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The Role of Service-Oriented Architecture as a Part of the Business Model

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Abstract
Digitalization is affecting business models of many enterprises and changing the way information work is done. Service-oriented architecture (SOA) is one way of implementing this change, but despite its capability to model services on a business level, the enterprises are not able to link the value of the services with the related investments. This paper proposes the use of ontology as a tool to make service-oriented architecture an integrated part of the business model. This linkage enables the SOA investments to be evaluated as a part of the value delivery process of the enterprises.

Keywords: business model, IT value, SOA, service-oriented architecture, ontology, case study, service identification, business model generation, business alignment, ValIT, cost volume profit analysis

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Ville Alkkiomäki

Introduction

Digitalization is predicted to change the future of employment, with forty-seven per-cent of the total US employment estimated to currently be at risk to some extent. The changes digitization will apply to educated office workers, as computers reduce the cost of information processing tasks (Frey and Osborne, 2013).

The IT Governance Institute has defined a Val IT framework (2008), which provides industry best practices on how to create business value with IT investments. The main principle of the Val IT is that IT-enabled investments must include the full scope of the activities that are required to achieve business value (IT Governance Institute, 2008). In other words, Val IT defines IT to be a part of the business and therefore requires that its value be modelled as a part of the business; there should not be any means to separate the value of IT from the business itself.

In modern enterprise, a business and IT are inseparable. However, despite extensive research in the IT value domain, both industry and academia are lacking conceptual linkage between IT investments and their business value. This paper proposes an ontological approach to merge these two conceptually.

The scope of the proposed ontology is an enterprise with one business model using service-oriented architecture (SOA). The proposed ontology is applied in a case study to evaluate its applicability in enterprises.

The paper's research question is:

- What kind of services do enterprises need and how can they be described to link them with the existing concepts of the business models describing value creation and delivery in the enterprise context?

The paper is structured as follows: the next chapter provides a literature review of the existing IT value research, followed by a chapter describing the research process of this paper. The next chapter proposes a merged ontology of the service-oriented business model, based on the existing research on business models and service-oriented architecture. The proposed ontology is then demonstrated and tested in the following chapters. Finally, the findings are evaluated and summarized.

Value of IT and Service-Oriented Architecture

The value of IT has been studied quite extensively from different viewpoints, but so far no ‘silver bullet’ has been found (Schryen, 2013). A literature review of 194 articles conducted by Marthandan and Tang (2012) categorized the papers based on their scope: 82% studied the topic on an organization level, 8% on an individual level, 5.2% on an industry level, and 4.6% on a national level. Out of these 194 papers, only one reports negative findings, while 104 report positive findings, suggesting that IT must bring some value.

Marthandan and Tang (2010) have identified five reasons for the difficulties of identifying the value of IT: ambiguous identity of IT business value; blurred reflection of IT business value; misunderstood value realization process; poor business-IT alignment: and complications from mediating factors. Another literature review (Schryen, 2010) combining the knowledge of 22 literature reviews of IT value, raises another fundamental issue, which is that the research still lacks common terminology and a conceptual definition for ‘IT’.

To understand how IT delivers value, it is necessary to conceptualize the IT. Melville et al. (2004) list five different approaches used in IT value research to conceptualize IT: (1) tool view, (2) proxy view, (3) ensemble view, (4) computational view and (5) nominal view. Melville et al. (2004) argue that systematic construct for IT is needed and propose a model based on the resource-based view of the firm (RBV), linking the IT as a resource into the value generating process of the focal firm through business processes. Osterwalder (2004) proposes that the IT applications need to be aligned with the company’s business model. Moreover, Jeansson (2014) argues that IT does not create value on its own and so proposes a valuescape to be used as a notion to describe the identified value of IT, but provides no conceptual linkage between the IT and its value.

Nevo and Wade (2010) apply systems theory to extend the RBV model conceptually, theorizing that both the human and the IT resources can be seen as composite systems, which may consist of either sub-systems considered as systems in their own right, or sub-systems that are elementary components. Additionally, systems may have properties derived from the interactions between the systems or the human resources, forming IT-enabled resources (Nevo and Wade, 2010). In order to function, these IT-enabled resources must be both compatible and integrated with each other (Nevo and Wade, 2010).

The basis of systems theory is analogous with the concept of service-oriented architecture (SOA), which is a widely adopted software architecture design pattern, based on the philosophy of designing new services, composed of reused existing services, to be used as a part of business processes to execute business activities (Papazoglou and Van Den Heuvel, 2007).

However, according to the earlier literature, using service-oriented architecture in this way does not deliver reusable services or business agility as promised. Instead, successful SOA implementation requires several enablers to succeed. These SOA enablers include: better facilitation of IT/business communication (Baskerville et al., 2010; Joachim et al., 2013; Van den Bergh and Viaene, 2012), top management support (Boh and Yellin, 2010), use of standards (Joachim et al., 2013), governance for SOA development (Joachim et al., 2013) and SOA competence (Joachim et al., 2013). The main common obstacles for successful SOA implementations include a lack of business involvement in SOA development (Baskerville et al., 2010; Kokko et al., 2009) as well as change resistance of the personnel (Kokko et al., 2009).

Kohli and Grover (2008) raises the role of information as one of the key elements in the IT value delivery process. Service-oriented architecture can be used to conceptualize the information as well with the Information as a Service (IaaS) approach (Dan et al., 2007), which decouples the data and the business logic.

The current research tends to agree on the need for conceptual linkage between business value and IT, and suggestions have already been made about how this could be achieved (Osterwalder and Pigneur, 2013; Yoo, 2013), but concrete proposals of such conceptual linkages are still lacking.

Service-Oriented Architecture (SOA) is used in this paper to represent IT, allowing it to be linked with the existing concept of the business model representing the business.

Research Process

Problem and Motivation

Company Investments in SOA are not currently delivering the business agility as promised, and one major obstacle is the lack of linkage between the SOA investments and their business value. At the same time academia lacks a conceptual linkage between IT and its business value.

The goal of this paper is to find the conceptual linkage between the SOA investments and the business value they provide. To validate the conceptual linkage, there needs to be a way to utilize the linkage in enterprises by providing practical tools to evaluate the financial feasibility of the SOA investments.

Design science fits into this twofold nature of the paper. Design science is an iterative research paradigm creating and evaluating IT artifacts intended to solve identified organizational problems, but also to add knowledge in the form of new theories (Hevner et al., 2004).

The research follows the design science research methodology (DSRM) proposed by Peffers et al. (2007) as visualized in the figure 1.

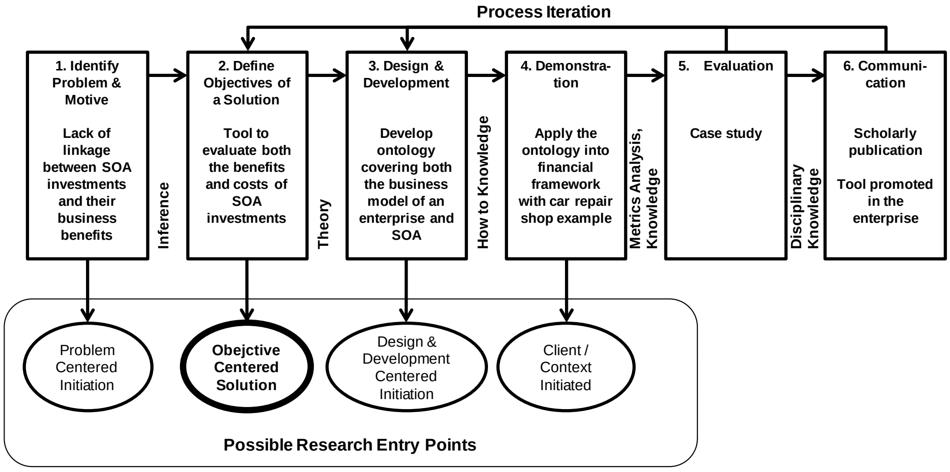

Figure 1 Nominal process of DSRM (Peffers et al., 2007)

Objective

To support decision making regarding SOA investments in enterprises, the resulting tool needs to be understandable both for the businesses' management, but also for the IT stakeholders to enable calculation and linkage of the value delivered by the SOA investments to the costs of the investment.

Design and Development

In order to provide such a tool, it is first necessary to understand the basic concepts of the business value and IT, as well as their relations, and thereby to create a linkage. This paper uses ontology to define the conceptual relationships between these two domains.

Ontology can be used to define the formal specifications of concepts, and it is used for information sharing and for reusing the knowledge about specific domains (Gómez-Pérez and Manzano-Macho, 2004). A simple methodology for developing ontology involves these steps: identification of the purpose, building and evaluating the ontology and documentation (Uschold and King, 1995).

In the following chapters, the existing ontology of business models representing the business is enhanced with a new ontology of services in enterprises. Linking the key concepts of business value and SOA, however, requires a rigid conceptual model of both.

Demonstration and Evaluation

To evaluate the validity of the conceptual linkage, the new ontology is applied by merging a service identification method with a financial management framework to provide an end-to-end tool for enterprises, enabling them to calculate both the costs and the benefits of different kinds of services.

The tool is demonstrated using a car repair shop as an example, which is tested in a case enterprise to evaluate the validity of the proposed conceptual linkage.

Ontology of Service-Oriented Business Model

Traditionally, IT has been seen as a tool that supports human workers. However, in this paper, SOA is used to conceptualize how the IT applications operate with the human information worker to execute business activities. SOA can also have the role of a tool automating the human worker's access to shared business data, which can be seen as an instrumental resource for their work.

Shared business data is a new kind of resource for enterprises that provides a fundamental difference compared to the tangible physical resources on which we once built our services. The data can be reused or cloned at almost no cost.

Ontology of Business Models

The creation of value is fundamental to any company's success and value analysis, value creation and value delivery have been the three major themes in business and industrial marketing research on this topic (Lindgreen and Wynstra, 2005). More recent research has considered the value of the business relationships and co-creation of the value, but still the resources remain just as instrumental for the value creation process, and planning how to accumulate, combine and exploit the resources and related activities to optimize the value (Lindgreen et al., 2012).

How value is created and delivered in an enterprise can be conceptualized with the business models. Teece (2010, p. 191) summarizes the concept of a business model as a means by which to "describe the design or architecture of the value creation, delivery and capture mechanisms employed".

There are different approaches for business modelling and the resulting models can have many meanings and usages. For example, they can be seen as recipes or role models that might be copied, a nutshell description of a business organization or as scientific models (Baden-Fuller and Haefliger, 2013). The same business model can also have many of these roles, which explains why the idea of a business model is so challenging to grasp and why scholars rarely agree on common concepts (Baden-Fuller and Haefliger, 2013; Zott et al., 2011).

In short, the business models can be used to describe how the firm is organized to distribute value, but there are still different views as to what 'value' really is (Baden-Fuller and Haefliger, 2013).

Business models have gained a lot of interest through special issues of management research journals recently, but the concept of a business model itself lacks an established theoretical grounding in economics or in business studies (Teece, 2010).

There are many conceptual business models available. One of the best-selling management and leadership books is *Business Model Generation* (Osterwalder and Pigneur, 2012). The book applies the business model ontology, which is built on previous research and provides a rigid conceptual model linking the customers to the business activities and to the resources through value propositions (see figure 2) (Osterwalder, 2004).

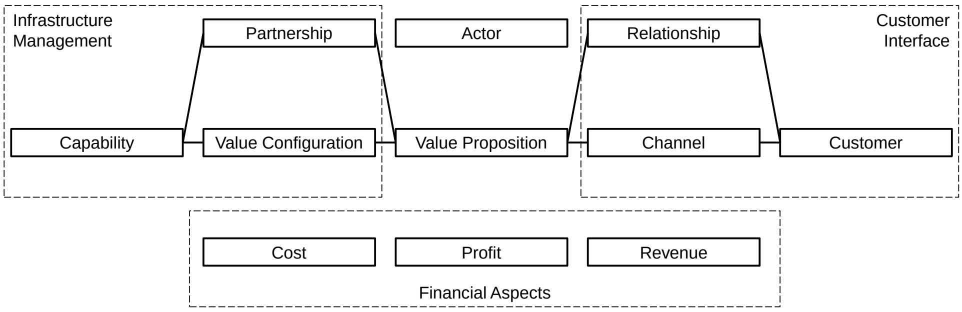

Figure 2 The Business Model Ontology based on Osterwalder (Osterwalder, 2004)

Osterwalder uses the concepts of value proposition and offering to represent the products of the company, or to be more precise, all that the company offers to its customers. The value proposition represents the value for one or more target customers, created using one or more capabilities of the company. Value proposition is further divided into set of offerings, which are elementary products or services offered to the customer, and outlines the assumed value to the customer. (Osterwalder, 2004)

The term 'capability' is used to represent a company's ability to execute a repeatable pattern of actions to provide the value proposition(s). The execution of activity requires one or more resources, which can be tangible, intangible or human resources. The resources can be also provided by outside actors, which are companies with whom the firm has partnership. (Osterwalder, 2004)

This paper links the resource and activity concepts used in Osterwalder's business model ontology with the concepts of SOA, allowing the IT to be conceptualized following the systems theory as proposed by Nevo and Wade (2010).

Ontology of Services in Enterprises

The basic ideology behind SOA is to package software resources as reusable and autonomous services representing business-complete work, that can be used in business processes as flexible building blocks for business development (Papazoglou and Van Den Heuvel, 2007). In other words, SOA provides a means of placing information technology into packages that are meaningful from a business point of view.

The main method for classifying the services in SOA has been through granularity of the services (Huergo et al., 2014). Granularity of service means the functional richness provided by the service (Rosen et al., 2008). The coarser the service is, the larger the functionality offered by the service. In other words, coarse-grained services provide more functionality within a single service operation than fine-grained services (Rosen et al., 2008).

Several frameworks and layer-models have been proposed for categorizing services, based on their granularity (Erl, 2005; Steen et al., 2005). In addition SOA Reference Architecture (SOA RA) (The Open Group, 2011) provides a standard for classifying the services into consumer, business process, services and implementation layers.

Categorization based on the granularity of the services does not take into consideration what the service does or provides for the enterprise, but rather classifies the services based on their intended consumers. In addition to service granularity, services can also be categorized based on their intended usage in the enterprises. A literature survey (Cai et al., 2010), which focused on service identification and classification methods, identified two methods that proposed business oriented service classifications. Both methods contain formal metamodels for services (Dwivedi and Kulkarni, 2008; Alahmari et al., 2010).

Dwivedi and Kulkarni (2008) proposed that the services should be classified as process, business, composite, informational, data, utility, infrastructure, and partner services. Alahmari et al. (2010) classified the services as process, composite, business, transactional-data, master-data, utility, and infrastructure services.

From a business model point of view, the granularity of the service is not a meaningful aspect. What matters in a business model is what the service does, not from how many layers it is built on. If we separate these two aspects as separate dimensions, we get a new classification of the services that better represent a business point of view.

Based on the meta-model proposed by Dwivedi and Kulkarni (2008), one service can have several classifications that are not related to the granularity of the services. Such classifications are: process, informational, data, and infrastructure services. Similar business-oriented service classifications proposed by Alahmari et al. (2010) are defined as process, transactional data, master data, and infrastructure services.

Both sets of classifications separate data services from process services and also differentiate aggregated and atomic data services into separate classes. Alahmari et al. (2010) further separates transactional and master data services due to their different nature in business intelligence. Master data is typically created once and reused in many business transactions, and is thus more likely to be reused more often than transactional data, which is shared only during the one specific transaction (Knolmayer and Röthlin, 2006). From a business model point of view, this distinction is less meaningful because a combination of both transactional and master data are needed in business activities, but it may, nonetheless, justify additional data governance to optimize the reuse of the shared business data (Baghi et al., 2014).

In general, data driven SOA is an approach used to decouple the data and the business logic, allowing systems to share the same data and data access logic (Dan et al., 2007). A data driven approach is also the core of Representational State Transfer (REST) architecture style, which is widely used to develop web applications (Fielding, 2000). REST encapsulates the business data as resources, which can be accessed and manipulated through a generic interface (Fielding, 2000).

Both studies (Dwivedi and Kulkarni, 2008; Alahmari et al., 2010) identified process services as one of the classifications. Process driven SOA is another SOA style in which the services encapsulate business logic functionality to be used by other services or the logic for interacting with a user (Papazoglou and Dubray, 2004).

Combining the meaningful classifications from a business model point of view provides the basis for business oriented classification of the services, appended with the infrastructure services supporting them. The classification is provided in table 1 and visualized in the figure 3.

Table 1 Service classification based on their intended usage in enterprises

Service category	**Definition and intended usage in the enterprises**
Elementary Data Service	Stores and provides access to the shared business data. Must be reused by all other services, which share the business data with each other. Intended usage is to enable shared access to the business data and enable reuse of the data and thus reducing the work needed to gather the data.
Data Access Service	Provides access to the shared business data through elementary data services. May enrich, merge or filter the business data to create a view the business data suitable for the specific business activity. Intended usage is to extend the access to the shared business data beyond the users of the elementary services. Often used to provide a digital channel towards the customers and/or partners.
Process Service	Automates business activity fully or partially. Intended usage is to relief the human resources from repetitive activities, which can be automated.
Infrastructure Service	Other services enabling the development and operations of the other services without direct linkage to the business activities.

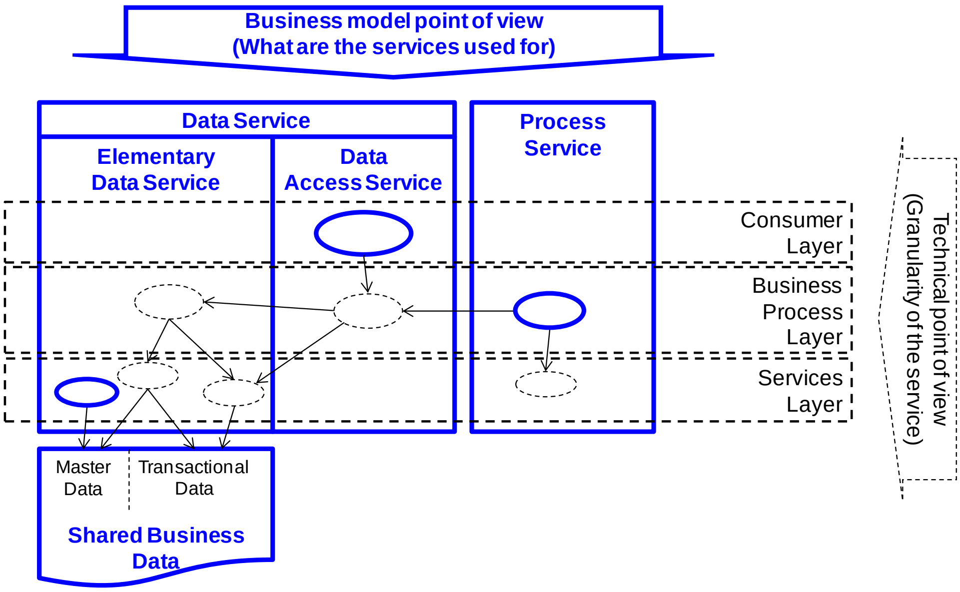

Figure 3 Ontology of services in enterprises

Shared business data can be accessed through data access services in a distributed application environment (within company or between companies) or through elementary data service within one application or manually by human resource. See figure 4 for a visualization of the different types of services and methods to access shared data.

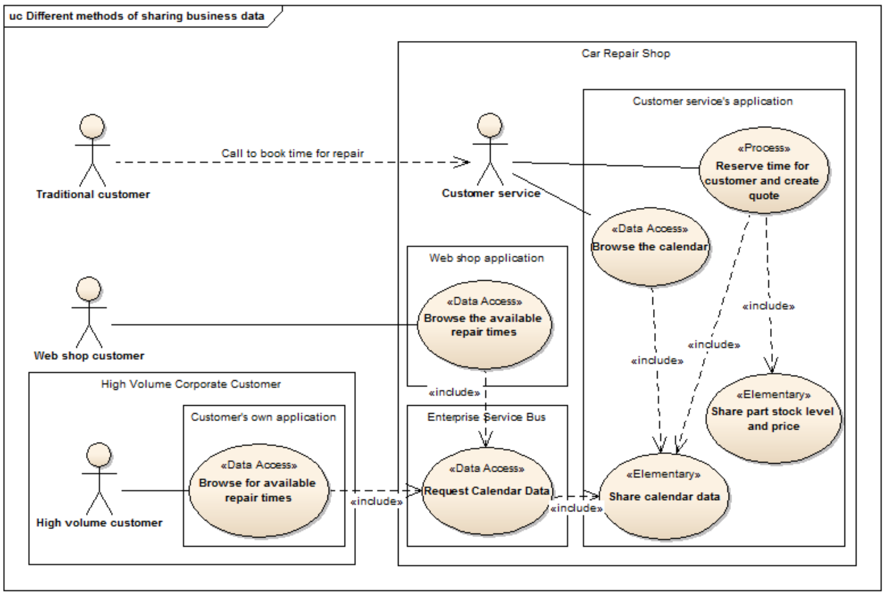

Figure 4 Different methods of sharing business data

The example in figure 4 shows the integration use cases (Alkkiomäki & Smolander, 2007) representing the services in a distributed application environment. The example shows how the calendar data can be accessed in different ways by different stakeholders. Technically the easiest way to access the data is through the data access services implementing the user interface inside the same application as the services storing the data. Alternatively, data access service can be implemented between the applications, allowing the data to be accessed through the user interface of another application, like the web shop application in the example. This secondary application can also be maintained by another company as the high volume customer in the example.

An enterprise service bus (ESB) is usually needed as part of IT infrastructure to provide technical interoperability and loose coupling between the applications (Papazoglou and Van Den Heuvel, 2007). Figure 4 shows the difference between elementary and distributed data services: shared calendar data is an elementary data service storing the data itself, while the data access service on ESB is accessing the data indirectly.

Service-Oriented Business Model Ontology

Services that have been categorized from the business model point of view can be linked with the Osterwalder's business model ontology (2004) as follows:

- Shared business data is one type of an intangible resource.
- Elementary and data access services are support activities, which can automate the access to and sharing of shared business data.
- Data access service may be also one type of channel if used by the Customer.
- Process service is a primary resource, which can automate information work activities.

The proposed extensions to the Osterwalder's business model ontology (2004) are shown in figure 5, where the proposed extensions to the model are highlighted in red.

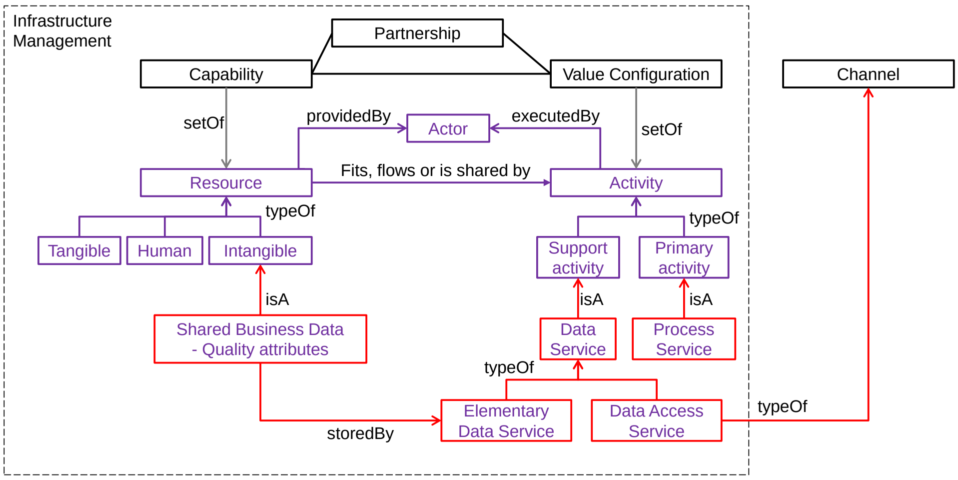

Figure 5 Extensions to Business Model Ontology

Additionally, business data quality can be considered to be an attribute of the shared business data. Data quality has many dimensions. For example, Pipino et al. (2002) have identified sixteen generic data quality dimensions ranging from completeness to understandability. The quality of the shared business data needs to be on an adequate level to be used as is by the process service. If the data quality is not sufficient, then the data needs to be fixed or inputted again manually. However, the data quality dimensions that are important in each activity differ and criteria for sufficient data quality are not in scope of this paper.

The Service Value Framework

The proposed merged ontology needs to be applied to be usable in enterprises. One way of applying the ontology in use is to use it as a basis for a cost-volume-profit (CVP) calculation to provide the break-even point for SOA investment.

CVP analysis is a planning technique evolved from the theoretical model of the firm. CVP can be used to calculate the units needed to reach the break-even point (BEP), where total revenues equal total costs, taking into account both the fixed costs and variable costs. Conventional linear cost volume profit analysis is based on the assumption that both fixed and variable costs, as well as the revenues per unit, remain constant. With these assumptions, the BEP can be calculated with the formula: BEP=(Total Fixed costs)/(Sales price – Variable costs per unit). (Martin, 2014)

To calculate the BEP for a SOA investment, the formula can be applied by using a year as a unit of measurement, increased productivity in activities in place of sales price and the operational costs related to both data and IT maintenance as variable costs. The CVP formula is used as a basis for the Service Value Framework presented in table 2 below.

Table 2 Service Value Framework

Business Activities and Resources	**Capital Investments**	**Volume**	**Operational Cost/Benefit**
<Changes to the value proposition >			<Financial benefit of each change to the value proposition>
<Automated business activities>	<Process re-design + SOA investment>	<number of activities per year>	<Financial benefit per activity>
<Activities and channels accessing shared data resources>	<Process re-design + SOA investment>	<number of activities per year>	<Financial benefit per activity>
<Shared data resources>	<Investment to gather the data initially>	<Number of updates needed to keep the data quality adequate>	<Cost of one data update>
Service development costs			
New process services	<cost of developing the services>		
New data access services	<cost of developing the services>		
New elementary services	<cost of developing the services>		
Service runtime costs			
Operational costs of new services		<number of new services>	<Yearly operational cost>
Totals	<Total capital investment>		<Total cost/benefit per year>
Break-even point	<Total capital investment / (Total benefit - Total cost per year)>		

Example Car Repair Shop

To illustrate the usage of the Service Value Framework, an example BEP calculation is provided for a car repair shop that is planning to invest in SOA to change their business model.

The car repair shop, used as an example, provides maintenance services, using manual processes before the change. The company was evaluating the feasibility of automating the repair time reservation and quoting process, to save the resources of its customer center.

Table 3 represents the business model canvas of the example car repair shop following the method described by Osterwalder and Pigneur (2013). Changes provided by the evaluated investment are bolded.

Table 3 Example business model canvas of the car repair shop

<table>
<tr>
<td rowspan="2">Key Partners
- Spare part suppliers
- New: SOA Partner</td>
<td>Key activities
- Maintenance of cars
- Spare part logistics
- Time reservations and quoting</td>
<td rowspan="2" colspan="2">Value proposition
- Low price and high quality car repairs

- New: Time confirmation during the first call</td>
<td>Customer relationships
- Retention of the regular customers with high quality</td>
<td rowspan="2">Customer segments
- Car owners</td>
</tr>
<tr>
<td>Key resources
- Repair men
- Customer service
- Warehouse staff

- New: Calendar and stock level data</td>
<td>Channels
- Telephone</td>
</tr>
<tr>
<td colspan="3">Cost structure
- Customer service work (reduced)
- Repair work
- Spare parts
- New: SOA runtime costs</td>
<td colspan="3">Revenue streams
- Time and material</td>
</tr>
</table>

Figure 6 represents the service architecture needed to implement the change using the integration use case method for visualization (Alkkiomäki and Smolander, 2007).

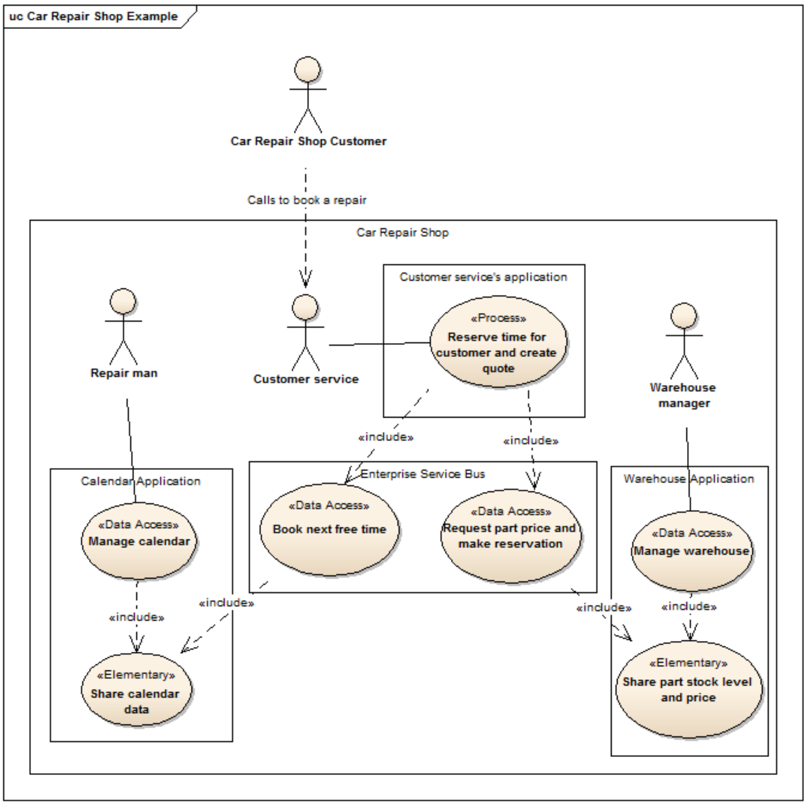

Figure 6 Service architecture matching the planned change to the business model

For the purpose of simplification, it can be assumed that the example car repair shop has a SOA partner providing cloud-based SOA infrastructure priced per service running on top of it, as well as a SOA development service priced with a fixed fee per service.

The next step is to merge the benefits of the business model and the cost of implementing the service architecture using the Service Value Framework as shown in table 4 below.

Table 4 Cost-volume-profit calculation of the example car repair shop

Business Value, Activities and Resources	Capital Investments	Volume	Operational Cost/Benefit
- Time confirmation during first call			Increased customer satisfaction
- Time saved by automating the quoting and reservation	Process redesign and training -10 000€	1 000 quotes / year	1000 x 40 min x 100€/h = +66 667€ / year
- Access to repair man's calendar - Access to warehouse stock level and price		1 000 accesses / year	(benefits of automated access included in the above)
- Maintenance of calendar data - Maintenance of part stock level and price	Initial warehouse inventory 50h x 100€/h = -5 000€	Avarage of 3 data updates per quote, 2min each.	1000 x 6 min x -100€/h = -10 000€ / year
Service development costs			
One new process service Four new data access services Two new elementary services	7 new services à 5 000€ = - 35 000€		
Service runtime costs			
Operational costs of new services		7 new services, à -1 000€ / year	-7 000€ /year
Totals	-50 000€		+ 49 667€/year
Break-even point	1,0 years		

The calculation in table 4 shows that the direct benefits saved in working time pay back the investment in roughly one year. In addition to this, the customers get confirmation for the repairing time during the first call, changing the value proposition itself and potentially increasing the customer satisfaction and enabling more net sales in the future.

The case study

The objective of this case study is to evaluate if the proposed ontology can be used in enterprises to link the changes in business model with related SOA investments to support decision-making.

The requirements for the proposed ontology to be evaluated by the case study are:

- The business stakeholders need to be able to understand the linkage between the business benefits and related IT investments.
- The IT stakeholders need to be able to estimate the needed IT investments and understand the linkage to the business benefits.

Exploratory case studies can be used to investigate situations in which the intervention being evaluated has no clear outcome (Baxter & Jack, 2008). There is no single agreed set of methods for a case study; instead the methods must be selected from the viewpoint of the case and the research question (Luck et al., 2006).

To evaluate the proposed framework, the presented approach was used in an enterprise to define a business case for one business/IT development investment proposal using the business model canvas and the integration use case methodology in the same way as shown in the car repair shop example.

The business case material was drafted based on the preliminary information provided by the business stakeholders as an input and then reviewed with both IT and business representatives.

The review session was audio recorded to gather and categorize the feedback from the stakeholders. Feedback is summarized in table 5 below.

Table 5 Feedback from different stakeholders

Stakeholder	Feedback received
Business stakeholder, i.e. person(s) understanding the business model and its value proposition.	**Business Model Canvas:** missing products in scope, contractual constraints and requirements from the manufacturing partner, end user usability, product market situation and potential synergies of reusing the same operating model with other kind of products. **Service Architecture:** differing actors and functional requirements when partner is involved, end user support model, terminology of the use cases, potential reuse of the IT solution, data maintenance needs, feasibility of data integrations between applications and product features. **CVP:** process automation activities and their structure, training needs and promotion efforts needed to deploy the new partially automated process, activity terminology, data maintenance effort, application integration feasibility, new customer value and project governance issues.
IT stakeholder, i.e. person(s) understanding what is required to implement the services.	**Business Model Canvas:** end user usability. **Service Architecture:** user support model, potential reuse of the IT solution, data maintenance needs, alignment between the IT solution and the business process. **CVP:** end user usability, process automation activities and their structure, project governance issues and availability of statistical data of current work effort of each activity planned to be automated.

The business model canvas was not familiar to the business stakeholder, but it was possible to get feedback on it by briefing the approach of the canvas first. The canvas acted mainly as a tool to document the business model, with only a little interaction between business and IT stakeholders.

Draft service architecture provided a good basis for discussing the IT solution and how well it is aligned with the business processes, data maintenance needs and differentiated requirements of different end user groups. Also the feasibility of the automated integrations between applications was discussed and agreed to be unnecessary in the ramp-up phase due to the low transaction volumes.

The CVP calculation was pre-filled with the known benefits. In this case, the main driver for the investment was the process rationalization and it was possible to estimate both the volumes and benefits per activity. The role of initial data gathering of the shared business data was limited as the majority of the required data existed already and required only a little maintenance effort. The need to train and promote the new way of working was understood, but it was not possible to estimate the cost or effort needed.

As a general comment from the business stakeholder, it was suggested that the high-level process activity map could be used as material to brainstorm which of the activities could be streamlined with a new way of working. The level of detail was sufficient for the IT stakeholder to get a preliminary cost estimate from the IT supplier as a basis for the project budget. Additionally, it was commonly agreed that this kind of material required an iterative approach to get all the necessary information gathered for the business case.

Overall, the material enabled two-way communication between the business and IT stakeholders and served its purpose as a tool to gather the relevant costs and benefits for the business case.

Discussion

This paper provides one response to the challenge raised to information science to provide conceptual and design-oriented research for understanding the essence of business models and their design (Osterwalder and Pigneur, 2013; Yoo, 2013).

The proposed extension to the Osterwalder business model ontology applies the idea of conceptualizing the IT with systems theory as proposed by Nevo and Wade (2010). The model can be used to form IT-enabled resources consisting of both human resources and IT applications designed using the service-oriented architecture.

The extensions are aligned with Osterwalder's (2004) recommendation to align the IT applications with the company's business model and treat the IT infrastructure as a cost element. Likewise, it is aligned with the Val IT to include the full scope of development activities, covering both the IT and non-IT activities to achieve business value for the investments (IT Governance Institute, 2008).

Although a final consensus on defining the concept of the business model has not yet been reached (Klang et al., 2014), a wide understanding of the basic concepts related both to the business and IT are required to understand how IT delivers value within an enterprise. Ontology has been proposed to be used as a link between SOA and its business value but with limited success (vom Brocke et al, 2009; Thomas and vom Brocke, 2009). Instead of the technical granularity viewpoint, this paper uses the business viewpoint as a basis for the ontology.

The presented framework is fundamentally based on the resource-based view of the firm and is thus limited to the value delivery process. The example shows how to calculate the tangible benefits of value delivery process, but does not take into account the changes in the value proposition and value creation process of the business model. These benefits can be counted with the framework, but it does not define how to calculate them.

The integration use case method and service value framework can be used to facilitate the IT/business communication, at all levels, including top management. Improving the IT/business communication has been found to be one of the key enablers for successful SOA adoption, and any practical tools for improving this communication are badly needed (Baskerville et al., 2010; Joachim et al., 2013; Van den Bergh and Viaene, 2012; Boh and Yellin, 2010).

In general, use cases are lacking a direct linkage with the business processes, and may be difficult to interpret without supporting narratives (Al-Fedaghi, 2014). In addition to the use cases, business processes could be utilized with a service-oriented approach to support the service identification, as suggested by the business stakeholder of the case study as well as by Baghadi (2014).

One advantage of SOA is the capability to model how the required business functionality is divided between the applications using composite services, as demonstrated in the Figure 6. Another advantage of SOA is the possibility to encapsulate the service implementation behind a service interface enabling mixed use of different architectural styles. Like most top-down approaches (Huergo et al., 2014), the selected service identification method focuses on the identification of the services, leaving any implementation concerns to be evaluated separately with other complementary methods. A simplified method was chosen as the purpose of the paper is to link the services on a conceptual level and concretize it, not to make the detailed service design.

The use of CVP to calculate the BEP for SOA development was proposed earlier by Kryvinska et al. (2011), but their model focused only on the long term benefits of development time and the reuse of services, compared to traditional IT development without reuse. Likhvarev and Babkin (2012) proposed a more sophisticated method to evaluate implementation options taking into account interest rate and risks separately on the service level, but without guidance as to how to identify the benefits of using the services. However, these kinds of methods can be used to complement the simplistic CVP calculations used in this paper.

In general, reusability has been the holy grail of the software industry for decades and the original idea of reuse was to use the same software source code through class libraries, which can be applied to SOA as well (Krafzig et al., 2005). This type of code reuse of services has a direct impact on the design, development, testing, and maintenance efforts of the services (Erl, 2005).

From a business model point of view, code reuse reduces the SOA development and maintenance costs in the long term, but from a single investment point of view, this long-term improvement is minor. Easy communication may be one reason why enterprises and especially IT departments are promoting the cost cutting potential of SOA instead of the positive contributions to business agility (Schelp and Aier, 2009).

Shared access to data provides enterprises with a new intangible resource, which can be cloned almost infinitely. Infinite resources will be needed if the enterprises continue to search for sustainable growth despite the environmental limitations they are currently facing with tangible resources (Kotler, 2011).

The case study covers only one investment case and more empirical data is required to understand if it is applicable to other kinds of cases. However, no fundamental issues were identified either in the approach to making the CVP calculations or in the conceptual linkage between the business model and the related service architecture and thus this contribution should be valuable both for researchers and also for practitioners.

Conclusion

In this paper we have applied common practices from strategic management (business modeling), managerial economics (cost-volume-profit analysis) and information science (service-oriented architecture) to investigate and search for conceptual linkage between information technology and business value. This concretizes the complexity of the concept of IT value and the proposed model just scratches the surface.

This paper contributes a unique two-dimensional ontology of services in enterprises, which is further merged with the existing business model ontology to provide an end-to-end service-oriented business model ontology. The merged ontology is evaluated with the help of two simple methods enabling conceptual linkage to be tested in practice.

Both the cost-volume-profit calculation framework and the integration use case method are simplistic, but can be replaced with more comprehensive solutions. However, both have served their purpose as a proof of concept for an end-to-end linkage between the business benefits of different kinds of services.

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