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TRANSFORMATION OF A SMALL-TO-MEDIUM-SIZED ENTERPRISE TO A MULTI-ORGANISATION PRODUCT–SERVICE SOLUTION PROVIDER

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ABSTRACT

This paper aims to: (1) précis the extant literature on servitization and enterprization transformations, focusing on the role of information technology (IT) and information systems (IS) and their inter-relationships; (2) illustrate these interrelationships by showing how a small-to-medium-sized enterprise (SME) can move from being a predominantly independent SME, delivering only products, to become part of a multi-organisation enterprise able to deliver product-service solutions; and (3) provide generic learning by proposing a new integrated business transformation model. The methodology used is abductive action research. A literature review is conducted to provide academically grounded themes to

inform and interpret practical actions. An empirical case study is conducted with a UK SME from the construction industry that provides empirical data to illustrate a business transformation. Inductive reasoning is used to propose a new integrated transformation model. Findings show that enterprization and servitization transformation themes are highly interdependent and co-implementable when an IT/IS focus is taken. Furthermore, these transformations can be used as part of a successful strategy for growth by an SME. A new operating structure, labelled a product-service enterprise (PSE), is proposed as part of a business transformation model to assist future deliveries of product-service solutions (PSSns). Actions and findings are based on a single empirical case abducted with academic themes. Whilst it is probable that the themes and actions have contributed towards the organization's successful growth, no absolute deterministic causality is claimed.

Keywords: product–service system (PSS); servitization; multi-organisation enterprise (MOE); enterprise systems (ES); enterprization; action research.

1. WHY ARE MULTI-ORGANISATION ENTERPRISES AND PRODUCT–SERVICE SYTEMS IMPORTANT?

In a competitive globalising world, organisations increasingly need to adapt their business models to bundle together products and services into integrated customer solutions, a practice that is often referred to as delivering a 'product–service system' (PSS) through the transformative tenets of servitization (Baines et al., 2009a). Servitization itself is a relatively new phenomenon and a term first coined by Vandermerwe and Rada in 1988. It describes manufacturing firms' strategic desires to enhance their business models and modus operandi by generating new revenue streams through more highly valued services, in addition to their existing product-related revenue generating activities (Baines et al., 2009a). Thus servitized organisations predominantly deliver PSSs, whereas non-servitized manufacturers will predominantly deliver only products. PSSs providers are considered to be a 'system of products, services and networks of "players" with supporting infrastructure who continuously strive to be competitive, satisfy customer needs and have lower environmental impact than traditional business models' (Goedkoop et al., 1999). It is believed that key benefits to being a provider of PSSs, through servitization, over and above purely product-based deliverables, are that PSSs are able to create a more sustainable competitive advantage for both providers and recipients of the PSSs (Cohen et al., 2006) as revenues increase and strategic relationships are prolonged (Sundin et al., 2009).

Thus the primary tenets of servitization and PSS deliveries seem to be intrinsically linked (Baines and Lightfoot, 2014). However, successful and profitable delivery of PSSs through servitization is not straightforward and requires product-centric organisations to undergo radical transformations from only being providers of products towards being providers of

products and highly valued, advanced, integrated services via radically adapted business models, something the construction industry might traditionally refer to as a 'turnkey solution provider' (Korczynski, 1996). Servitization transformation in construction can be broad-ranging and include changing inter-related and interdependent aspects of business models by using new product technology, adopting new infrastructure technology, devising an enhanced operations strategy, producing new sales and marketing plans and devising innovative financial revenue streams (Leiringer and Bröchner, 2010).

The full magnitude of such changes, required by servitization and PPS delivery, are often not achievable in the short term by single, traditionally structured organisations, especially if they are a small-to-medium-sized enterprise (SME) with a limited resource base to drawn upon. Hence the pressure on organisations to transform more quickly can sometimes lead to managers of contemporary organisations changing from operating as a traditional, single, autonomous, legal entity towards producing creative outsourcing strategies and, in some more ambitious instances, to use the concepts, structures and strategies of multi-organisation enterprise (MOE) management (Binder and Clegg, 2007). The European Commission's (2003) definition of an enterprise is 'an entity, regardless of its legal form … including partnerships or associations regularly engaged in economic activities' and is used to define the high-level unit of analysis for this research, with particular emphasis on partnering and associations rather than on the traditional, single, autonomous, organisation. Parts of such MOEs can be either quasi-autonomous parts of large companies (e.g. a product division or a geographically based business unit), or whole SMEs, or quasi-autonomous parts of SMEs. In this context these quasi-autonomous 'parts' are referred to as an enterprise module where each module provides a valuable core competence (e.g. specialised design, fabrication, or installation knowledge and equipment) for the whole MOE at some point in the multi-

organisation value stream, together with boundary-spanning connective capabilities (e.g. IT, Internet connection, culturally acceptability, etc.) to allow core competences to be effectively absorbed into and utilised by a wider enterprise.

In this context the theory of boundary-spanning uses boundary objects (e.g. people and or artefacts) from parts of different organisations to develop a new joint interest in pursuit of a common goal (e.g. PSS delivery) which unites them while, at the same time, distinguishes them from others who are not engaged in a similar pursuit (Levina and Vaast, 2005). Organisations often try to develop boundary-spanning competences with other organisations for this purpose (Dyer and Singh, 1998; Powell, 1990); a prime example being how IS technologists (e.g. people) develop new shared IT solutions (e.g. artefacts) to help catalyse organisation change. Thus enterprise modules which form the sub-units of analysis in an MOE analysis (Binder and Clegg, 2007), and embed boundary objects, are able to unite with boundary objects embedded in other organisations' modules through boundary-spanning activities; such as new IT developments as 'IT-based artefacts can support the development of an organisation competence in boundary-spanning by becoming boundary objects-in-use' (Levina and Vaast, 2005).

This study purports that by using the concepts of MOE thinking (European Commission, 2003) to deliver a PSS, an organisation can develop increased agility and be more prepared for proactive changes, can become more resilient and reactive to external socio-economic changes and can create greater trust in new and more sustainable revenue streams (Trim and Lee, 2008). Dramatic transformative shifts of this type are considered more likely to occur if information technology (IT) is also embedded into both operational and strategic processing roles (Ojiako and Maguire, 2008) where any information system (IS)/IT being used becomes

a boundary-spanning link joining together different enterprise modules. Thus new ISs are becoming increasingly designed to make effective collaborations between organisations in an MOE easier, as IT and IS can act as enabling or boundary spanning (Dorka et al., 2014) elements of MOEs, which in turn make each company's operations more efficient and better integrated (Kowalkowski et al., 2013). Research indicates that the supply chain management, customer relationship management, financial forecasting, and distribution functions are usually the first functions to become integrated in this way across organisations (Rosacker and Rosacker, 2010) as these functions can most directly enable and automate superior operational control over the delivery of PSSs (Belvedere et al., 2013; Clegg and Wan, 2013).

The overall aim of this research was, therefore, to review the extant literature on servitization and enterprization transformations, précis the role that IT (and IS) plays in these transformations, and demonstrate how an SME in the construction sector (Coen Limited) began these transitions as parts of a radical programme of changes to their business model and operations. This research gives some new insights, as most previously published cases on these topics have been founded on large, established, manufacturing organisations trying to diversify, rather than on SMEs trying to grow.

2. PRÉCIS OF SERVITIZATION AND ENTERPIZATION TRANSFORMATION LITERATURE

This research has commonality with other related research (e.g. Lightfoot et al., 2013) as it's based on publications found in EBSCO, ProQuest, ScienceDirect, Emerald and ProQuest databases published between 1988 and 2014. Search terms used in this search of journal

publications were, however, different to other reviews. This study used the following singular search terms: ‘technology’; ‘servitization’; and ‘multi organisation enterprises’. This study also used the following dual search terms: ‘technology’ and ‘servitization’; ‘technology’ and ‘multi organisation enterprises’; ‘ICT’ and ‘servitization’; ‘product service systems’ and ‘transformation’; and lastly ‘technology’ and ‘product service systems’. Together these search term combinations identified 241 papers. A deeper analysis of these papers’ abstracts resulted in 132 papers being excluded as not relevant. Relevant publications were found to be relatively few throughout the late 1980s and the 1990s (see Figure 1), after which they steadily increased in number until the end of 2014, showing that these topics are now well established, of growing interest and concentrated in a few key journals (see Figure 1 and Table 1). In this paper the key themes from the remaining 109 papers are discussed thematically, and illustrated empirically using Coen Limited (here on in referred to as ‘Coen’) via an abductive action research case study and inductive reasoning (Barton et al., 2009).

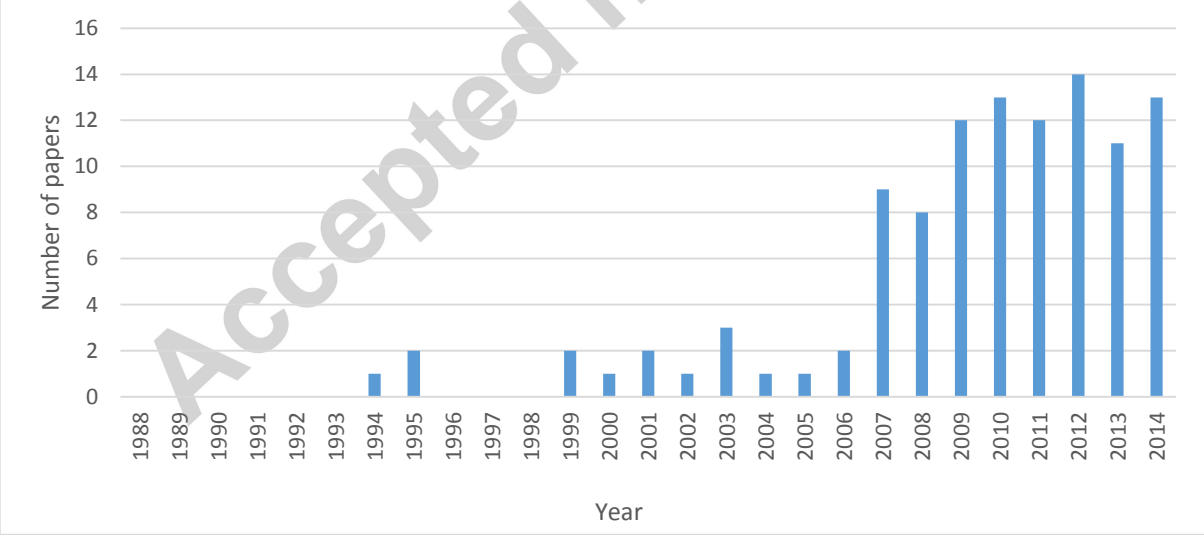

Figure 1: Distribution of papers relating to technology-enabled servitization in MOEs according to search terms

Table 1: Journals with five or more relevant publications

Name of journal	Number of papers 1988–2014
Journal of Manufacturing Technology Management	18
International Journal of Production Economics	9
International Journal of Advanced Manufacturing Technology	8
Service Industries Journal	6
Strategic Change	6
International Journal of Operations and Production Management	5

Three distinct observations emerged from having read these 109 papers. Firstly, there was a lack of research devoted to the interdependent relationship between servitization and MOEs' transformations. Secondly, there was a lack of knowledge about how IT and ISs could be used most effectively to encourage servitization and enterprization transformations. And thirdly, there were relatively few case studies found to illustrate these topics in an SME (useful exceptions include Chalal et al., 2015; Dubruc et al., 2014; Ha et al., 2016; Lin et al., 2014) which – when found – were mostly technical conference papers that had not yet become well cited enough in comparison to other research papers based on large manufacturing organisations (e.g. Gremyr et al., 2010). The following sections give a précis of IT/IS focused themes from the relevant, identified, extant, academic literature.

2.1. Servitization – creating product-based advanced services

There are many reasons for the decline of manufacturing in high cost regions, and the emergence of alternative low cost sources are probably the most significant (Martinez et al., 2010). Consequently, to allow high cost regions' business operations to successfully and sustainably compete, traditional manufacturing organisations in these regions have begun to add integrated and advanced services to their products (Baines et al., 2007; 2009b). Significant academic works on this topic start with Vandermerwe and Rada's seminal work on servitization in 1988 (Vandermerwe and Rada, 1988). From that point onwards academics began to debate whether servitization is simply a manufacturing phenomenon, where firms undertake a manufacturing transformation to increasingly compete through PSSs, or whether servitization is more pervasive and should be regarded as an all-encompassing innovative enterprise-wide strategy for transformation (Smith et al., 2014). Whichever scale of view is taken it is now commonly believed that it is operationally and strategically desirable to pursue a transformative shift, of some kind, from traditional manufacturing product-centric operations towards a customer-orientated provision of product-based, advanced, integrated services (Baines et al., 2007; Martinez et al., 2010; Neely, 2008). However, any such transformations must be underpinned by organisations' genuine propensities to undertake radical organisational, cultural and technological transformation, based upon their effective absorptive capacity to adopt new IS and IT (Barlow and Jashapara, 1998).

If one holds true that modern manufacturing has now gone 'beyond production' (Baines and Lightfoot, 2014), one can also hold true that product-based offerings provided with additional, innovative, highly valued services can become a strategic path towards sustainable growth (Kastalli and Looy, 2013; Kowalkowski et al., 2013). More specifically, increased financial or economic benefits (Neely, 2008; Wise and Baumgartner, 1999) and improved competitive and customer relations factors (Baines et al., 2007) are seen as strong

motivations for servitization. Anderson et al. (1997) also emphasise that the volatility of demand for products during economic downturns is greater than that of service-based provisions, which are believed to be more resilient than pure product-based offerings in such times. As such, servitizers, when successful, have reported cases where long-term, sustainable economic growth, estimated at between 5 and 10 per cent per annum, has been achieved (Baines and Lightfoot, 2013).

Academics still, however, debate whether servitization is a profitable and sustainable transition to undertake as some recent research highlights that lack of technological infrastructure readiness, knowledge, awareness and investment remain to be significant and expensive barriers to servitization (Hernandez-Pardo et al., 2012); overcoming these can have substantial risks, which can result in organisations struggling to reap any benefits (Gebauer and Friedli, 2005; Martinez et al., 2010; Neely, 2008).

However, overall, academic literature is generally in favour of organisations integrating advanced services with product offerings to form PSS or product–service solution (PSSn) provisions. Also, on balance, servitization is generally seen as a potential path to growth. This is despite the transformation being complex and drawing on many disparate disciplines, which include leadership, operations management and strategic planning (Baines et al., 2009b). Literature is still patchy though, particularly in describing how organisations can achieve this transformation in the early stages of growth for an SME (Oliva and Kallenberg, 2003). Therefore some tentative steps are proposed towards the end of this paper to address this dearth.

2.2. Enterprization – forming an MOE

MOEs are an operational structure in which enterprise modules collaborate with parts of other companies (i.e. other enterprise modules) to deliver (complex) products and services (Clegg and Wan, 2013; Meier et al., 2010). Enterprization is the transformative process by which companies' operations move from being predominantly autonomous, operating in an adversarial and often un-orchestrated network of suppliers, partners and customers, towards a collaboratively designed, strategized and orchestrated MOE of modular competencies. Contemporaneously this is often typical of how large, complex PSSs (e.g. cars, trains, planes, buildings and their integrated services) get delivered to their end users, rather than by one, single, autonomous company doing everything in a classically Fordian, vertically integrated, monolithic company entity (Boardman and Clegg, 2001; Clegg et al., 2013; Kinicki and Williams, 2009; Meier et al., 2010).

Enterprization is a new transformational phenomenon that determines structure and strategy of an MOE through numerous trade-off decisions to identify whether new core competences for an MOE should be built in-house or acquired from outside (Binder and Clegg, 2007). MOEs are created when external organisations can provide services or products more efficiently and or economically than can be provided by a single company legal entity (Binder and Clegg, 2007), as long as close and trusted working relationships prevail. Outsourcing and virtualisation have meant that companies increasingly create value by formulating joint ventures, which requires working beyond traditional company boundaries through the co-delivery of integrated PSSs using shared intellectual property, processes, hardware and ISs (Binder and Clegg, 2007; Meier et al., 2010).

External factors such as globalisation, virtualisation and outsourcing encourage managers to further transform their organisations' structures from traditional, single, autonomous entities towards MOEs if the forces of complementarity become stronger and more attractive than the forces of competitive rivalry. Thus contemporary organisations commonly deliver goods or services in MOE collaborative ventures (Binder and Clegg, 2007), which are believed to have positive effects on MOEs' propensities to servitize – as recent research highlights that organisational structure, supplier relationship configuration and servitization implementation are tightly coupled, co-implementable and interdependent (Ahamed et al., 2013).

Transformation towards servitization in MOEs presents many challenges though, from strategic, technical and operational to legal, human and financial (Mills et al., 2013), and ideally requires the use of cross-company enterprise-wide ISs to enable cross-company intra-enterprise systems and processes to be operated (Dorka et al., 2014; Kowalkowski et al., 2013; Ojiako and Maguire, 2008). MOE collaborations are enhanced by the rapid and efficacious development of shared IT and ISs (Peppard and Ward, 2016) as mutually beneficial collaborations brought about by enterprise systems can help to develop new market opportunities and new PSSs for the benefit of all members of an MOE.

Despite the obvious synergy between servitization and business ISs, the connection is not sufficiently discussed in case studies and further research is required (Meier et al., 2010).

2.3. Enterprise Systems – operating servitized MOEs

'Enterprise systems' (ES) is a generic term that includes all types of enterprise resource planning (ERP) systems and other workflow management-related systems (such as customer

relationship management and supply chain management systems) used in organisations to perform and integrate vital tasks, such as managing supply chains and enhancing strategic alliances (Davenport, 1998; Zhang et al., 2005). MOEs rely on such ES to ensure compatibility with collaborators and provide purposeful delivery of specific PSSs. Lederer and Gardiner (1992) refer to such ES as 'portfolio[s] of computer-based applications' that can be used to implement collaborative business strategy. Davenport and Brooks (2004) highlight the importance of these ES to enhance and catalyse organisational transformations.

There are many documented exemplars of successful ES-facilitated organisational transformations (such as BT Plc) successfully achieved by implementing bespoke ES (Ojiako and Maguire, 2008) to either support, enhance or optimise organisational innovation. There are also documented examples as part of change processes across entire (multi-organisation) enterprises (Mariano and Pavesi, 2000). As such the general emphasis and importance of advanced information technologies is now shifting away from single organisations towards MOE implementation by integrating ES across company boundaries. For instance, Clegg and Wan (2013) illustrate the critical role of ES in optimising and delivering improved strategic, structural and operational competitive advantage in Zoomlion (a Chinese multi-organisation manufacturing enterprise); in this case the MOE was considered to have achieved more effective operations through the use of shared ES' functions (e.g. manufacturing, production, sales, finance and accounting) than were singularly achievable. A similar, collective, greater good phenomenon is also reported by Ward et al. (2005).

ES can help to optimise management decision making, strategic planning and organisational transformation processes by making information flow more expedient and dynamic (Belvedere et al., 2013; Haines, 2009) as the advent of inter-organisational ES makes it

possible for organisations to 'virtually' integrate different parts (e.g. enterprise modules) of their company with parts (e.g. enterprise modules) of other different companies in new, collaborative, business models. For instance, in their case-based analysis, Johnson and Mena (2008) highlighted how organisations were combining products with services to provide increased client value, and illustrated that this is more likely to occur if effective supplier integration and real-time ISs are used.

ES' models and representations to help explain how servitized value is delivered are, however, still predominantly single-organisation centric and product focused (Oliva and Kallenberg, 2003). This is despite an emerging recognition that a servitized environment benefits from many different inter-organisational actions and collaborations, including links to SMEs, as characterised by Mills et al.'s (2013) study.

Therefore, whilst MOEs are strategizing, ES should be used to integrate and automate business systems and data into one IS to reduce infrastructure fragmentation and unnecessary duplication of work (Davenport, 1998). However, radical transformation becomes increasingly politicised in enterprises as the number of different legal entities or 'valued members' increases – as found in large MOEs (valued members being those companies who are able to provide valuable enterprise modules for common use and benefit to the wider enterprise). As such, MOE governance needs to be thoroughly and robustly developed with clear understandings of integrative requirements (e.g. technical, commercial, privacy, etc.) for each of its valued members (Aladwani, 2001; Motwani et al., 2002); this is especially true for valued members who are SMEs that tend to underuse ES and need to become more connected to wider inter- and multi-organisation enterprise operations (Acar et al., 2005).

3. ACTION RESEARCH APPROACH

An abductive (Barton et al., 2009) action research study conducted from January 2013 to March 2015 (twenty-seven months) at Coen used Susman and Evered's (1978) Canonical Action Research (CAR) cycle. This was suitable because Coen, an SME in the construction industry, wished to undergo enterprization and servitization transformations within a two to three year period, working in unison with a university who had knowledge of these subjects. The owner–manager of Coen did this with the intention of delivering improved PSSs to their clients and growing his company. The university did this with the intention of transferring knowledge of enterprization, servitization and ES into Coen whilst simultaneously developing new teaching and research case materials. Thus the researchers took the roles of 'activist' (Croom, 2009, p.65) and 'agents of change' (Coughlan and Coghlan, 2009, p.243).

Following Susman and Evered's CAR cycle the project went through the following steps:

1. Diagnosing – the project aimed to deliver practical changes to Coen by (i) determining how the company could abduct from the concept of servitization, (ii) determining how the company could abduct from the concept of enterprization, (iii) establishing whether these concepts were co-implementable and able to improve PSS deliveries to clients, (iv) documenting the role IT played in these transformations and (v) documenting perceived contributions from these changes towards Coen's strategic plan for growth.
2. Action planning – consisted of a full-time research associate being recruited by the university and Coen and placed in Coen. The research associate was given an official position of 'visiting research fellow' at the university, and visited the university one

day per week for tuition and mentoring. Fortnightly meetings were held between academics (led by a senior member of faculty supported by a PhD student) and Coen managers (led by the owner–manager and supported by the research associate).

3. Action taking – a project plan was followed that (i) launched the project and initiated the literature review of frameworks and themes, (ii) reviewed current standard operating procedures, strategy and culture in Coen, (iii) identified improvement plans within Coen, (iv) abducted enterprise and servitization concepts into Coen, (v) engaged with Coen's wider enterprise to identify process links, (vi) analysed and interpreted Coen's wider enterprise, (vii) conducted working sessions with Coen and their wider enterprise members, (viii) planned implementation of ideas generated by the whole enterprise, (ix) implemented change throughout the enterprise based on frameworks and themes, (x) documented lessons learned about enterprization and servitization from the construction industry, (xi) mentored the research associate to become an able manager of change and business development and (xii) achieved the repositioning of Coen as an integrated provider of construction-related PSSns.
4. Evaluating – enterprise models and improvement points were developed and reviewed in two, day-long workshops involving Coen employees, academics and other organisations in the wider enterprise ((i) with Prime Contractor K and Customer S; and (ii) with Prime Contractor L, Contractor P and Contractor B). The emerging ideas were also presented to eight focus groups of thirty owner–managers of SMEs in one-hour workshops for feedback; these took place throughout the project to gain feedback and validation from other SME owner–managers to help build 'empirical evidence of usability' (Fitzgerald, 1996, p.12). Two academic focus groups (of ten ISs specialists each) also took place to verify and iterate new ideas as necessary in what Argyis and Schon (1978) describe as 'double-loop' learning.

5. Specifying learning – outcomes of this research have improved the conceptual validity of enterprization and have demonstrated that servitization and enterprization can help to transform and grow an SME, which gives an insightful academic contribution abducted to and from empiricism. This project therefore extends current knowledge by applying these transformational concepts together, and by applying them in a new context. For example, for Coen, comprehensive change has been achieved by abductive learning based on these concepts, which were new to them – strategically, operationally, culturally and technically. Hence practical interventions in a 'social system' have also been achieved through this action research.

Figure 2 gives a simple schema detailing these CAR steps for this project against its twenty-seven month timeline. Although presented separately and relatively linearly, like all action research projects, in reality these steps were intrinsically interdependent and iterative (as described by Coughlan and Coghlan, 2009, p.252).

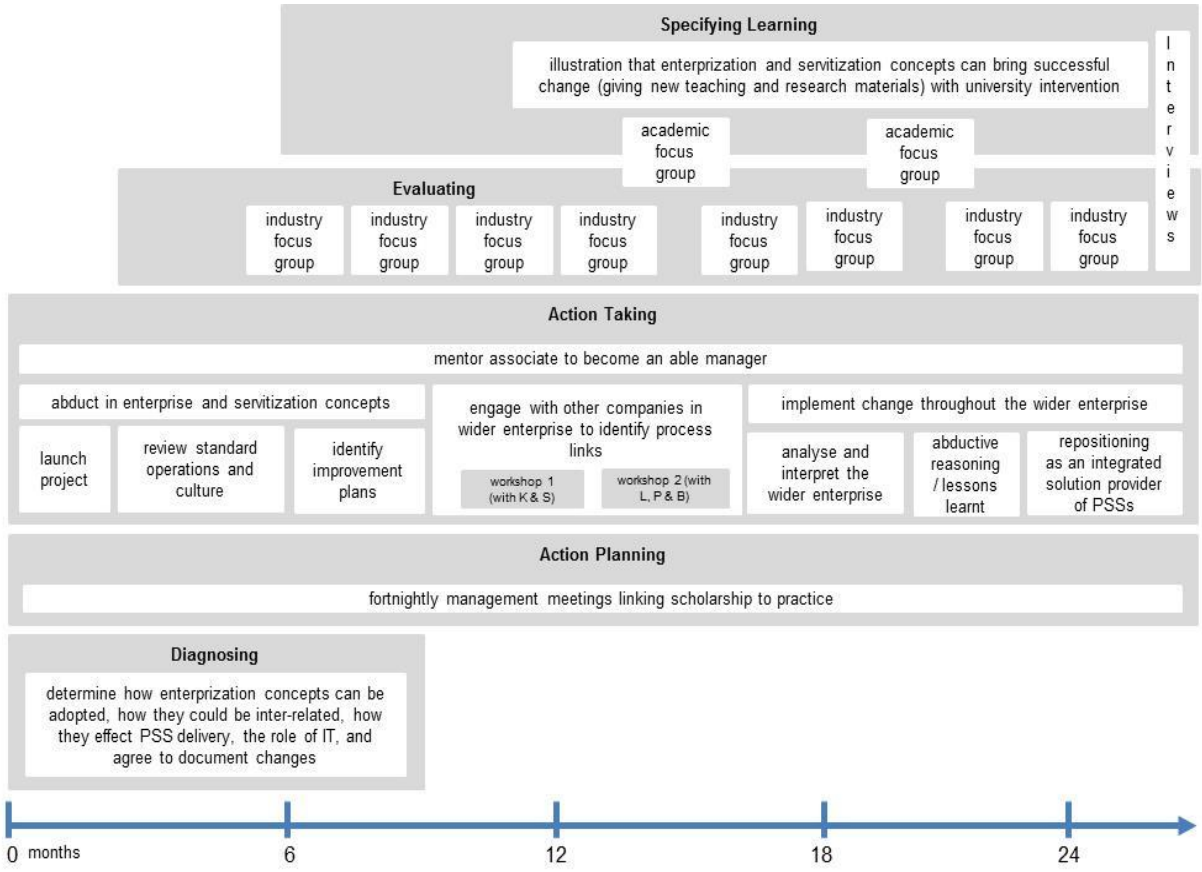

Figure 2: Timeline for the CAR methodology used at Coen

During this project, academic members of the action research team worked closely, on site with Coen. This was important because there was a 'need to explore context and action, where context is a product of action, and where action is a product of context' (Pettigrew, 1990, pp.269–270). For this reason this project specifically used the abductive approach to action research (Spens and Kovács, 2006) as it readily supports 'reasoning from effect to causes or explanations' (Lamma et al., 1999) by using the particular growth plans of Coen as a 'puzzling observation or an anomaly that cannot be explained using established theory [or theories]' (Andreewsky and Bourcier, 2000; Dubois and Gadde, 2002). Simultaneously this project used servitization, enterprization and ES literature themes to provide a 'deliberate application of an alternative theory for explaining a phenomenon [or phenomena]' (Kirkeby, 1990) via 'theory matching' (Spens and Kovács, 2006), which supports theorizing about the

initial puzzle, observation or unit (e.g. the enterprise) and sub-units (e.g. enterprise modules) of analyses, as reported later in this paper.

In more practical terms this means that changes in Coen were abducted from a priori themes from the extant academic literature on servitization, enterprization and ES implementation, after which a posteriori empirical practices from Coen were assimilated with academic literature themes for other researchers to generalise from via a newly proposed, integrated, transformation model, given at the end of this paper. The model's purpose is to encourage 'double-loop' learning through newly framed, empirical insights (Argyis and Schon, 1978). As Checkland states, 'there must be an intellectual framework [or themes], declared in advance, in which general learning outcomes can be defined. Without such a framework, action research can quickly become indistinguishable from mere action' (Checkland, 1981, p.400). Description of this abductive action research at Coen is given below.

4. THEMES IN PRACTICE: COEN CASE STUDY

Construction is a major contributor to UK gross domestic product (GDP), peaking at 10 per cent overall in 2008, and has historically been a major driver of GDP growth. The construction industry's value chain consists of approximately 300,000 firms, the majority of which are SMEs, and a significant proportion of construction employees (approximately 60 per cent) are low skilled labourers with relatively limited alternative employment opportunities (LEK Consulting, 2010).

Although a steady recovery in output has been experienced since the rapid decline at the beginning of the 2008 economic downturn, the industry still remains 10.3 per cent below its 2008 pre-downturn level (Barbour ABI, 2014); at its worst the commercial construction sector was at 38 per cent below the recorded level before the recession, which means that there is a long-term need for construction to regain its previous level. Ongoing economic recovery has largely being supported by a revival of the private sector residential market since 2013, with the UK government's economic return-to-health policies, such as the 'Help-to-Buy' scheme (Construction Products Association, 2014); however, moderating economic factors, such as a lack of skilled labour and professional skills shortages, cause a continuing squeeze on profit margins, cost rises and the poor financial positions of major established contractors (Richardson, 2014), meaning that robust contingency and growth plans have to be made by companies in this sector. It therefore stands that innovative and radical ideas, such as enterprization, servitization and newly developed ES, are welcomed by forward-thinking construction organisations as they strive to improve their performances.

Businesses in the construction industry are also receptive to enterprization because they are predominantly project-based (Gann and Salter, 2000), inter- and multi-organisational enterprises by nature (Barlow and Jashapara, 1998), which are also quite often temporary and established to design, build, install and maintain specific deliverables (e.g. buildings, highways or railway stations) (Packendorff, 1995). So in comparison to manufacturing organisations, construction organisations can have greater discontinuity of demand, greater complexity of offerings and are more closely tied to specific significant outputs (Cova et al., 2002) in their 'installed base' (Oliva and Kallenberg, 2003). To address these issues, in the absence of any government intervention, construction organisations often seek to collaborate and co-operate through MOEs to deliver their installed assets and provide extra, more highly

valued services to the customer (Artto et al., 2008; Blindenbach-Driessen and van den Ende, 2006; Grubic, 2014). However, these issues, before they can be adequately addressed, need to be acknowledged (Davey et al., 2010). The UK government has recognised that new IT, for improved supply chain management and procurement, is necessary, but this is just one critical factor needed for growth across the industry (Cabinet Office, 2011); the issues are far more multifaceted and wide-ranging than just IT – as illustrated by the Coen case study.

4.1. Coen – an SME in the UK construction industry

Coen is a small-to-medium-sized construction enterprise. In 2012 the company had thirty-three employees and an approximate turnover of £1.8 million; most of its revenue was produced through plastering and dry-lining of private housing, and contracts were won on the basis of being the lowest priced bidder in a competitive tendering process. The owner–manager of Coen, new to the company in 2010, perceived the contribution from his company's operations as 'good' but wished this to increase this to 'leading' within one to three years' time. The three top constraints to growth were perceived by Coen at that time to be a lack of:

1. employees' skills, positive attitudes, aspirations and propensities towards change, especially amongst the incumbent management team in respect to developing service and product-related services
2. operational process definition, documentation and adherence to practice by employees, particularly by tradesmen working on site alongside prime contractors and subcontractors (as proven by ISO 9001, ISO 14001 and ISO 18001 audits)
3. information and process automation, as the majority of administration was still paper based.

Therefore, overall, Coen's service provision in the context of Oliva and Kallenberg's (2003) framework was very much seen as an 'add-on' and Coen aimed to place at least equal emphasis on the deliveries of their products and services within three years by 'elevating' (Blackstone, 2001) these top three constraints – partly by implementing enterprization and servitization concepts – and thus repositioning itself toward the middle of Oliva and Kallenberg's (2003) product–service continuum rather than being at the product-only end.

Since 2012 much has been transformed at Coen. For instance the entire workforce, including senior managers, have been removed over time and replaced with new employees who share the same modernisation views as the new owner–manager by, in part, using servitization and enterprization concepts. A dedicated quality manager was hired to define, document and train the workforce in operational processes, and provide guidance to support this initiative on the company intranet. The workforce of builders, plasterers and craftsmen, when on construction sites, now use a newly developed software application accessed through a mobile electronic device (e.g. smartphone, tablet or laptop computer) that enables them to manage their own work outputs in real time (e.g. time sheets, invoices, job progress, quality problems and on-site deliveries) in transactions directly linked to head office systems. Development of this proprietary piece of software was initially outsourced to a specialised software company. Further developments of it have been brought in-house, with a view to reselling user licences to other SMEs with similar mobile workforce requirements. These changes were considered to be the first small steps towards servitization and enterprization as detailed further below.

4.2. Servitization at Coen

Coen has reviewed and improved its operational routines and relationships and evolved from being a product-centric deliverer to become a service-centric deliverer, placing them approximately midway in Oliva and Kallenberg's (2003) framework continuum. Indeed, they now offer aspects of 'full service solutions' from conception through to post-construction for all of their products (Grubic, 2014). Coen has simultaneously achieved year-on-year growth. According to Coen's owner–manager (given as approved paraphrases of interviews conducted in October 2015), successful moves towards servitization include:

(i) A change to strategic thinking – 'No longer does Coen aim to be a product only company; instead it can provide full-fit serviceable solutions. For example: the installation of pre-fabricated external wall panels instead of only rendering, the installation of mechanical and electrical facilities instead of passing-off work to other trade companies; and managing turnkey projects rather than acting as a subcontractor. These changes will enable Coen to provide basic services, which we believe are an essential prerequisite to providing more advanced services more closely associated with servitization.'

(ii) A change to operational practice – 'Employees now think of themselves as professional solution service providers rather than as traditional builders. Traditional services offered by Coen have significantly changed, and the realisation that simply installing a product (e.g. solid wall installation) is of limited value and promotes short-term thinking. Instead Coen now incorporates and sells products as part of additional services relating to concepts such as "energy improvement schemes" aimed at optimising clients' operations and reducing the energy consumption of their built assets [i.e. their installed base].'

(iii) Delivery of more highly valued services – 'This has been the realisation that we can develop a new capability to install new electro-mechanical monitoring devices in buildings which Coen construct and (re)fit (e.g. restaurants, supermarkets, university buildings) to help measure and maintain the condition of built-environment systems, which moves Coen towards provision of full on-call facilities management capability for our clients' built and installed assets … really good servitization stuff!'

4.3. Enterprization at Coen

Enterprization has taken the form of greater collaboration with suppliers, partners and clients as Coen has quickly grown by acquiring competences through collaboration in MOE operations, which has proven to be faster and easier than developing them themselves in-house. According to Coen's owner–manager, through the use of improved processes and process automation Coen has:

(i) Closer collaboration with suppliers – 'We have got our suppliers to provide just-in-time delivery of materials to site in prefabricated kanban stillages, which has reduced damage, pilfering and storage problems on building sites … a practice more commonly found in line-side feeds in high volume manufacturing facilities rather than in construction. Suppliers are also able to login to Coen's information systems to report inventory details; this has enabled us to work more closely in collaboration with suppliers to ensure materials are available on sites … so that construction projects can meet agreed timescales and costs.'

(ii) Joined-up strategic thinking with key customers – 'Process re-engineering activities took place in joint workshops, which helped us to tailor our products and services to customer

needs. We worked closely with partner organisations to identify long-term trends in construction, including the need to incorporate environmentally friendly elements to their construction practices, which include the reduction of waste and energy during construction and reducing the overall cost of ownership of the built product throughout its lifecycle. For example, with clients K and L more information was shared during the bid, mobilisation and delivery stages, which made these projects run smoother, and increased our clients' propensities to follow-on and purchase higher-value-added services from us afterwards.'

(iii) Part ownership of suppliers – 'A supplier, DWL, who provided electrical and mechanical design and installation, was acquired, and has since become a critical, complementary, core competence. Coen and DWL now operate in an extended enterprise to deliver product and service around a modular window and wall panel system. For example DWL provide a manufacturing facility, which Coen never previously had, and Coen provide an installation service and route to market, which DWL never previously had.' Ownership in DWL makes it possible to deliver turnkey projects in an MOE. Mutual reciprocity of Coen's and DWL's core capabilities delivered in an MOE is therefore perceived to enable an improved overall service for the end client.

(iv) Established a new start-up company – 'A new start-up company, CITI, was founded to develop proprietary software – a mobile workforce management system – which has helped us link to our suppliers, customers and partners.' Initial development of this new software had been through a virtual enterprise set-up (built and hosted by one company, and operated and maintained by Coen), which after initial internal success was in-housed by CITI and rewritten to further develop its associated intellectual property, and help manage its suppliers, customers and its own mobile workforce. 'In the future it is planned that this software will be

a unique selling point for Coen, and could also be sold on to third parties as a bundle of technology, process and quality improvement practices as we [Coen] become increasingly renowned for our growing expertise in higher-value-added advanced services.'

4.4. ES at Coen

In addition to the development of the new CITI mobile workforce management system, other new ES have been used. According to Coen's owner–manager these include:

(i) Adopting business analytic and intelligence tools – 'We use these for looking at patterns of customer behaviours to see which projects, services and product deliveries have been most profitable and where future improvements could be made to those which are less profitable; we also use them to identify target markets which are most likely to be early adopters for our new services and technology ... A surprising insight has been that our service skills and technology developments may be marketable beyond the construction sector.'

(ii) Developing computer-aided design/computer-aided manufacturing (CAD/CAM) capabilities – 'We are preparing ourselves to work with electronic build information, given to us by collaborating design companies, so that our bills of materials and engineering changes can be exchanged and managed more effectively.' This is becoming a necessary prerequisite for forthcoming Building Information Management (BIM) compatibility, which is now becoming widespread throughout the construction industry (BIS, 2012; Demian and Walters; 2013).

(iii) Implementing new accounting software – 'which is compatible with transactions made in our mobile workforce application being developed by CITI, which will speed up our financial transactions and reconciliations for suppliers, customers and partners'.

Coen believes that these fundamental changes have taken place over this research project's duration and was due to the strategic vision Coen had to enterprize and servitize through IT/IS, although it is acknowledge that other factors such as market forces and sheer luck could also have played a part. However, it remains that in 2015 Coen is a very different company to what it was in 2012. Not only has it elevated its top three constraints to growth (i.e. skills, processes and IS/IT process automation), it has also moved to larger premises in a better location nearer to a science park and two universities. A new company, to prefabricate insulation panels, has been acquired and co-located to enable Coen to have more control over their suppliers and their value stream, and move into new markets, with new products, generating new and diversified revenue streams, which are becoming more focused on service aspects to generate a greater percentage of their revenue. Ongoing, continual, professional development and training of staff, through stronger links to universities and trade bodies, are also now normal practice at Coen (e.g. training in concepts such as enterprization and servitization have taken place and will continue to do so). Coen has also recently worked with huge, international, construction companies, in partnership with universities, to discuss and implement MOE management concepts, which has resulted in them as being seen as an emerging thought leader in the industry and, '… a cut above the average construction SME' (strategic purchasing manager of a multinational construction company). In 2015 Coen had twenty-seven employees and a £3.9 million turnover, demonstrating a near threefold increase in productivity per person. In part, the Coen management team believe this was due adopting servitization and enterprization concepts

(accepting that other exogenous factors and hysteresis could have also been influential). These specific Coen learnings and deliverables are shown in Figure 3 against the same project timeline as used in Figure 2.

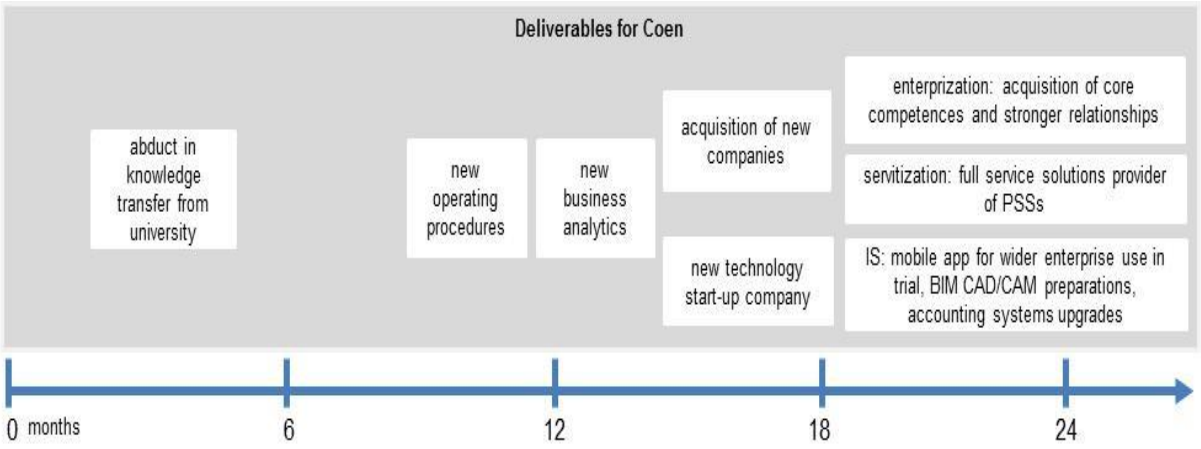

Figure 3: Specific learnings and deliverables for Coen against the project's timeline

In the future other constraints to Coen growth will be elevated by ongoing cultural change training, encouraging further adoption of forward-thinking concepts amongst its workforce, improving project management practice, reducing material wastes, and improving materials handling on site and in the DWL fabrication plant, which should be demonstrable through a matured quality management system and suitable key performance metrics for individuals, processes and the overall MOE.

5. CONTRIBUTIONS TOWARDS SME TRANSFORMATION

As seen from this case and literature précis, servitization is a field of research that comprises a broad range of traditional academic topics from distinctly different research communities

(e.g. Oliva and Kallenberg, 2003; Malleret, 2006; and Slack, 2005 as cited by Lightfoot et al.'s, 2013 review). But there is still a lack of specific and practical servitization literature devoted to helping SME owners and managers to compete through PSS delivery and ISs use within MOEs as existing literature is still too generic and insufficiently supported by empirical evidence. As the majority of modern organisations work in close collaborations and jointly deliver products and services (Binder and Clegg, 2007), there is need for more cases and frameworks to improve servitization transformation in MOEs that explore nuanced scenarios – such as SMEs in construction. This research begins to redress this imbalance, as described more generally below.

5.1. Towards MOEs

Enterprization can create a 'solution-specific business' using enterprise modules that collaborate and constantly evolve (by joining and leaving) to accommodate endogenous and exogenous factors to be able to appropriately situate and deliver any particular PSS in a vertically integrated, virtual or extended MOE form – determined by temporal core competences in each specific scenario. This is particularly suitable for the construction industry, as enterprise module–enterprise module relationships are complex and constantly changing as MOEs are established to deliver complex, specific PSSns at particular times, before having to reconfigure and deliver another complex PSSn through a different MOE. The construction industry does this partly because of its high sensitivity to changing economic conditions, interest rates and government policies on house building, infrastructure development, subsidies and environmental factors, and partly due to their own needs to remain agile and proactive.

5.2. Towards PSSs

Traditionally, construction firms (in the UK) have collaborated through 'short-term', project-orientated, business models to satisfy customer needs, based on single product delivery within agreed timescales and costs. Economic conditions, and changes in practice due to factors such as BIM, are forcing organisations to innovate to be able to sustain their business operations. Thus servitization is now seen as an operations strategy to enable longer-term offerings based on 'product component' and 'after-product implementation' service components (Kujala et al., 2010).

As highlighted this case, services are present in all aspects of product delivery – from conception to implementation. Post-implementation phases of construction projects are seen as particular areas of significant opportunity for offering value-added services as they can enhance the utility of built, installed and commissioned base assets (i.e. products). This is akin to practice more commonly associated with manufactured products (for evaluation, monitoring and maintenance) (Windahl et al., 2004) but could perhaps become more widespread for construction companies, especially the smaller ones who seek to grow.

5.3. Towards growth – of companies and theoretical understanding

This is probably the first time such insight has been documented for a construction sector SME at an embryonic stage of adoption. For Coen, through an abductive application of Susman and Evered's CAR cycle, themes from academic literature produced the following outcomes:

1. Diagnostic – (i) servitization has taken the form of advanced service provision preparation through the development of new proprietary IT, (ii) enterprization concepts have encouraged collaboration with software companies, metal fabrication companies, subcontractors and key customers, (iii) both servitization and enterprization seem inextricably linked in this case, (iv) changes were documented using an abductive philosophical CAR methodology and (v) Coen has grown as a result.
2. Action plan – these transformations have only been possible by resourcing a full-time 'activist' researcher on site at Coen who has a permanent link to a university and who was mentored by other part-time team members composed from Coen's management team and academics with topic specific expertise.
3. Action taken – the action research project plan was a success, particularly for the parts that explicitly involved workshops with people from outside Coen but were in Coen's wider enterprise (e.g. Prime Contractors K and L, Customer S and Contractors P and B).
4. Evaluation – concepts and plans for strategic collaboration were presented to the wider enterprise members (e.g. Prime Contractors K and L, Customer S and Contractors P and B) who were keen on the ideas and 'expressed wishes to adopt the new technology' (senior supply chain manager, Prime Contractor L); implementation discussions are still underway (in 2016). Feedback from industrial focus groups consisting of other owner–managers was also very positive and fuelled the founding of CITI and in-housing of the mobile workforce management software's development. Similarly other presentations of this project's outcomes to academics confirmed that servitization and enterprization concepts were seen to prevail successfully in Coen's strategic plan.
5. Specific learning – lessons on these concepts have been successfully transferred into Coen and implemented. These can be proved by the change of practice and growth of

the company's productivity and turnover (see Figure 3). Experiences of this project are also being used as practical teaching cases for executive education at the university (see Figure 2).

Based on this case study and literature themes, we propose, through inductive reasoning, a new, integrated, transformation model for simultaneously achieving enterprization and servitization through the implementation of new IT and new IS, as shown in Figure 4, which gives a picture (or 'graphical abstract') to help generalise simultaneous servitization and enterprization transformations to other similar scenarios.

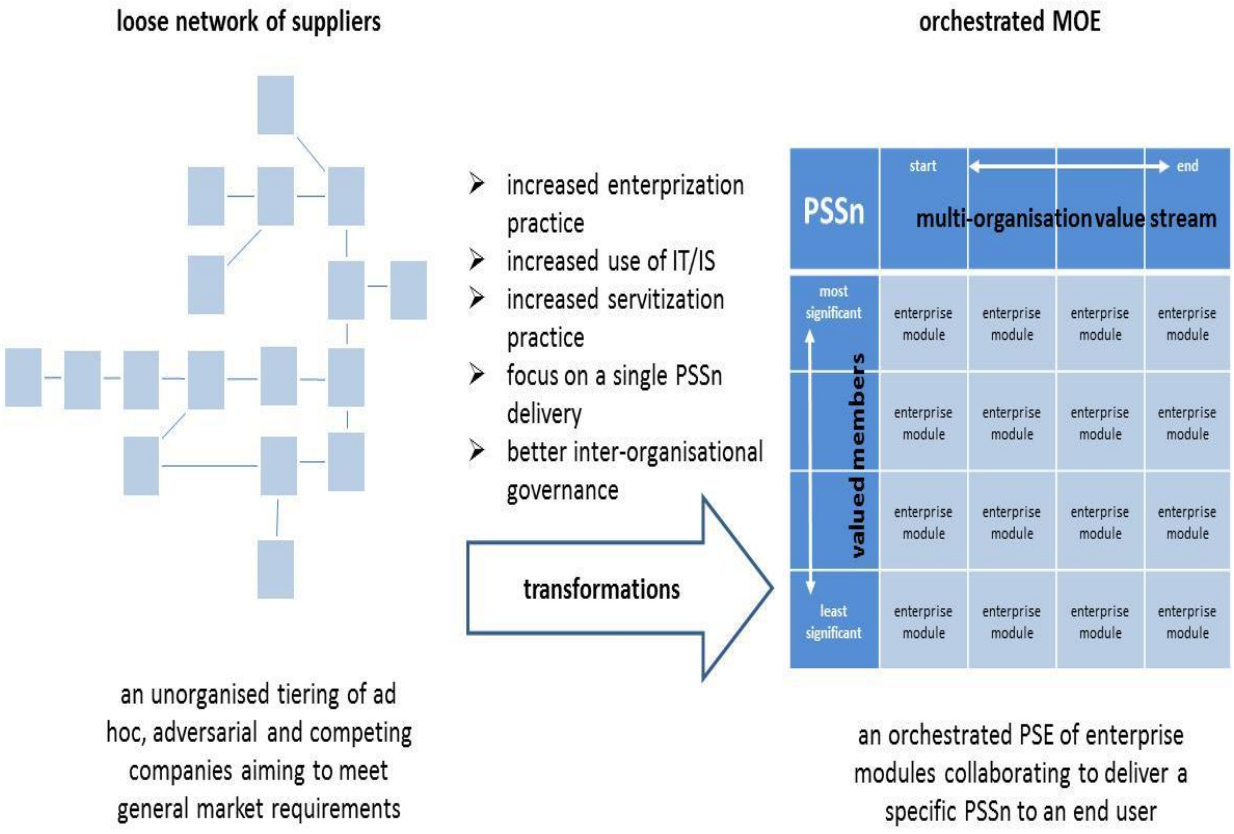

Figure 4: New, integrated, transformation model – transforming a loose network of suppliers towards an orchestrated MOE

On the left-hand side of Figure 4 a loose and relatively un-orchestrated network of suppliers is shown, which tends to emphasise the ongoing supply of parts and services at operational levels. Typically such a network will supply a mix of product and service components in a fragmented and adversarial manner for traditionally designed, built and maintained installed base assets. Through enterprization and servitization transformations, increased use of ES, better inter-organisational governance, and increased focus on a particular PSSn (see Figure 4 central arrow) this network can change to a conscientiously designed, orchestrated MOE (on the right-hand side) – where an 'enterprise matrix' is used to depict the MOE (Binder and Clegg, 2008). In such a way the MOE unit of analysis has, in contrast, been specifically designed to deliver a particular set of PSSn bearing competences (each an enterprise module and a sub-unit of analysis) in a specific MOE configuration before the MOE dynamically reconfigures to deliver another, different PSSn in another MOE (represented by a different enterprise matrix). This MOE, which is focused on delivering a specific PSSn, is referred to here for the first time as a product-service enterprise (PSE).

In contrast the MOE has more a strategic emphasis on competences, resource interdependency development, structure and valued-member agility than a loose network of suppliers.

A PSE's governance team will also know, in contrast to a loose network of suppliers, in far greater detail, with far greater certainty and confidence, which enterprise module of which valued member is contracted to deliver which core competence in which part of the MOEs' multi-organisation value stream. This is achievable, at a high level, by more cohesive, enterprise governance visions for enterprization, servitization, joint use of IT/IS and shared

processes for each (family) of PSSn delivered by the PSE. In detail it requires a mix of tactical and operational changes such as embarked upon in Coen's case.

It is important to note that the Coen's case contrasts strongly with how large companies try to diversify through servitization, as larger organisations often seek to firstly consolidate diffuse traces of service provision across their organisations before enhancing and outsourcing them to external specialised service providers – as in Oliva and Kallenberg's model (2003). Instead, Coen was seen to make every attempt to forge wider connections to parts of other larger companies' enterprise modules as an integral manifestation of its strategy for growth.

Thus successful transformation of any single company towards becoming more of a PSE, with the intention of improving their deliveries of PSSns, requires a full appreciation of the whole multi-organisation value stream and the role of each of its valued members. Only through such mapping, understanding and implementation activities is it possible to become a leading integrative force, power broker or primary enterprise integrator of the MOE (Binder and Clegg, 2008).

In effect, a leading enterprise integrator becomes the prevailing boundary-spanning adhesive force (i.e. the 'glue') of any MOE using its IT/IS, superior and more comprehensive knowledge, and contractual terms and conditions (Dubruc et al., 2014) to bind together other valued members of the enterprise to focus them upon the delivery of a particular PSSn. The tighter the enterprise modules of different valued members are bound together to collaborate, rather than compete, the more they become enterprized, the less they resemble a loose un-orchestrated network of suppliers, and the more they resemble an MOE.

6. SUMMARY

In summary, as large companies look to outsource to embrace servitization and SMEs look to integrate into larger companies' value streams to servitize, there seems a natural, mutual propensity for more enterprization and more use of ES in the construction sector.

To ensure the concepts of enterprization and servitization evolve, remain relevant and become more widespread, 'double-loop' learning (Argyis and Schon, 1978) is required to constantly question perceived prevailing wisdom about supply networks and embrace new paradigms. To aid this learning, two new terms are proposed to fit the construction sector's nuances:

- product–service enterprise (PSE) – to define the collection of enterprise modules of different companies who work together to deliver a specific PSSn
- product–service solution (PSSn) – to define the specific deliverable produced by a PSE.

It is important to note that while a PSSn becomes used and sometimes owned by the end client, the PSE competences and strategy remain collectively owned and operated by the valued members. It will be used to deliver other PSSns to other end clients or for repeat deliveries to its existing clients in the future, where PSSns are likely to be delivered through a reconfigured PSE to meet prevailing, temporal, organisational imperatives and economic requirements.

7. LIMITATIONS

This study is limited by the subjective and interpretive nature of abductive action research, and by being focused on only one company in the construction sector. However, the case is sufficiently in-depth and founded in literature themes to be generalisable to other similar companies, of which there are many hundreds of thousands in the UK alone. Due to hysteresis and any unaccounted for endogeneity or exogeneity (Guide and Ketokivi, 2015) changes in Coen cannot, beyond all doubt, be solely attributed to the enterprization and servitization transformations or ES implementations described in this paper. However, as testified by Coen's owner–manager and the ten different focus groups, they are believed to have significantly contributed towards them.

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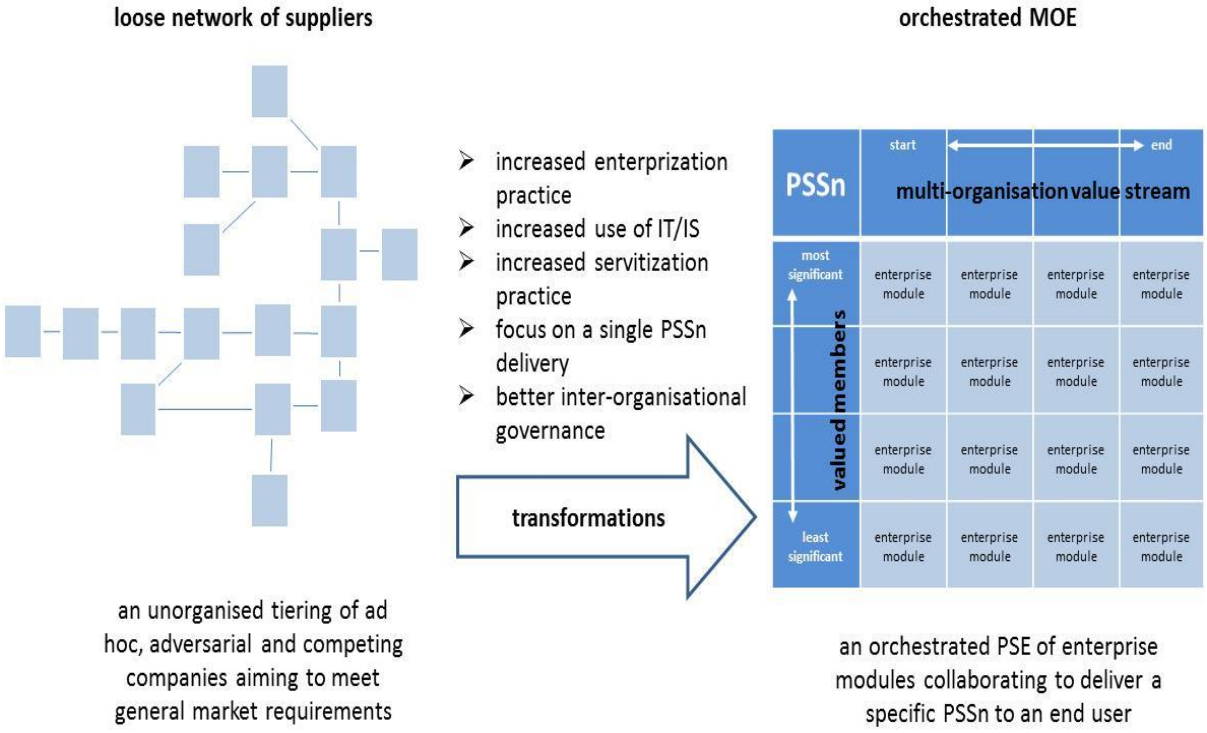

HIGHLIGHTS

- Describes how product–service enterprises deliver product–service solutions
- Illustrates how IT/IS facilitates enterprization and servitization transformations
- Demonstrates how an SME can grow into a multi-organisation enterprise
- Demonstrates how a UK construction SME develops product–service solutions

- Reveals a successful growth strategy for an SME in the UK construction sector