Available online at www.sciencedirect.com

ScienceDirect

International Journal of Project Management 35 (2017) 1006–1021

International Journal of Project Management

www.elsevier.com/locate/ijproman

Sharing the burden of integration: An activity-based view to integrated solutions provisioning

Tuomas Ahola [a,*], Mervi Vuori [b], Esa Viitamo [b]

[a] Tampere University of Technology, Industrial and Information Management, P.O. Box 527, FI -33101, Tampere, Finland
[b] Aalto University, School of Science, P.O. Box 15500, FI -00076, Aalto, Finland

Received 18 November 2016; received in revised form 3 May 2017; accepted 3 May 2017
Available online xxxx

Abstract

While earlier research stresses the integration of suppliers and their diverse technological capabilities as a core capability of systems integrator firms, research on ways in which this integration is achieved in practice remains scant and rarely considers the suppliers' perspective to integration. We analyse how ABB, a systems integrator, delivered a complex subsea transformer solution to a customer in the oil and gas industry. Our dyadic, empirical, qualitative case study drawing on interviews of 17 informants revealed that while the responsibility for achieving cross-organizational integration lies primarily by the systems integrator, when motivated by potential of future collaboration, suppliers also actively participate in specific integrative activities. In addition, selection of integrative activities appears to reflect involved actors' priorities amongst time, cost, and scope objectives.

Keywords: Integrated solutions; Systems integrator; Supplier integration; Integrative activities

1. Introduction

Many traditional manufacturing firms have assumed the role of a systems integrator (SI) by shifting from the delivery of standardized products and services towards provision of bespoke integrated solutions (IS) responding to unique customer needs (Brady et al., 2005; Davies et al., 2007; Davies and Brady, 2016). The role of innovative technology is emphasized as deliveries frequently rely on technologies which are new to the world (Magnusson et al., 2005). Earlier research has shown that while SIs excel at integration of technologies at an architectural level, much of the domain-specific technological knowhow is situated within their supplier bases (Prencipe, 1997). Indeed, the essence of the concept 'systems integration' denotes bringing together resources that reside with various actors and compiling them to a coherent entity (Rutten et al., 2008). Thus, SIs need to know more than they make (Brusoni et al., 2001). As noted by Pagell (2004), integration can be studied at different levels of analysis. Internal integration refers to functions and departments within a single organization that "work together in a co-operative manner" (Pagell, 2004, pp.460) whereby external integration refers to the establishment and use of co-ordinating structures, technologies, processes and practices with downstream and upstream business partners in order to support and collaboratively manage the flows of information, goods and services (Vijayasarathy, 2010; Flynn et al., 2010). Thus, when internal integration takes place inside company boundaries, external integration takes place across company boundaries. Internal integration can be regarded as an important enabler for external integration (Yu et al., 2013). This paper focuses on supplier integration, with emphasis on integrating across company boundaries with upstream business partners.

The key role of the SI in coordinating activities that reside within its supplier base has been emphasized in earlier research (Hobday et al., 2005; Davies and Brady, 2016; Winch and

* Corresponding author.
E-mail addresses: tuomas.ahola@tut.fi (T. Ahola), mervi.vuori@aalto.fi (M. Vuori), esa.viitamo@aalto.fi (E. Viitamo).

http://dx.doi.org/10.1016/j.ijproman.2017.05.002
0263-7863/00

Leiringer, 2016). The suppliers, on the other hand, have simultaneously been portrayed in a much more passive role. This is somewhat surprising, since suppliers taking part in IS provisioning are frequently world leaders in their technological domains (Prencipe, 1997; Ahola et al., 2008) and can thus be expected to possess considerable expertise regarding the integration of their technologies in customer applications. Furthermore, most of the earlier studies focusing on the provision of IS have addressed integration from the perspective of organizational capabilities (e.g. Hobday et al., 2000; Gann and Salter, 2000), focusing on e.g. processes and knowledge that support the SI in their integrative role. In addition to this dominant macro perspective, a number of studies (e.g. Martinsuo and Ahola, 2010; Jaakkola and Hakanen, 2013) have addressed integration from the micro perspective, focusing on distinct *integrative activities*, i.e. *purposeful activities for facilitating the coordination of tasks across organizational boundaries*. Besides delivery projects, the coordination of supplier activities has also been discussed in the context of new product development (e.g. Wagner and Hoegl, 2006; Lau, 2014) and manufacturing (e.g. Choi and Hong, 2002).

While earlier research has identified various integrative activities used by SIs to coordinate tasks across organizational boundaries (e.g. Söderlund et al., 2008; Ruuska et al., 2009; Davies and Mackenzie, 2014), there is a lack of detailed knowledge regarding under which circumstances, and how these activities are used in system delivery projects. In particular, it is unclear to which extent the use of integrated activities is planned vs. emergent, or pro-active vs. reactive. Also, the contribution of individual integrative activities to project management objectives (i.e. cost, time, and scope) remains ambiguous. Finally, while earlier research emphasizes the role of the SI in achieving integration, the role of individual suppliers has received less interest. To broaden the current knowledge of how integration is achieved between the SI and its suppliers in IS provisioning, we studied project Åsgard in which ABB, a globally leading supplier of automation and power solutions, delivered a complex underwater transformer solution to an energy company operating in the offshore oil and gas industry. The focal project called for integration of multiple new-to-the-world technologies mastered by the participating suppliers. Correspondingly, the aim of our case study was to obtain a thorough understanding of how integration occurs on the micro-level by identifying integrative activities and describing their role in the focal project. More specifically, we sought answers to the following research question:

How are activities coordinated across organisational boundaries in integrated systems deliveries?

Our analysis of semi-structured interviews of 17 individuals representing the focal SI and six suppliers revealed that while the SI assumes the primary responsibility for integrating tasks across organizational boundaries in solution deliveries, the suppliers may take an active role in supporting integration especially when they are motivated by the potential for future collaboration with the SI. Furthermore, our observations indicate that the selection and use of a particular integrative activity is context-specific, i.e. activities are selected to support the achievement of time, cost, and scope objectives of the project.

This paper is structured as follows. We first review research on integrated solution provisioning and supplier integration, and then proceed to describe our research methodology, including the research approach and context, data collection and analysis. We then present the results of our study, focusing particularly on salient characteristics of the 13 integrative activities identified. In the discussion section, we contrast our findings to earlier literature, highlight their managerial implications, and review the main limitations of our study.

2. Literature review

2.1. Provisioning of integrated solutions

In many industries, IS deliveries represent the predominant mechanism for renewing production assets (Davies et al., 2007; Cusumano et al., 2015). For example, in the offshore oil business, oil producers acquire highly sophisticated production platforms tailored to the characteristics of the oil field in question. In shipbuilding, cruise line operators demand larger and larger vessels featuring new-to-the-world experiences, such as cocktail bars served by fully autonomous robots to meet the ever-growing expectations of passengers. The provision of IS represents a difficult integrative challenge calling for the involvement of several complementary firms, each of which are specialized in specific technologies or subsystems. Motivated by the rapid growth in IS deliveries worldwide, a growing number of high-technology firms are assuming the role of SI that are responsible for delivering high-technology solutions to their customer base (Hobday, 2000; Roehrich and Caldwell, 2012; Davies and Mackenzie, 2014).

Integrated solutions encompass numerous interconnected components in which even minor changes may induce significant implications for the design and manufacturing of other components or subsystems (Prencipe, 1997). As a result, the delivery of IS requires sophisticated management processes and design approaches. As ISs are unique and highly challenging to produce, the effectiveness of the outcome is of paramount importance as, for example, the cost of an oil production platform is marginal compared to the value of oil produced over its life-cycle (Hobday, 1998). To ensure reliability and effectiveness of the delivered system over its life-cycle, ISs are typically produced in projects involving a specialized SI which draws on the complementary expertise of several suppliers that are frequently world-leaders in their technological domain. Prencipe (1997) has further elaborated the technological interfaces between the SI and its suppliers by distinguishing between inner core technologies fully mastered by the SI and outer core technologies where the SI holds a full design capability, but the locus of expertise lies in the supplier base.

SIs must be able to cope with numerous challenges including the need to proceed with incomplete technical and commercial