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# Solutions for Integrated Systems

**Federica Ceci**

*University G.d'Annunzio, Italy*

## INTRODUCTION

Recent empirical evidences shows that in many sectors the provision of integrated bundles of products and services is increasing (Ceci & Masini, 2011; Davies, Brady, & Hobday, 2007; Kapletia & Probert, 2010). An example is found in the information technology (IT) sector, in which ERP (Enterprise Resource Planning) systems comprising hardware, software, and technical support and assistance are increasingly offered as turnkey solutions. The IT clients do not buy single components from different firms. Instead, they purchase a complete ERP system from a single supplier that provides software and hardware as well as consultancy services, post-sales assistance, system customization, and hardware maintenance. In some situations it is also possible to outsource the management of the complete IT system to the external provider, that charges a fixed rate for the storage, management, and processing of data and information. The chapter will explore the implications for operations that firms should face while providing the new offering.

## BACKGROUND

Integrated systems are becoming prevalent in a large number of industries (Davies, Brady, & Hobday, 2006; Galbraith, 2002; Oliva & Kaltenberg, 2003). The diffusion of integrated systems is particularly significant in the IT sector (Gager, 2006; Gerstner, 2002), where they are rapidly transforming the competitive landscape of the industry. In order to remain competitive in a sector where value creation is shifting from hardware manufacturing or software development

to service-oriented activities (Dolbeck, 2007), product and service providers face increasing pressure to supply bundled systems rather than individual subsystems (Tidd, Bessant, & Pavitt, 2000). These bundles, often linked by proprietary interfaces, tie customers into a solution with a single point of purchase and after-sales support, and guarantee higher margins than stand alone products or services (Wise & Baumgartner, 1999).

Whilst economically appealing, the provision of bundled products and services poses a number of challenges for IT firms. In this new competitive environment, firms become integrators of components, resources, and services that are developed by external organizations (Brusoni & Geuna, 2001). Supplying integrated systems thus entails a change in the boundaries of the firm. It also requires a redesign of the firm's offers and the reconfiguration of its capabilities (Ceci & Prencipe, 2008; Davies et al., 2006). Compared to firms focusing only on either products or services, integrated systems providers must develop multiple capabilities to address a broader set of customer needs. They must also carefully evaluate the trade-off between the development of specialized and generic capabilities. In today's hypercompetitive markets, the development of multiple capabilities may dilute the firm's core competences and, ultimately, erode its sources of competitive advantage.

Restructuring the organizational architecture of a firm, reconfiguring its internal capabilities, and developing new competences are challenging tasks that can be approached through different strategies. Firms in this industry have developed a variety of different capabilities and have historically followed different paths to become integrated systems providers (Ceci & Masini, 2011; Davies

et al., 2006). However, none of the strategies adopted has yet emerged as generally superior. For instance, firms originally specializing in manufacturing must integrate their manufacturing-oriented competences with service-oriented capabilities. However, the delivery of services requires organizational principles and structures that are almost completely new to a product manufacturer. By the same token, service companies that choose to offer bundles of products and services also need to acquire new competences.

The heterogeneity of the approaches followed by integrated system providers suggest that there is uncertainty about the most appropriate ways to conceive, implement, and manage the provision of integrated systems. They also indicate that the nature of the organizational capabilities required to succeed in this challenge is unclear too. The blurred picture on the practice side is symptomatic of a knowledge gap at the theoretical level as well. Previous studies on this topic have stressed that to become integrated systems providers, firms must develop appropriate capabilities (Wise & Baumgartner, 1999). Yet, the literature provides limited information on how firms should develop these new capabilities or reconfigure their existing ones. It also gives limited guidance regarding the shaping of integrated systems offers and offers few insights into the factors that affect both the current structure and the future evolution of this industry.

## **MAIN FOCUS OF THE CHAPTER**

### **Two Cases of Successful Integrated Systems**

To illustrate the empirical grounding of the integrated system phenomenon, two cases of successful solutions will be described. The first case is about Iveco, an Italian manufacturer that specializes in industrial vehicles. Research shows that an industrial vehicle used for business produces revenues for its owner only 20 days over 250 days of use. Thus, simply to break even – to cover costs

such as the vehicle price, maintenance, insurance, taxes and other additional costs – the vehicle must be used 230 days per year. If the vehicle should have a breakdown or other failure that prevents its usage, every additional day or hour out of service dramatically decreases revenues for the owner. The resulting need to resolve vehicle problems or failures as soon as possible is the motivation that pushed the Iveco Customer Services department to adopt a series of measures to increase the speed and efficiency of its post-sales assistance. To fully protect its customers from any sort of damage or risk, Iveco launched its planned maintenance contract (PMC), a full solution that ensures timely vehicle servicing and, in accordance with customer requirements, partially or completely covers any necessary service operations. The offering of PMC solutions has posed a number of challenges to Iveco, however, from a number of standpoints: (i) the development of appropriate technology; (ii) the adequacy of risk management; (iii) the hiring and retaining of qualified workers; and (iv) the redesign of processes. By concentrating on these four aspects, Iveco managed to successfully implement its integrated systems offering. Besides increasing customer loyalty and customer satisfaction, Iveco added a new range of services characterized by high value-added, raising the competitiveness of its offer and the profitability of its business. Iveco realized that in tomorrow's truck and bus industry, customers will not want to wholly own a quickly depreciating asset; they will prefer to lease it, preferably only paying for it when it is actually on the road. Innovations such as per-kilometre contract hiring lead Iveco to continue to invest heavily in customer support, a strategy that has been highly successful in its implementation to date.

The second case is from the aerospace industry: Rolls-Royce was founded in 1884. Now Rolls-Royce is the second largest aeronautics engines producer, and it is the leader in the production of marine propulsion systems. Despite its long manufacturing tradition and the strong capabilities acquired in that area, recently Rolls-Royce modi-

fied its offering, increasing the number of services offered and including innovative sales contracts such as Power-By-The-Hour. Power-By-The-Hour is a type of integrated systems contract offered by Rolls-Royce to airplane producers and owners. In this relationship, the Rolls-Royce engine required for the airplanes is not actually sold; instead, firms pay a fixed rate for the use of the engine, which includes the cost of maintenance, usage, and repair. Rolls-Royce retains the ownership of the engine, effectively selling to the client the energy, or power, required for the proper functioning of the plane. The payment is calculated on the basis of the energy required by the engine and used by the client – thus the name ‘Power-By-The-Hour’. As usually happens in offers of integrated systems, clients are not in charge of the management and maintenance of the product; they buy from Rolls-Royce the propulsion service, the intangible component of the product itself. Advantages for clients from this type of program reside in the possibility of transforming fixed costs into variable costs and, even more importantly, the opportunity to outsource to a specialized provider all of the engines’ maintenance operations. The clients’ need for a high-quality, reliable propulsion system that runs the airplane is met by the turnkey solution proposed by Rolls-Royce. Opportunities have opened up on a variety of levels, making it possible not only to migrate downstream to services but also to offer something more substantial to the customers in terms of adding value to their objectives, whether that is realized as greater efficiency or as improved combat effectiveness. The ability to integrate such factors into a solution and thereby to add distinctive output value is quite possibly the newest source of unique and sustainable competitive advantage on which firms operating in any context should focus.

### **A Classification of Integrated Systems Capabilities**

The resource-based view (RBV) assigns central relevance to internal resources and capabilities

as the sources of a firm’s competitive advantage and clarifies the nature and role of these variables in the provision of integrated systems. Organizational capabilities are the outcome of a resource integration process that is enabled and supported by knowledge. When they are valuable, rare, inimitable, and non substitutable, resources can guarantee the achievement of competitive advantage, especially if they are integrated into a unique set of capabilities.

Management scholars have also stressed that capabilities are not static and immutable, but rather dynamic (Zollo & Winter, 2002). When competitive landscapes shift continuously, market boundaries are blurred, business models become unclear and the achievement of sustained competitive advantage is guaranteed only by the ability to continuously reorganize and reconfigure internal resources to match changes in the external environment. The dynamic nature of organizational capabilities creates path-dependency (Eisenhardt & Martin, 2000), which further increases their stickiness. Organizations thus should not ignore the capabilities they already possess when they make strategic choices in the provision of integrated systems. A software development company that starts providing IT consulting services will never possess the same capabilities as an IT consulting firm that moves into software development. The two firms will choose different strategies for the provision of integrated systems; they will target different markets, they will sell to different customers, and they will offer solutions with different technical characteristics.

Scholars have stressed that to be successful in the migration to integrated systems offerings, firms must develop adequate capabilities (Galbraith, 2002; Wise & Baumgartner, 1999). When offering integrated systems, firms can move upstream and/or downstream. To embrace the new business model, therefore, a change in the existing set of capabilities is required.

While the general approach was a downstream movement, in line with Wise and Baumgartner’s (1999) suggestion, some firms moved upstream.

This is the case of consulting firms such as WS Atkins, which expanded from an engineering consulting company into an integrated systems provider. This services-based firm moved toward the provision of integrated systems by entering product manufacturing and therefore the development of systems integration capabilities. Although the direction of the change can be different, the goal should be the same: be able to provide integrated products and services to the customers (Davies, 2001, 2004).

In the transition towards integrated systems, firms move base. This growth is successful if firms are able to use their experience to develop the capabilities required by the new business model. The capability building process implies explorative and exploitative learning, and it is required every time that firms move into a new market or technology (Brady & Davies, 2004). As noted above, the direction of change can be up- or downstream. In both cases, successful growth requires the development of adequate 'core competencies'. Davies (2001) and Ceci and Prencipe (2008) identified the following seven types of capabilities that should be managed by a solutions provider:

1. Systems integration capabilities. These are core capabilities required to manage integrated systems. Integrated system providers must be able to put together different aspects of the solution in a system that works properly. The integration of the different aspects of the solution (consulting services, physical goods, financing support) is a difficult task and one that is central to the success of the transition.
2. Operational services capabilities. These affect all the additional post sales services not already managed by the firm that are related to the full life-cycle of products. Examples of operational services include customer support services, training activities and maintenance services .
3. Business consulting capabilities. These are a very important set of capabilities for integrated systems suppliers. In selling integrated systems, firms must help their customers in the planning, building and maintenance of the systems. This requires them to spend time talking with the customers to find the right solution.
4. Financing capabilities. These refer to the ability to provide funds for the customers' activity. Because these capabilities are typically very distant from the core business of the integrated systems provider, not all firms develop them. For this reason, the ability to assist customers with the arrangement of financing constitutes a competitive advantage for the firm.
5. Post-sales capabilities. Post-sales capabilities include activities related to hardware maintenance, software assistance, software problem solving, and user training. They are fundamental because of the very nature of the products sold: it is nearly impossible at the present time to sell software without post-sales assistance, especially in B2B environments. This is also one of the reasons that the IT sector pioneered the business of solutions.
6. Production capabilities: Production capabilities are of two types: the ability to develop software (in other words the design, development and testing of software), and the ability to manufacture hardware and infrastructure, which includes the manufacturing and assembly of hardware products as well as other physical tasks associated with the installation of cables and networks. These two sets of capabilities are distinguishing characteristics of integrated system providers because they differentiate these providers from pure IT consultants.
7. Delivery capabilities: they comprise the ability to deliver hardware and software (including software customization). Software customization is a critical capability that needs

to be managed by every solution provider. It is particularly critical for firms offering complex packages, such as ERP, which need to be customized to fit the characteristics of the client.

## **Different Typologies of Integrated Systems Providers**

Literature identified four typologies of integrated systems providers, which correspond to different strategic approaches to the business (Ceci & Masini, 2011).

### **Off-the-Shelf Solution Providers**

These firms possess primarily delivery, post-sales, and consulting capabilities, whilst they do limited software development or hardware manufacturing. They either sell their own standardized packages or work in partnership with larger software firms for which they commercialize and install standard products after adding the minimum level of customization required. The presence of consulting capabilities is an indication that off-the-shelf solution providers have already worked with their customers before installing the product. They assess the business needs of their customers and help them select the most appropriate IT solution available on the market. They also deliver and install the solution, which is composed of standardized products often sourced from external suppliers. As their business does not require any industry-specific competence, they serve a large number of clients in different industries. The low customization of the solutions and the strong emphasis on consulting capabilities make this business model largely adopted by former consultancy companies.

### **Resellers**

Firms in this group are small and relatively young companies characterized by specialized capabilities, mostly in finance and systems integration.

They serve customers from different industries yet they focus on few typologies of products. Similar to off-the-shelf solution providers, resellers help their customers buy hardware and software from third parties, and do not produce in house. Yet, in contrast, they do not deliver or install the solution; they simply provide assistance to improve the compatibility among legacy systems that are not fully interoperable. Accordingly, they provide solutions tailored to customer needs (they have the second highest degree of customizability in their capabilities). Thus, they offer to their customers IT competencies that the latter are not able or not willing to develop.

### **Industry Specialists**

These firms focus primarily on software development and, to a lesser extent, on delivery and post-sales activities. They are relatively small and newly established companies that operate with clients in a specific industry (for example, health care, transportation, publishing, or public administration). Although the solutions they deliver are not tailored to specific customer needs, they are highly industry-specific. This enables industry specialists to develop specific knowledge of the internal processes of their customers. In turn, this specific knowledge allows them to prepare ad hoc solutions for the idiosyncratic needs of the industry. Finally, as industry specialists are the only ones possessing the specific product knowledge necessary to offer adequate post-sales services for the products they developed, they may use this knowledge to lock their customers into a long-term business relationship.

### **Technologists**

Technologists are former hardware manufacturers and software vendors that have moved into the integrated system business. They are large and well-established firms offering a wide range of customized products and services. They possess capabilities in software development and

hardware manufacturing and pay little attention to delivery and post-sales activities. Similar to industry specialists, technologists focus on a restricted number of industries. Yet, in contrast to industry specialists, they occupy the upstream section of the industry value chain and delegate to other firms (for example, resellers) the task of implementing the solution. Whilst industry specialists sell standardized products and use their process knowledge to lock customers into their delivery and post-sales processes, technologists try to achieve the same objective by leveraging their technological skills to develop highly customized hardware and software products that cannot be easily substituted by other providers' solutions.

## **FUTURE TRENDS**

An important direction for further research is represented by the long debated standardization vs. customization dilemma. In this work we have suggested that these two characteristics are two facets of the same coin, i.e. they represent two extremes of a single dimension along which firms optimize their offer. The assumption underlying this perspective is that firms can deliberately decide the optimal degree of customization they want to apply to their offers. Clearly, resource scarcity, organizational characteristics and other exogenous contingencies may constrain this decision and force firms to make sub-optimal choices. Future research may shed further light on this issue, looking at the specific firms characteristics that may facilitate or hamper one characteristic in favour of the other.

Another interesting research avenue is represented by the possibility to facilitate knowledge integration through modularity. But whereas modularity is effective and widely used in the IT sector, it might not be so in other industries.

## **CONCLUSION**

This chapter has focused on main characteristics of integrated systems. Special attention has been devoted to the discussion of the way that firms must match different configurations of capabilities with their external environment to achieve superior performance. To embrace this new business model, firms must change their position in the value stream so as to manage bundles of products and services and develop appropriate capabilities.

There are a number of possible implications for practitioners and policy makers, which will be discussed shortly. In fact, the offering of integrated systems is strongly influenced by the pool of capabilities a firm already possesses. A strong path dependency is found among the firms: a final offer is influenced by the characteristics of the firm's value-chain movement, that is, either up- or downstream.

Second, the identification of strategies that serve as alternatives to integrated systems and the analysis of performance differences also yield useful insights. Managers and practitioners can use these results to verify whether the strategies implemented are consistent with the capabilities of their organizations. They can also use them to decide whether a shift in strategy is needed and, if so, how to manage this change consistently, given their internal resources.

Moreover, a correct alignment of resources, environment and performance is crucial. No one 'best fit' plan exists; rather, managers are called upon to clearly establish their objectives while developing their strategies. There is a trade-off between different performance indicators, specifically customer satisfaction and labour productivity. In the solutions business, customer satisfaction can be achieved by focusing on standardized systems, which allow for greater control of time and costs, but labour and project productivity require different strategic decisions, such as a focus on small markets and/or the development of high valued-added and customized solutions. Firms that operate in niche markets tend to privilege specialization

and software customization. However, the risk of this strategy is that overly customized solutions may be too complex to use and may create compatibility problems with existing platforms, thereby dissatisfying clients. Specialized solutions developed for a small number of clients may be difficult to manage, rendering after-sales activities costly and ineffective and causing delays in the development and delivery phases of the solution. Empirical evidence shows that firms trapped in these situations find it difficult to keep time and costs within budget, and this has a negative effect on customer satisfaction. On the other hand, firms working in heterogeneous markets offer comprehensive, highly standardized solutions, adopting the following strategy: they offer products and services that involve a defined core architecture that can be slightly customized to meet customer requests, with specific customization modules and options ready for implementation. This reduces implementation time and cost, allowing firms to stay within budgetary and schedule constraints, and increases customer satisfaction. The knowledge of such mechanisms can facilitate management and help firms align their capabilities and environment consistently with their objectives.

To conclude, three major objectives guide firms' strategy in the solutions context: to retain comparative advantage(s); to maintain flexibility; and to fulfil customers' needs. The role of the context is crucial in the decision among these objectives, because the need for flexibility and the need to meet customer demand are context-driven. Firms should begin with an analysis of their internal assets, then match these with the requirements of their context – requirements that may be difficult to satisfy, since demand is often uncertain and change is inherently unpredictable. Moreover, the heterogeneous nature of capabilities configurations and the dispersion of activities throughout the value chain pose challenges for coordination.

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## KEY TERMS AND DEFINITIONS

**Customization:** Adaptation of the offer to a customer’s individual requirements.

**ERP:** (Enterprise Resource Planning): Systems comprising hardware, software, technical support and assistance used to control and manage the firms informative system.

**Financing Capabilities:** Ability to provide funds for the customers’ activity.

**Integrated Systems:** Offering constituted by a customized bundle of products and services.

**Operational Services:** Additional post sales services such as customer support services, training activities and maintenance services.

**Organizational Capabilities:** Outcome of a resource integration process that is enabled and supported by knowledge.

**Post-Sales Activities:** Activities related to hardware maintenance, assistance, problem solving, and user training.

**Systems Integration:** Firms ability to develop and integrate internal and external inputs, components, skills, and knowledge from its own resources and from other organizations.

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