Introduction

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Manufacturing industries which produce tangible goods provide their customers with additional services such as operation support, monitoring, maintenance, repair, overhaul, and training. Recently, many manufacturers have started to redefine the value of services, creating a holistic product-service offering (Agarwal et al., 2015). The term 'servitisation' has been coined to describe this transformation of manufacturers to service providers, and the term 'service economy' to underlay the importance of services for the national economy. For many manufacturing companies, the differentiation through innovative service offerings is becoming a key selling point to set themselves apart from their competitors. Subsequently, they are forced to offer continuously improved and new services in the marketplace, to always stay ahead of the competition and at the same time to fulfil customer needs and expectations over the whole product lifecycle. So the term 'good service' gets its new meaning that services must be seen more as separate products than they have in the past.

Moreover, economy and society are dominated by complex networks of service systems: overlapping systems that continuously interact and create value, known as service system networks (Kijima, 2015). The increasing complexity and interactive capability of these networks lead to an extensive exploration of the expansive possibilities for service innovation and integration across different types of service systems. In parallel, service engineering as a novel engineering discipline emerges which includes comprehensive design methodology of both, products and services. Today, two directions for its further development can be observed. First, depending on the industrial sector, manifold options and barriers must be considered and broken down to develop a marketable service offering related to the structure, process, outcome and market (Mochimaru et al., 2014). Second, traditional manufacturers have to preserve many internal and supporting activities with respect to the manufacturers' need to reorganise their processes in order to cope with the challenges of adopting a novel business model (Redding and Roy, 2015).

With this issue, we address various areas of service engineering from the concurrent engineering research perspective (Stjepandić et al., 2015): integral product-service development and its transformation to high-reliability service, maintenance service system planning, personalised service design, distributed engineering design services, performance-based contracting environment, tight synchronisation of maintenance services with health monitoring, synchronised forecasting of spare parts demand, and IT services which ensure the operational readiness during transition.

This special edition primarily includes invited papers selected from contributions to the 21st ISPE Inc. International Conference on Concurrent Engineering held in Beijing, China on 8–11 September 2014 (Cha et al., 2014).

Margherita Peruzzini et al. address the concept of product-service (P-S) representing a novel way to create new business opportunities, improve sustainability, support continuous innovation, and increase the product value. This paper proposes a new methodology to support ideation and preliminary design of sustainable product-service systems (PSSs) within industrial chains. The method is based on quality functional deployment (QFD) approach and allows defining a set of robust requirements for creating new PSSs in respect with the specific customer needs and the sustainability principles of the industrial network. The research demonstrates the method validity on three case studies involving different industrial chains distributed all over Europe (i.e., white goods, machine tools, and textile industry), an easy definition of three distinctive PSS concepts starting for the specific market needs, and the robust requirements elicitation concerning both functional and ecosystem aspects.

V.S. Viswanath Dhanisetty et al. present an approach for the optimisation of maintenance intervals, incorporating several distinct elements. First of all, Weibull analysis provides a generalisable means to estimate reliability of non-repairable products. Next, an optimisation model has been developed that employs maintenance interval length to optimise for cost under specific reliability and operational constraints. The developed approach accounts for different types of failure regimes and incorporates the main three maintenance policies identified in literature (failure, preventive, and predictive), in contrast to existing methods. The applicability of the developed approach has been tested in three case studies, each describing application and results for a different type of industry and associated product. The results notify the user on the optimum interval time for inspection, where costs are minimised within an acceptable reliability range.

Wen-Bin Hsiao et al. highlight the approach of mass customisation for personalised services and goods. In order to overcome the gap between mass customisation and mass personalisation, this study proposes a service engineering methodology to break through the limitations of mass customisation and finally design personalised services through customer co-creation. The research applied personalised hotel room layout service as a case study. The customer satisfaction would be measured to validate the proposed methodology according to service strategic module. The study also found that customer would pay extra expense for personalised hotel service. Therefore, the personalised service would not only increase customer satisfaction and customer loyalty, but also gain competitive advantage for company. The proposed methodology provides customers with diversified services and let them experience the process of value co-creation to achieve the efficiency of mass personalisation.

Xi Chen et al. reconsider the current aircraft maintenance philosophy, and introduces the emerging technologies, such as structural health monitoring (SHM), to reduce long-term maintenance cost and increase aircraft availability. It introduces a timely and automatic diagnostic and prognostic capability which may bring substantial changes to the current maintenance philosophy. This study investigates an integrated approach of scheduled maintenance and SHM by suggestion various logical maintenance procedures. A probabilistic model is established to examine the effects of the SHM synchronisation with scheduled maintenance and the impact on both safety and economy.

Nan Li et al. investigate the approach and mechanism of distributed design resources integration and binding in collaborative design process based on service-oriented architecture. A SORCER-based collaborative design environment is presented. Essential design factors matrix is designed as the binding mechanism to drive distributed design

resources integration process during the design tasks execution time. Then, a coupling analysis method for design service modelling and execution is proposed. In order to build multi-resolution coupling model in the local and global size, essential design factors binding matrix and essential design factors matrix group will contribute to expressing the inside of the relationships between design services.

Trevor Byrne and John P.T. Mo investigate the critical factors for design of successful performance-based contracting environment. The goal is to attain desired capability levels that can be measured as a performance outcome of systems in-service. There are two parts in the contractual framework: system acquisition and sustainment (in-service support). The sustainment agreement imposes significant risks because the revenue is now tied with the actual system performance which can be out of the control of the service provider. There are a lot of uncertainties in the performance-based contracting environment and questions have to be asked by both sides of the contract. The manufacturers should ask whether it is beneficial for them to take on the risks to be committed. The asset owner should ask whether the contractor has given sufficient evidence that they can meet the stringent performance-based contracting environment. This paper attempts to answer these questions by exploring from experience and people involved in performance-based contracts the concept and value for money to the contracting parties.

Moustafa Elnadi and Essam Shehab present the main enablers and factors that are considered to be important for the successful implementation of lean practices in PSSs. Five main enablers and 33 factors emerging from the main enablers are considered to be vital for the successful application of lean in PSS. A combination of research methodology approaches have been used in this research. This was followed by interviewing the relevant key managers working in six UK manufacturing companies that successfully implement lean practices in the service offering process. Finally, results obtained were validated via workshops in the target companies.

Sergej Bondar et al. present the network-centric operations (NCO) during transition in global enterprise. NCO occurs when systems are linked or networked by a common infrastructure, share information across geographic borders, and dynamically reallocate resources based on operational needs. It makes an environment where seamless collaboration between networks, systems or elements within systems is possible. Understanding system-of-systems engineering (SOSE) is critical to a robust architecture development of NCO systems. One of typical areas of interest are the supplier networks which are triggered to work concurrently. Such networks suffer enormous stress in case of transition. Solution approaches derived in cooperation between the data exchange service centre http://www.opendesc.com and two global suppliers demonstrate the practical use of NCO.

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