have successfully developed 'advanced services' portfolios, a substantial amount of critical experiences accumulated by trial and error over significant time-periods has been incorporated into the framework. Manufacturers that are now starting to explore servitization and its specific opportunities can build upon these valuable experiences and early on recognise the different business perspectives that play a role in the development of a servitization initiative and the diversity of progress and outcome implications that characterise its performance.

The research not only provides manufacturers with an opportunity to adopt the individual measures for their context but also to use the developed framework as a focal point to integrate the diverse parties that have a stake in their servitization initiatives. The development and implementation of performance measurement frameworks often stimulates important discussions among decision-makers and contributes to the establishment of common ground around key strategic objectives (Johanson et al., 2006). The BSC in particular has been likened to a 'pull rope' that helps align managerial actions and efforts across a diverse range of stakeholders (Voelpel et al., 2006). We expect the performance measurement framework developed here to provide an immediate template for stakeholders in a manufacturing firm to discuss the wider implications of their transformation plans and develop a common ground for their future efforts. The balanced scorecard is widely adopted and understood among manufacturers (Rigby and Bilodeau, 2009, Kaplan and Norton, 2005), which will likely enhance management understanding, and provide opportunities for directly integrating the measures into existing balanced scorecards.

Limitations of this research and possibilities for future work

When evaluating the qualities and contributions of the developed framework, the limitations of the underlying research also need to be acknowledged. From a more theoretical perspective, this paper has based its findings on those articles that have been published in highly regarded international journals (i.e. ABS 4*, 4 and 3 rated journals). Such decision was made to ensure the contributions on which we draw our analysis are widely recognised, but we are aware that articles published in ABS 2 and 1 rated journals could provide additional insights. Furthermore, although the involvement of an expert panel in the development of the framework has integrated a significant practical perspective into the study the developed framework has not yet been assessed in practice. Manufacturers are likely to adopt the

performance measurement framework in different ways and further industrial engagement is required to confirm its wider applicability. In addition, the expert panel members were drawn from large manufacturers with significant experiences of performance measurement and resources to implement and operationalise these measures which may have biased the range of measures that have been developed. Small- and medium-sized manufacturers, which are also very interested in the servitization opportunities (Aichigui et al., 2015, Gebauer et al., 2012a), will likely seek to refine these measures to suit their particular profiles.

Based on the findings of this research, future studies could focus on (i) the effect internal factors (e.g. organisational structure, business processes, etc.) and external factors (e.g. competitive landscape, value network structure, etc.) have on the applicability and usefulness of individual performance measures; (ii) the performance impact that the introduction of a performance measurement framework has on a manufacturer's servitization initiative and success, and (iii) comparing and contrasting the servitization trajectory of manufacturers that have employed a balanced performance measurement framework to assess and guide their service-related operations, in general, and their transformation towards advanced services, in particular, and those that have not.

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"Due to sensitive nature of the collected and analysed data, no interviewees consented to their data being retained or shared for reuse. Additional details relating to other aspects of the data are available from the Aston University data repository, found at xxx"

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Appendix 1

The consolidated set of measures relevant to the context of advanced services

	Financial Perspective	Internal Business Perspective	Customer Perspective	Innovation & Learning Perspective
Manufacturing Advanced Services-related Measures	<ul style="list-style-type: none"> • Growth in profit • Growth in revenue • Growth in sales • Growth rate of profit • Return on assets • Return on sales • Profit as a percentage of sales • Return on investment • Volume of service delivered • Market share growth • Achieving higher overall profitability • Average return on sales • Return on sales in comparison to industry • Exceeding market share objective • New services exceed market objectives • New services exceed sales objectives 	<ul style="list-style-type: none"> • Top management recognition • Alignment with customer's requirements • Bringing service to market quickly • Cost saving • Cross-functional communications of service employees • Infrastructure for service delivery • Info Sys applied in service delivery • Inter-organisational info sharing • Number of service staff • Service training • Staff readiness / staff service knowledge • Innovation in service development • Knowledge of customer's needs • Management awareness of services as differentiators • Level of service support • Number of services not finally delivered • Number of service evaluation • On-time contract delivery • Service sales performance • Time of service delivery • Number of errors in service delivery • Decision-making process to solve customer problems 	<ul style="list-style-type: none"> • Developing brand identification • Additional services to loyal customers • Broadness of service offerings • Closeness to customers • Having a unique benefit perceived superior to competitors • Service as the main reason customers selecting us • View of customers towards the innovativeness of the firm • Conformance to customer's requirements • Ability of service customization • Customer retention rate • Customer satisfaction • Degree of loyalty • Realisation of customer's satisfaction • Frequency of period contracts with major customers • Time between service order and service delivery 	<ul style="list-style-type: none"> • Financial potential of services • Customer input into corporate strategy • Marketing benefits • Number of patents • Intellectual capital and knowledge generated • Percentage of use of service delivery capability • Strategic benefits of services • Constant learning from supplier/customer/competitors • Gaining competitive advantage