Conceptualization of a Value Cocreation Language for Knowledge-Intensive Business Services

Christophe Feltus[1[0000-0002-7182-8185]], Lysanne Lessard[2[0000-0003-3013-0044]], François Vernadat[3[0000-0003-3596-1699]], Daniel Amyot[2[0000-0003-2414-1791]], Erik H.A. Proper[1[0000-0002-7318-2496]]

[1]Luxembourg Institute of Science and Technology, Esch-sur-Alzette, Luxembourg
[2]University of Ottawa, Ottawa, Canada
[3]University of Lorraine, Metz, France
christophe.feltus@list.lu, lessard@telfer.uottawa.ca, vernadat30@gmail.com, damyot@uottawa.ca, erik.proper@list.lu

Abstract. Knowledge-intensive business services (KIBS) are business-to-business services that are characterized as being knowledge intensive, relying on expert employees, and providing knowledge-based solutions to customers. As a context for service design, KIBS bring unique challenges regarding the need to communicate about value cocreation among companies entering into a service exchange. Unfortunately, until now, there have been limited contributions in the area of modeling languages to support the cocreation of value during business exchanges. In this paper, an abstract language (metamodel) is proposed to support IT designers in understanding value cocreation in the field of IT-related business services. A value creation metamodel is first structured around three dimensions: the nature of the value, the method of value creation, and the business object impacted by the value. Then, value cocreation is modeled as a specialization of the value creation metamodel. This new language is illustrated with a case study related to KIBS in the financial sector.

Keywords: Value cocreation, Service-dominant logic, Knowledge-intensive business services, Metamodel, Language, Service system.

1 Introduction

Knowledge-intensive business services (KIBS) are business-to-business services, such as engineering services, management consulting, and information technology (IT) sourcing [1], that are characterized as being knowledge intensive, relying on expert employees, and providing knowledge-based solutions to their clients [2]. These characteristics imply that clients co-define and co-produce desired solutions with KIBS providers [3]. As such, designing KIBS requires paying attention to the value cogenerated amongst KIBS providers, clients, and partners [4]. Value cocreation (VCC) is a concept anchored in marketing theory that explains how value can be co-defined and co-generated during business exchanges among two or more partners [5, 6]. Many examples of

adfa, p. 1, 2011.

value cocreation in KIBS are gathered in [1]. One of them concerns, for instance, the company PowerDrive, a Swedish manufacturer of hydraulic drive systems that cocreated value with three of its customers based on the collection and analysis of data from an existing remote monitoring system [7]. Another example from [4] concerns KIBS engagements between a team of university professors and their students, and a number of departments within a Canadian municipality, which collaborate on the development of an online event intended to promote city services to a broader range of city residents. In many cases such as PowerDrive and the Canadian municipality, VCC is facilitated thanks to interconnections between the organizations' information systems (IS) and their clients. As a result, understanding how value cocreation happens in this context is essential for the design of information systems that support the development of impactful business-to-business services and information exchanges between the employees who design KIBS, at the provider and client sides. Unfortunately, despite a significant body of empirical research aiming to depict the foundations of VCC (e.g., value in use, value in exchange, etc. [5, 6, 8-12]), and a profusion of languages to express elements of *value creation* (method, natures of the value or type of objects concerned by the value), few contributions have paid attention, until now, to the issue of languages to support the *cocreation of value* during business exchanges, especially in the field of KIBS. This shortcoming makes core concepts of value cocreation difficult to operationalize and, consequently, becomes a risk when KIBS designers must communicate with each other [13] to cocreate value. For example, during the creation of the value proposition, a provider needs to communicate (using a dedicated language) with its customers in order to understand the elements that the latter consider as valuable, and to request access to some parts of the customers' IS architecture.

In that context, this paper proposes a metamodel (language) to support KIBS designers in understanding value cocreation in the field of IT-related business services (e.g., IT outsourcing). The design of this language is illustrated with a case study related to KIBS in the financial sector. The first part of the case study illustrates the *creation of value* in the field of IT outsourcing when a bank outsources the archiving of its customers' data to a datacenter. The second part of the case study illustrates the *cocreation of value* between the bank and the datacenter. Indeed, because both companies have been collaborating for a long time, the datacenter has good knowledge of the bank's information system. For that reason, the bank has decided to outsource the improvement of the privacy of the customers' data to the datacenter. Both have hence started to cooperate to design the privacy improvement service of the customers and therefore the bank has agreed to give information about its information system (architecture, functions, etc.) to the datacenter. In turn, the latter enhances its offer of services and thereby stabilizes its own business. The enhancement is possible as a result of the bank's feedback.

Concretely, in our previous work [14], we have observed through an analysis of the literature from different disciplines and various business sectors, that the three following aspects need to be considered together in order to address the cocreation of value: the nature of value (e.g., privacy and money), the method used to create value (e.g., privacy impact assessment method), and the object concerned by value (e.g., the bank customers' data archived by the datacenter). Based on this previous work, the paper presents research performed in the context of the design science research approach that

aims to produce two artefacts: an improved version of the value creation metamodel proposed in [14] that incorporates stakeholder and resource concepts, and a specialization of the latter to the processes of value cocreation.

The paper is structured as follows: in the next section, the literature related to value cocreation is reviewed and in section 3, the applied research method is presented. Section 4 presents the findings, namely the improved version of the value creation metamodel and its specialization to value cocreation. Section 5 discusses these results and section 6 concludes the paper.

2 Literature Review

The concept of VCC originates from the field of marketing. It aims to define and to explain the mechanism for the co-generation of value during business exchanges amongst two or more companies [5, 6, 8]. Vargo et al. [5, 6] formalized it using a framework for defining VCC in the perspective of the service-dominant logic (S-DL). According to the authors, a service is the basis of all exchanges and focuses on the process of value creation rather than on the creation of tangible outputs. As a result, a service system is a network of agents and interactions that integrates resources for VCC [5]. On that basis, Vargo et al. further elaborate on the idea that value is derived and determined in use rather than in exchange, meaning that value is proposed by a service provider and is determined by a service beneficiary. Hence, the firm is in charge of the value-creation process and the customer is invited to join in as a co-creator [5]. For Grönroos et al. [15], this interaction is defined through situations in which the customer and the provider are involved in each other's practices. Consequently, the context (social, physical, temporal, and/or spatial) determines the value-in-use experience of the user in terms of his individual or social environment [16].

Modeling value cocreation in the specific field of the Knowledge-Intensive Business Service has been addressed by Lessard [6] who proposes the value cocreation modeling (VCM) framework to fulfill the requirement emerging from that domain. In parallel, Hastings et al. [10] also define a set of six concepts to design the practice-driven service framework for value creation, namely: customers co-create value with providers, value is created in service systems, modular business architecture, scalable Glo-Mo-So (global, mobile, social) platforms, continuous improvement via learning, and multi-sided metrics. At the analytical level, Storkacka et al. [11] have complementarily proposed to analyze the actors' engagement as a micro-foundation (explanation on a low analytical level) for VCC whereas Frow et al. [12] proposed a framework to assist firms in identifying new opportunities for value cocreation. Therefore, the authors provide a strategically important new approach for managers to identify, organize, and communicate innovative opportunities.

Recently, Chew [17] has argued that, in the digital world, service innovation is focused on customer value creation. Chew proposes an integrated Service Innovation Method (iSIM) that allows analyzing the interrelationships between the design process elements, including the service system. The latter being defined as an IT/operations-led, cross-disciplinary endeavor. At the information system domains level, Blaschke et

al. [18] propose a business-model-based management method encouraging cocreation interactions by reconciling value propositions, customer relationships, and interaction channels. Gordijn et al. [19] explain that business modeling is not about process but about value exchange between different actors. Gordijn et al. propose e^{3}value to design models that sustain the communication between business and IT groups, particularly in the context of the development of e-business systems. In [20], Weigand extends the e^{3}value language to consider cocreation. He defines so-called value encounters, which consist in spaces where groups of actors interact to derive value from the groups' resources. In a similar way, Razo-Zapata et al. propose visual constructs to describe the VCC process [21]. These constructs are built on requirements from the service-dominant logic and software engineering communities. They aim to express three cocreation types (co-ordination, co-operation and collaboration) following the three elements of the customer relationship experience: cognition, emotion, and behavior [9]. According to [22], the cocreation may happen through different processes (B2C, B2B, C2B, or C2C) and may refer to different types of value (for the company or the customer).

While existing approaches help to operationalize the concept of VCC, none of them fully considers all the dimensions necessary to cover the VCC domain. This can be seen through recent work presenting the state of the art in the field of VCC. The first one reviews the existing literature through both following perspectives: co-production and value-in-use [23], and the second through two dimensions: theoretical dimension of the cocreation, and collaboration and cocreation between firms and customers [24]. Thus, despite existing contributions, the need to design an effective language to support the management of VCC [19-20] while considering the nature of the value, the object concerned by this value, and the method used to create the value, has yet to be addressed.

3 Research Methodology

At a methodological level, the research that is undertaken concerns the improvement of value cocreation in the field of knowledge-intensive business services. To achieve this goal, the approach consists in designing a value creation metamodel and in specializing it to express value cocreation. Through this research, we aim to strengthen the organizational capability to improve the design of the information system that sustains this cocreation of value. Hevner et al. [25] explain that the Design Science Research (DSR) paradigm seeks to extend the boundaries of human and organization capability by creating new and innovative artefacts. Practically, provided that we aim to design two new artefacts to support the design of the information system, we acknowledge that this research may plainly be considered in the scope of DSR [26]. Moreover, given that both artefacts are motivated by real problems and rely on the knowledge of the field, we need to involve practitioners all along the artefact building activities. Therefore, we apply the Action Design Research method proposed by Sein et al. [27], whose objective is to strengthen the connections between the practitioners and the researchers by combining the building, intervention, and evaluation (BIE) activities. Moreover, postulating that the elaboration of the artefacts strongly relates to the IS, we apply an IT-Dominant BIE generic schema (Fig. 1).

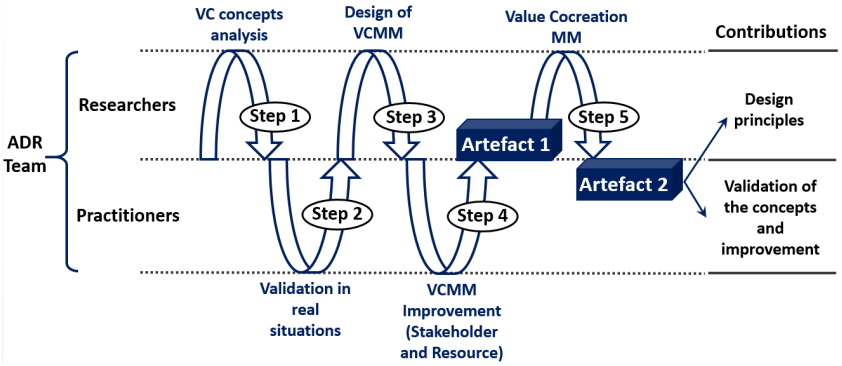

Fig. 1. IT-Dominant BIE generic schema applied to VCC design (adapted from [27])

As advocated by DSR principles [26, 27], the method used to design the value creation model is an iterative approach. Applied to this research, in step 1 (Fig. 1), we (researchers) have analyzed the concepts meaningful to the creation of value from the literature and from different frameworks and we have designed a high-level value creation metamodel, structured along three dimensions (nature of the value, value creation method, and object concerned by the value). In step 2, this value creation metamodel has been tested with regard to real situations with practitioners from different sectors but mostly from healthcare and financial institutions. In step 3, we have formalized the first version of the value creation metamodel (VCMM); the latter was presented in [14].

In this paper, we analyze to what extent this value creation metamodel may be used to model the cocreation of value in KIBS. Therefore, a first statement is that, opposite to value creation, value cocreation implies at least two stakeholders who collaborate. Additionally, the latter may have different roles among which the role to provide resources to support the value cocreation. Consequently, an intermediary step in the approach consists in improving the value creation metamodel proposed in [14] with the concepts of stakeholder and resource. We hence perform a conceptual integration of the value creation metamodel with the model of value presented in [28, 29] (step 4). The resulting integrated metamodel, improved with the stakeholder and resource concepts, consists in artefact 1. Afterwards, in step 5, this artifact 1 is specialized to the processes of value cocreation. The latter is applied to the context of KIBS and is illustrated based on the *Processes of value cocreation* proposed by [6]. The cocreation itself is illustrated with a case of IT outsourcing in the financial sector, namely the outsourcing of *privacy* management. This specialization is artefact 2.

4 Research Findings

In this section, the new version of the value creation metamodel is presented. It corresponds to the version presented in [14] improved based on the value model from [28]. Then, the value creation metamodel is specialized to the processes of value cocreation.

4.1 Value Creation Metamodel

In this section, the metamodel of value creation in the field of IT-related business services is defined according to three dimensions (Fig. 2): the nature of the value, the method of value creation, and the object concerned by the value.

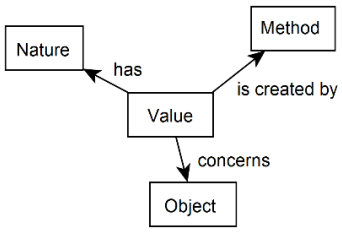

Fig. 2. Three value dimensions

Provided that this research is anchored in DSR, this section presents the last version of the value creation metamodel design iterations. The metamodel is elaborated based on the analysis of value related frameworks [30-48], of scientific literature [3-6, 8-12, 16-23] and on a *performance evaluation methodology for decision support in industrial project* proposed in [28]. The aim of this methodology is to propose a benefit-cost-value-risk based approach to help decision makers in evaluating performance at any stage of an industrial project. The latter allows considering two additional concepts necessary to model the cocreation of value in the field of knowledge-intensive business services: *stakeholder* and *resource*.

In the next sub-sections, each dimension of the value is successively analyzed and modeled, and the integrated value creation metamodel is presented in the last sub-section. Moreover, concepts of the metamodel are illustrated using the first part of the case study related to the outsourcing, by the bank, of the customer's data archiving to a datacenter.

Dimension 1: Nature of the value

To understand and model the nature of the value, first a set of frameworks addressing the different value natures in the field of IT has been reviewed, including security, quality, compliance, privacy, responsibility, and others (Table 1). Based on this review, the most meaningful concepts necessary to express this nature have been extracted. For example, the information systems security risks management (ISSRM [30]) framework, which addresses the IS security (*Nature of the value*), has been analyzed. This framework characterizes security through integrity, confidentiality, availability, non-repudiation, and accountability (*Value components*), and the latter concerns business assets of the company (*Objects*). Finally, based on a deeper review of the literature, our own definitions of the concepts composing the dimension have been provided in an integrated metamodel of nature of the value (Fig. 3).

Table 1. Nature of the value in the field of IT

Value reference framework	Nature of the value examples		
	Nature of the value	***Component of the nature of the value***	***Concerned object***
ISSRM [30]	IS Security	Confidentiality, Integrity, Availability, Non-repudiation, Accountability	Business Asset
ReMMo [31]	Responsibility	Accountability (e.g., RACI)	Actor
Web Quality Model [32]	Quality	Functionality, Reliability, Usability, Efficiency, Portability, Maintainability	Web feature
EA Compliance Model [33]	Compliance	Correctness, Justification, Consistency, Completeness	Acts of software developers
Privacy Metamodel [34] and [35]	Privacy	Notice, Choice and Consent, Proximity and Locality, Anonymity and Pseudonymity, Security, and Access and Resource	Sensitive information
VDML [360]	Generic Value	Factor of benefit, Factor of interest	Business item
HCI [37]	Usability	Learnability, Flexibility, Robustness	Design rules, design knowledge

Basically, most reference frameworks [30-37] analyzed focuses on depicting the semantic of value following a given perspective being function of the beneficiary of the value. In practice, due to the quantity of heterogeneous value natures [22], clearly defining the semantic of the latter is laborious. However, we observe that two main perspectives of value nature emerge depending on the context: value at the provider's side vs. value at the customer's side. At the provider's side, the basic rationale for all companies entering into dyadic exchange relationships is the value capture [49] from a service exchange. This can be in the form of value-in-exchange (e.g., money given by the client), or in the form of value-in-context. In that regard, it is worth noting that considering the provider in the context of the digital society expands this narrow meaning to the consideration of other value elements, such as the information collected on the customers (e.g., analyzing customer data to support the creation of new offerings) which, afterwards, contributes to economic increase [50]. On the customer's side, value generated by a transaction never refers to money but consists in other wealth, which contributes in sustaining and supporting the customer's own business.

According to [28], value is described as the degree of satisfaction of a set of stakeholder expectations or needs, expressed by the appreciation level of a number of performance indicators. Li [29] explains that value can be described by the relative worth, utility, or importance of something. Value increases when the customer's degree of satisfaction increases. The concept of value becomes different depending on the point of view (stakeholder). Accordingly, the *expected value* is the value that the stakeholder would like to get and the *perceived value* is the real value that a stakeholder can finally get. The degree of satisfaction is identified through the comparison of these two elements. According to Zeithaml, value implies some form of *assessment of benefits against sacrifices* [8].

Regarding the case study proposed in the introduction, at the bank's side, the privacy of the customers' data is a legal requirement that has to be fulfilled by each entity processing private information. Having this data privacy generates the benefit of being compliant with regulations, but it is also expensive because the bank needs to deploy an appropriate mechanism to set up this privacy, such as performing privacy impact assessment. At the datacenter's side, offering 24/7 data availability to the bank is a benefit to distinguish the datacenter from its competitors, but this offering is also costly because it requires a very robust infrastructure.

According to this review, the concepts that are relevant to the metamodel for the nature of the value are:

- **Value.** This concept is defined as a degree of worth that concerns something [28, 29] and that improves the well-being of the beneficiary after it is delivered [51].
- **Nature of the value.** Table 1 shows that the nature of the value expresses a domain of interest related to which the value will be delivered (e.g., security of the IS, the cost of a transaction, or the privacy of personal data). As a consequence, the nature of the value **defines** the value to be delivered. In the case of the datacenter that archives the data of the bank customers, the nature of the value generated by the datacenter is the *availability* of the customer's data.
- **Value component**. This concept expresses the different elements that constitute the value, or the pillars that found this nature (e.g., availability, confidentiality, portability, etc.). Hence, the value **aggregates** value components and the latter may also, as a result, themselves be other **types of** value. Regarding the case study, one component of the availability is the *accessibility in real time*.
- **Object.** The object concerned by the value is the element from the information system that has significance and is necessary for a company to achieve its goal, and that is be better off after that value is delivered (e.g., software, process, data). From a modeling point of view, the value is associated to an object with a relation of type **concerns** or objective to be achieved. In the case study, the object concerned by the value is the *customers' data.*
- **Measure.** The measure corresponds to a property on which calculations can be made for determining the amount of value expected from a value creation method. This measure (e.g., the *% of time data is available*) can result from different factors impacting value. This corroborates the statement made in [28], which argues that the value components are measured by means of estimation methods. Accordingly, there exist an association named **appraises** from the concept of measure to the concept of value, an association named **is function of** between the concept of measure and the type of value, and between the concept of measure and the object concerned by the value. The first expresses that the measure is characterized by the nature of the value and the second that the measure also depends on the object concerned by the value. According to [28], this measure may integrate qualitative and quantitative elementary performance expressions.

Based on the above definitions, the nature of the value is modeled in Fig. 3.

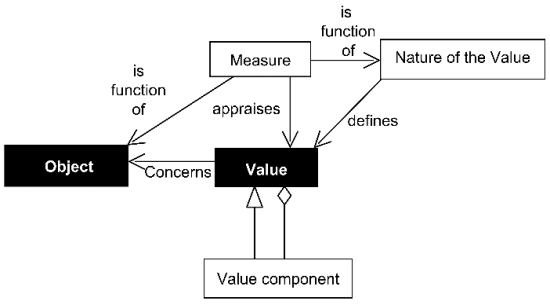

Fig. 3. Nature of the value metamodel

Dimension 2: Method of value creation

A method of value creation corresponds to a set of activities that contribute to the generation of value in the field of IT. Likewise as for the nature of the value, in order to depict the elements relevant for the creation of value, a set of IT-related frameworks about value creation methods have been reviewed (Table 2) and this review has afterwards been completed with elements from the literature. The methods analyzed so far include method by design [35], model driven [28], impact assessment [29], method chunk [40], risk-based [41], and process-based [42] approaches.

Traditionally, value is created through the exchange and use of goods and services [5]. Methods for value creation are the body of techniques and activities that use and generate resources [52]. These correspond, at the corporate level, to a bundle of approaches including the design of strategies, the integration of models, the evaluation of results, etc. (Table 2). By looking more closely at the methods analyzed, it has been observed that each has a dedicated goal, that they are composed of method elements, and that the latter are organized in a sequence of ordinated steps. For instance, by investigating the model-driven approach to interoperability, one can notice that it has for goal to improve interoperability of enterprises' information systems that it is composed of models, and that three steps are required for model-driven interoperability: model design, model integration, and model instantiation. Amongst the other methods reviewed, it is also interesting to highlight that one (method chunk) has for particular objective the creation of methods themselves, using, as chunk of existing methods as method elements, and as method steps the decomposition of existing methods into method chunks and the definition of new method chunks from scratch [40].

As a summary and according to this analysis, the concepts that make the method of value creation are:

- **Method**. The method is a specific **type of** object that defines the means used by the stakeholder to **create** objects and value. According to Table 2, a method is **composed** of a set of activities necessary to achieve a dedicated goal. In the same vein, Sein et al. [27] explain that the elementary quantitative value expressions (the value components) are aggregated by means of selected aggregation methods and quanti-

tative weights to generate the overall value. The method used to create the availability is *the exploitation of a redundancy system (tools and procedures to guarantee redundancy).*

Table 2. Methods of value creation in the context of IT development

Method reference	**Method of Value creation examples**		
	Method	***Goal***	***Activity***
[35]	By design	Prevent privacy risk from occurring	Project-by-project approach realization
[38]	Model-driven	Improve interoperability of companies' information systems	Models design, model integration, and model instantiation
[39]	Impact assessment	Explore social consequences for social security policies	Scenario design, Design of strategies, Assessment of impacts, Ranking of strategies, Mitigation of negative impacts, Reporting, Stimulation of implementation, Auditing and ex-post evaluation
[40]	Method chunk	Method creation	Decomposition of existing methods into method chunks and definition of new method chunks from scratch
[41]	Risk-based	Security strategy development	Analysis of the method elements and identification of the options that exist in investment decisions
[42]	Process-based	Risk management for global supply chain	Step-by-step execution in a function of the dependency amongst them

- **Activity**. The activity is an element of the method that corresponds to a unitary task (e.g., analysis, collect of information, or report). The activities **compose** the method and are organized and coherently articulated with each other (e.g., if-then-else, process elements ordination, etc.). This relation is modeled using an iterative association of a type: activity **follows** activity. The articulation of activities corresponds to the aggregation from [14]. One particular type of activity consists in **generating** resources. For instance: *acquiring a backup tool, maintain the backup tool, etc.*
- **Stakeholder.** A stakeholder is a human, a machine or an organization that is involved in the creation of value at three levels. First, it **performs** the method that generates value (e.g., the risk manager performs a risk analysis); second, it **generates** resources used by the method; and third it **expresses** the value expected after the execution of the method. For example, the *datacenter* is the stakeholder that exploits the redundancy system and the *bank* expresses that it expects availability of the data.
- **Resource.** This element is **a type of** object from the IS that is generated by a stakeholder and that **is used by** an activity composing the value creation method. Resources are typically information and data (e.g., passenger location), but could also consist in computing resources, funding, manpower, etc. For instance, the *backup software* is the resource used by the exploitation of a redundancy system.

Based on the above definitions, the value creation method is modeled in Fig. 4.

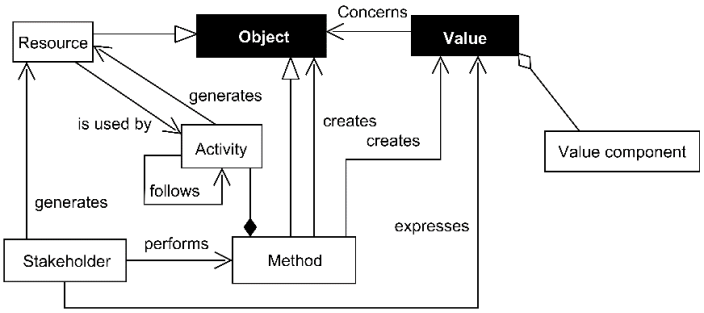

Fig. 4. Value creation method metamodel

Dimension 3: Object concerned by the value

The object concerned by the value corresponds to elements (e.g., information, process, tool, or actor) that exist in a specific environment represented at the information system level by the context. The latter has an influence on the type and the amount of value associated with this object, for instance, a *customer's browsing history* is an object of a data type that has a particular pecuniary value for an airline travel agency that can estimate the value ascribed to a flight ticket for a customer. This value is calculated based on the number of times this flight ticket is viewed on the company's website by the customer. At the opposite, this *customer's browsing history* is not an object of value on a drugstore website with fixed prices. Complementarily, it is also worth noting that this context has no impact on the nature of the value. For example, privacy in healthcare is defined in the same way with the same characteristics as in industry.

To collect and deal with the concepts that are necessary to model the object of value, it has been assumed that each sector of activities, should it be manufacturing, finances, or healthcare, to name a few, is associated with a specific information system. The latter models the objects composing it as well as the relationships between these objects, using a dedicated language.

Sector-specific information systems and enterprise architecture (EA) models and languages are good approaches here because they semantically define generic objects and sometimes concrete languages to express these objects. Numerous frameworks have been designed to model IS and EA of various sectors, e.g., Cimosa [43], ArchiMate® [44], BSE [45], DoDAF [47], and many others (Table 3).

Regarding the financial case study, the data of the bank's customers is the object concerned by the required privacy (generated by the bank) and concerned by the required availability (generated by the datacenter).

Table 3 provides an overview of some metamodels and languages used to depict the context targeted, the IS under scope, and some examples of objects addressed.

As a summary and according to this analysis, the concepts defining the context and the object concerned by the value are:

- **Information system**. The information system encompasses, and **is composed by,** the objects concerned by the value and the stakeholders that benefit from the value created.

Table 3. Objects of value within an information system

Reference/ Language	Object concerned		
	Context	***Information system***	***Example of objects***
CIMOSA [43]	Production Industry	Industrial information system	Business process, flow, step, function, information, resource and organization aspects, business user, control, capability…
ArchiMate® [44]	Enterprise	Enterprise information system	Service, actor, role, process, function, contract, software, data, capability, role, device, node…
BSE [45]	Enterprise	Business Service Ecosystem	Service, capability, resource, process, actor…
Demo [46]	Enterprise	Business Process, Information Systems	Models (interaction, business process, action, interstriction, and fact), actor, action…
DoDAF [47]	Military	DoDAF Meta-Model (DM2)	Guidance, activity, capability, resource, performer, location, information, project materiel, system, service, organization…
ARIS [48]	Enterprise	Business process management	Data, function, organization, material, IT resources, or machine resources…

- **Context**. The context represents the surrounding of the IS. It includes (1) the constraints on the system in which the value is created and (2) the definition of the borders of this system (e.g., the sector and the sector purpose of the business entity that is concerned by the IS, the rules and regulations related to the sector or the IS, the institutional arrangements, etc.). Accordingly, the context is associated to the information system with an association named **characterizes**. As stated in [28], the context also allows selecting the *performance components* […] necessary *to define the scope of the performance evaluation problem*. Hence, this selection defines a particular context, or viewpoint, for the evaluation of the value. To model this, the concept of context is associated to the measure with a relation named **influence**. Regarding the case study in the financial sector, the context is the *financial regulation.*

Based on the above definitions, the object concerned by the value is modeled in Fig. 5.

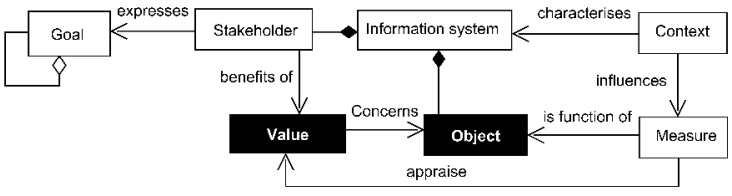

Fig. 5. Object concerned by the value metamodel

Integrated model instantiated to the financial sector case study

In the previous sections, three aspects related to the creation of value have been successively presented and each of these dimensions has been modeled in a dedicated metamodel. All along the description of the concepts, illustrations have been provided regarding a case of IT outsourcing in the financial sector, namely, the archiving of a bank customer's data to a datacenter. Figure 6 presents the integrated value creation metamodel instantiated to the IT outsourcing case.

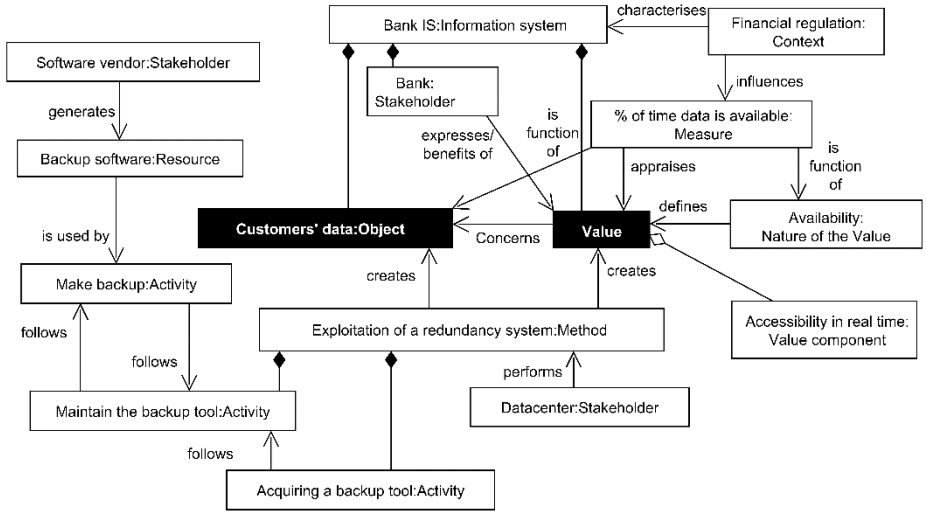

Fig. 6. Value creation metamodel instantiated to IT outsourcing in the financial sector.

4.2 Modeling Value Cocreation as a Specialization of Value Creation

As reviewed in the state of the art, no model for representing the creation of value following the three value dimensions exists yet. This observation is even more relevant for the field of value cocreation, in the context of the service-dominant logic, when two or more stakeholders cogenerate value during business exchanges.

In this respect, as explained in the introduction, the paper proposes an innovative value creation metamodel aiming to support the cocreation of value in the field of knowledge-intensive business services engagements. This section aims to analyze to what extent the value creation metamodel (Figures 3, 4 and 5) is suitable to model the processes of value cocreation in KIBS proposed in [1] (Fig. 7). To that end, as also explained previously, one specificity of value cocreation is that value is cocreated on the basis of a collaboration between many stakeholders who have different responsibilities during the cocreation, including the generation of the appropriate resources needed for cocreation activities. Consequently, a prerequisite before modeling the value cocreation was to enrich the value creation model with the concepts of the stakeholder and the resources. This improvement was achieved in previous section by integrating the value creation model presented in [14] with the value model proposed in [28, 29].

These processes and generative mechanisms of value cocreation in KIBS engagements are illustrated in Fig. 7. Only the processes dedicated to the alignment within and between actors are considered in the following.

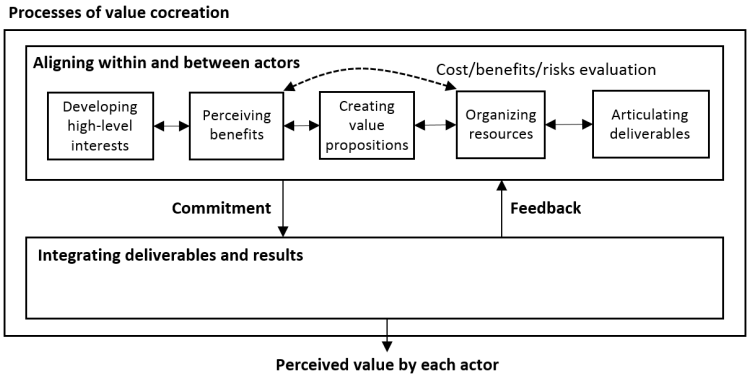

Fig. 7. Processes of value cocreation in KIBS engagements (adapted from [6])

In the following, the value creation metamodel is specialized concept by concept, as illustrated in the object diagram of Fig. 8:

- **Object.** In the cocreation metamodel, like in the creation metamodel, the object concerned by the value is the element from the information system that aims to be better off after that value is proposed and accepted. In the case of the cocreation of privacy between the bank and the datacenter, the object concerned by the value is still the *customer's data* at the bank's side and the *service portfolio* at the datacenter's side.
- **Context.** The context of the cocreation is also equivalent to the one from the creation metamodel. In the case study, this context is the *financial regulation.*
- **Nature of the value.** The nature of the value defines the value generated by the creation or the cocreation. In the case study, this nature of the value is *privacy* (for the bank) and *stability* (for the datacenter).
- **Stakeholders.** They are the entities performing the method that cocreates value, who benefit from this value, and who generate the resources used by the method activities. These stakeholders are of three types in the field of KIBS: companies, their customers, and partner organizations. In the case study, the stakeholders are the *bank* and the *datacenter*.
- **Information system.** This concept is not addressed in the processes of value cocreation [6]. However, to keep the specialization of the metamodel coherent, a specialization of the information system is created and named: *Stakeholder's information system*. In the case study, an instance of the information system is the *Bank's information systems.*
- **Value component.** This concept expresses the different elements that constitute the value. At the case study level, an instance of the privacy component is the *anonymity* and an instance of the stability component is the *diversity of services.*
- **Measure.** The measure that appraises the level of privacy is the *% of privacy breaches* and that appraise the level of stability is the *number of new customers.*

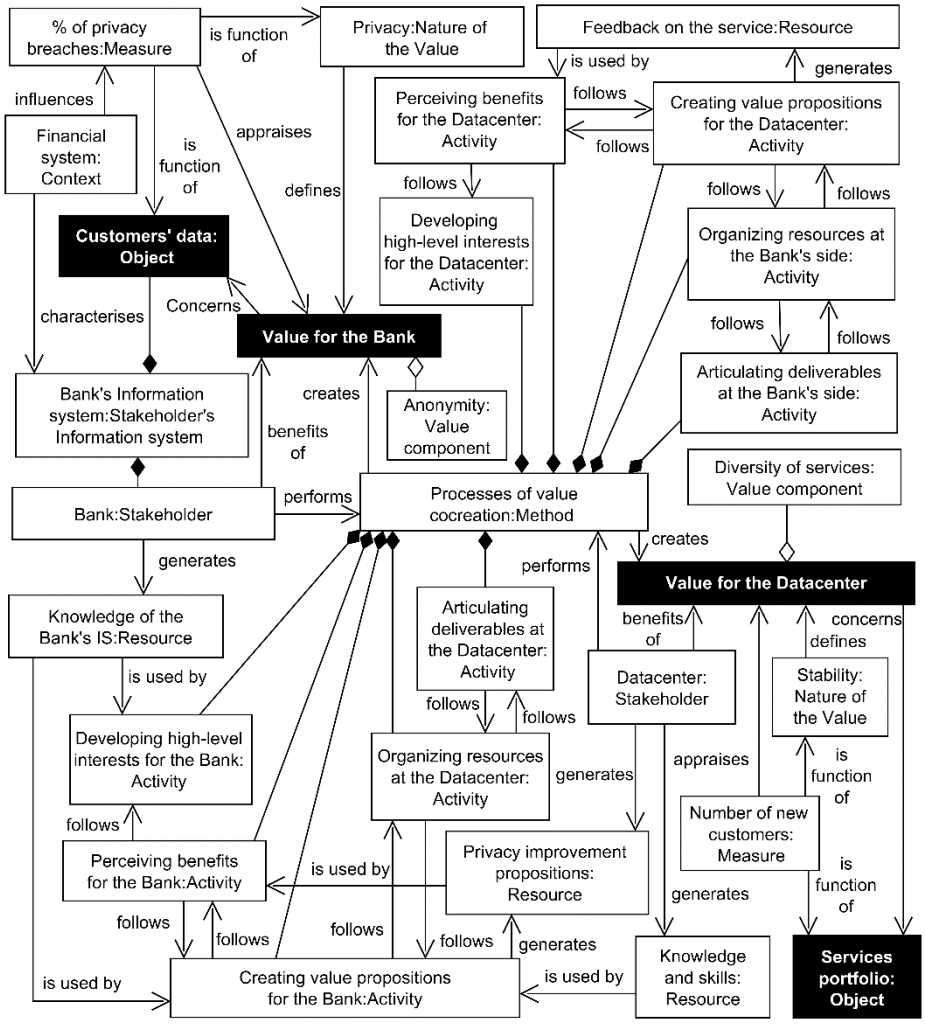

Fig. 8. Specialization of the VCMM to the value cocreation in KIBS engagements

- **Method.** The approach followed in [6] to cocreate value is a process-based approach. The first process related to the need for alignment among KIBS actors and the second concerns the integration of the deliverables and results. The case study only focuses on the first part and considers that the integration of the deliverables and results may be achieved similarly. Regarding the case study, the method used to design the *privacy of the bank customers data* could be composed of the same activities as the ones that compose the process of value cocreation in KIBS engagement, namely: *developing high level interest for the bank and the datacenter to cocreated the audit of the leased-line*, *perceiving benefits at each side*, *creating value proposition from the bank and the datacenter business*, etc.

- **Activity**. To be achieved, the method is composed of activities that are articulated with each other. The mechanisms within the processes of value cocreation are considered as a specialization of the concept of activity. Five of them (from the aligning process) are represented in Fig. 8: *developing high-level interests*, *perceiving benefits*, *creating value propositions*, *organizing resources and articulating deliverables*, at the bank's and datacenter's sides.
- **Resource**. According to the definition, a resource is a type of object used by an activity. Many types of resource are needed for the realization of the activities of the value cocreation processes. Example of resources here include: the *privacy improvement propositions* used to perceive benefits, the *knowledge and skills* used to create value propositions, the *knowledge of the bank IS* used to create value propositions, at the bank's side, and *feedback on the services*, at the datacenter's side.

5 Discussion of Findings

The analysis achieved in previous section allows elaborating a new design iteration of the value creation metamodel previously presented in paper [14]. The design of this new iteration is motivated and oriented by the needs to enhance (1) the relations between the value created and the stakeholder that generates and benefits from it, and (2) the relations between the method, the activities composing it, and the resources that are created and used by the latter. Compared to the previous version, this new iteration offers the following advantages:

- It allows expressing the role of each stakeholders involved in the value creation, more especially, it allows expressing who is responsible to perform the method that creates value and who benefits from it. This improvement is mandatory to appraise the value generated and, as a result, to improve the level of that value. Indeed, according to [28], value is appraised in function of the degree of satisfaction of a set of stakeholders' expectations or needs. This set of expectations is introduced in the value creation metamodel by means of the relation: *Stakeholder expresses goal*.
- It allows expressing the resources that are necessary to achieve activities composing the value creation method, but mostly, it allows expressing which resource is generated by which stakeholder during the cocreation activities and which resource is itself generated by the cocreation. For instance, this improved version allows expressing that a stakeholder shares personal information with a service provider in exchange of a service.
- The importance of the context is consolidated by a relation expressing that the context influences the measure of the value created.

The second contribution of the paper lies in specializing the value creation metamodel to the processes of value cocreation in knowledge-intensive business services proposed by [6]. The resulting advantages of that specialization are manifold but mostly, it demonstrates that considering the processes of value cocreation as a type of value creation is justified and, as a result, that cocreation may be handled, at the modeling level, as a specific type of value creation. Acknowledging this, modeling the value

cocreation as a type of value creation allows integrating additional elements in the expression of the cocreation, among which:

- The information system. It gathers the elements that are impacted by the (co)creation of value and that are characterized by the context in which this (co)creation happens. These characteristics are, e.g., the IS composition, its structure, the business sector in which it evolves, etc. The cocreation of value impacts the characteristics of the information system. For instance, the cocreation of value generates new collaborations that must be integrated in business processes supported by the information system. These new processes may generate new information that also needs to be managed by the IS (e.g., accessed by the stakeholders, exploited by method, or stored in databases). This impact is not represented in the metamodel.
- The context is a particular type of element that characterizes the information system. Knowing this context is important for the cocreation of value because it may generate constraints to be considered during the design of the cocreation (e.g., regulation, sectorial requirement, institutional arrangement, etc.)
- The stakeholders. They are key players in the cocreation and are the ones that will be better off after value is delivered. First, clearly modeling the stakeholder that performs the cocreation of value is an important management requirement [52] for instance during the assignment of responsibilities [31]. Second, knowing the beneficiary of the value is preponderant to assess the latter, considering that value is evaluated on the basis of the beneficiary's satisfaction [28].
- The resource. Modeling the resources involved in the cocreation is beneficial because this allows expressing the input required for this cocreation. Indeed, resources often play an important role in cocreation, like when a resource is an information based on which value is created by means of a data mining method. The resource is also an element that may be generated by an activity of the cocreation method and that is worth representing. For example, on Fig. 7, Perceived benefits is an information (resource) generated by the process Perceiving benefits (activity) that is used by the process Valuing during the integration of the deliverables and results.

The metamodel is mainly elaborated based on the review of frameworks from the information system domain [30-48], completed with elements from the scientific literature [3-6, 8-12, 16-23]. This limitation concerning the scope of the domain analyzed is a source of weaknesses for the metamodel, which is currently only valid for use in this area. As a result, further work is necessary to verify the option that has been chosen to ground the metamodel based on the three specific dimensions and to consolidate the latter according to the nature of values, methods, and objects considered in other domains (e.g., healthcare, industry, etc.).

6 Conclusion

The contribution of our research is an enriched version of the value creation metamodel (language) [14] with the concepts of stakeholder and resource [28], and a specialization of that metamodel to the cocreation of knowledge-intensive business service (KIBS).

In comparison to the state of the art, despite the impressive amount of literature aiming to explain the concepts and mechanisms of value cocreation, no language has been expressed yet to support the exchange of information related to value cocreation between information system designers. Consequently, this paper contributes in conceptualizing such a language considering three dimensions: the nature of the value, the method of value creation and the object concerned by the value.

The practical implication of our modeling approach is the consideration of four additional elements during the design of value creation and cocreation models: (1) the stakeholder and its role in the processes, (2) the resource and its utility, (3) the information system that is influenced by the cocreation, and (4) the context that dictates the constraints and the institutional arrangement in which the cocreation arises. The impact of the later has been demonstrated in the field of KIBS, but it could also be demonstrated with other types of organizations or businesses, for instance, in finance or information security [53].

Given the limitations of the metamodel (cf. Section 5), we intend to further integrate the performance dimensions of the "performance evaluation methodology for decision support" in industrial projects [28] and the process of alignment within and between actors from the value cocreation process described in [6]. We also want to improve the alignment between the concept of measure from the value creation metamodel and i) the evaluation of the cost/benefits and risks during the alignment within and between actors, and ii) the outcome and quality metrics of the integration of deliverable and results process from [28]. Finally, the elaboration of the metamodel being performed in the frame of an iterative design approach, further validation of the latter is still expected, in real settings and in view of concrete business collaborations. This may require the development of a concrete syntax (textual or graphical) for the language corresponding to the metamodel.

References

1. Lessard, L., Okakwu, C.P.: Enablers and Mechanisms of Value Cocreation in Knowledge-Intensive Business Service Engagements: A Research Synthesis. In: 2016 49th Hawaii International Conference on System Sciences, HI, USA. IEEE Computer Society, pp. 1624–1633 (2016)
2. Muller, E. Doloreux, D.: What we should know about knowledge-intensive business services. Technology in Society, 31(1), 64–72 (2009)
3. Bettencourt, L.A., Ostrom, A.L., Brown, S.W., Roundtree, R.I.: Client Co-Production in Knowledge-Intensive Business Services. Calif. Manag. Rev. 44 (4), 100–128 (2002)
4. Vargo S.L., Lusch, R.F.: Evolving to a new dominant logic for marketing. J. of Marketing, 68(1), 1–17 (2004)
5. Vargo S.L., Lusch, R.F.: Service-dominant logic: continuing the evolution. J. of the Academy of Marketing Science, 36(1), 1–10 (2008)
6. Lessard, L.: Modeling value cocreation processes and outcomes in knowledge-intensive business services engagements. Service Science, 7(3), 181–195 (2015)
7. Westergren, U. H.: Opening up innovation: the impact of contextual factors on the co-creation of IT-enabled value adding services within the manufacturing industry. Information Systems and e-business Management, 9(2), 223–245 (2011)

8. Zeithaml, V.A.: Consumer perceptions of price, quality, and value: a means-end model and synthesis of evidence. J. of Marketing, 52(3), 2–22 (1988)
9. Payne, A.F., Storbacka, K., Frow, P.: Managing the co-creation of value. J. of the Academy of Marketing Science, 36(1), 83–96 (2008)
10. Hastings, H., Saperstein, J.: A practice-driven service framework for value creation. In: 15th Conference on Business Informatics. IEEE, 145–152 (2013)
11. Storbacka, K., Brodie, R.J., Böhmann, T., Maglio, P.P., Nenonen, S.: Actor engagement as a micro foundation for value co-creation. J. of Business Research, 69(8), 3008–3017 (2016)
12. Frow, P., Nenonen, S., Payne, A.F., Storbacka, K.: Managing Co-creation Design: A Strategic Approach to Innovation. British J. of Management, 26(3), 463–483 (2015)
13. Ziemba E., Kolasa I.: Risk Factors Relationships for Information Systems Projects – Insight from Polish Public Organizations. In: E. Ziemba (ed.) Information Technology for Management, LNBIP, vol. 243. Springer, 55–76 (2016)
14. Feltus, C., Proper, H.A.E.: Conceptualization of an Abstract Language to Support Value Co-Creation. In: Proc. of FedCSIS. ACSIS, Vol. 11, pp. 971–980 (2017)
15. Grönroos, C.: Service logic revisited: who creates value? And who co-creates? European business review, 20(4), 298–314 (2008) DOI:10.1108/09555340810886585
16. Chandler, J.D., Vargo, S.L.: Contextualization and value-in-context: How context frames exchange. Marketing Theory, 11(1), 35–49, (2011) DOI: 10.1177/1470593110393713
17. Chew, E.K.: iSIM: An integrated design method for commercializing service innovation. Information Systems Frontiers, 18(3), 457–478 (2016)
18. Blaschke, M., Haki, M.K., Riss, U., Aier, S.: Design Principles for Business-Model-based Management Methods – A Service-dominant Logic Perspective. In: Designing the Digital Transformation (DESRIST 2017), LNCS, vol. 10243. Springer, pp. 179–198 (2017)
19. Gordijn, J., Akkermans, H., Van Vliet, H.: Business modelling is not process modelling. In: ER 2000, LNCS, vol. 1921. Springer, pp. 40–51 (2000)
20. Weigand, H.: Value encounters–modeling and analyzing co-creation of value. In: I3E 2009. IFIP Advances in ICT, vol. 305, Springer, Berlin, Heidelberg, pp. 51–64 (2009)
21. Razo-Zapata, I.S., Chew, E.K., Proper, E.: Visual Modeling for Value (Co-)Creation. In: 10th Int. W. on Value Modeling and Business Ontologies, Trento, Italy, paper 6 (2016)
22. Alves, H., Fernandes, C., Raposo, M.: Value co-creation: Concept and contexts of application and study. J. of Business Research, 69(5), 1626–1633 (2016)
23. Ranjan, K.R., Read, S.: Value co-creation: concept and measurement. J. of the Academy of Marketing Science, 44(3), 290–315 (2016)
24. Galvagno, M., Dalli, D.: Theory of value co-creation: a systematic literature review. Managing Service Quality, 24(6), 643–683 (2014)
25. Hevner, R., March, S. T., Park, J.: Design science in information systems research. MIS quarterly, 28(1), 75–105 (2004)
26. Peffers, K., Tuunanen, T., Rothenberger, M.A., Chatterjee, S.: A design science research methodology for information systems research. J. of Man. Inf. Sys., 24(3), 45–77 (2008)
27. Sein, M.K., Henfridsson, O., Purao, S., Rossi, M., Lindgren, R.: Action design research. MIS Q., 35(1), pp. 37–56 (2011)
28. Li, F., Etienne, A., Siadat, A., Vernadat, F.: A Performance Evaluation Methodology for Decision Support in Industrial Projects. In: Proc. 7th IESM conference, htw saar, Germany (2017)
29. Li, F.: Performance Evaluation and Decision Support for Industrial System Management: A Benefit-Cost-Value-Risk based Methodology. PhD thesis, Arts & Mét. Paritech, France (2017)
30. Matulevicius, R., Mayer, N., Heymans, P.: Alignment of misuse cases with security risk management. In: 3rd Int. Conf. ARES. IEEE, pp. 1397–1404. (2008) DOI:10.1109/ARES.2008.88

31. Feltus, C., Petit, M., Dubois, E.: Strengthening employee's responsibility to enhance governance of IT: COBIT RACI chart case study. In: 1stACM Workshop on Information Security Governance. ACM, pp. 23–32 (2009)
32. Calero, C., Ruiz, J., Piattini, M.: Classifying web metrics using the web quality model. Online Inf. Review, 29(3), 227–248 (2005)
33. Foorthuis, R.M., Hofman, F., Brinkkemper, S., Bos, R.: Assessing business and IT projects on compliance with enterprise architecture. In: GRCIS'09. CEUR-WS Vol-459, paper 6 (2009)
34. Feltus, C., Grandry, E., Kupper, T., Colin, J. N.: Model-Driven Approach for Privacy Management in Business Ecosystem. In: 5th Modelsward 2017. SciTePress, pp. 392–400 (2017)
35. Langheinrich, M.: Privacy by design—principles of privacy-aware ubiquitous systems. In: Ubicomp 2001: Ubiquitous Computing, LNCS, vol. 2201. Springer, pp. 273–291 (2001)
36. OMG: Value Delivery Metamodel, Version 1.0. OMG Document formal/2015-10-05 (2015)
37. Dix, A.: Human-computer interaction: A stable discipline, a nascent science, and the growth of the long tail. Interacting with Computer, 22(1), 13–27 (2001)
38. Bénaben, F., Touzi, J., Rajsiri, V., Truptil, S., Lorré, J.P., Pingaud, H.: Mediation information system design in a collaborative SOA context through a MDD approach. In: MDISIS'08, CEUR-WS Vol-340, pp. 89–103 (2008)
39. Becker, H.: Social impact assessment: method and experience in Europe, North America and the developing world. UCL Press, London, UK (1997)
40. Ralyté, J.: Towards situational methods for information systems development: engineering reusable method chunks. In: Proc of 13th ISD. Advances in Theory, Practice and Education (2004)
41. Daneva, M.: Applying real options thinking to information security in networked organizations. No. TR-CTI. Centre for Telematics and Information Technology, University of Twente (2006)
42. Manuj, I., Mentzer, J.T.: Global supply chain risk management. J. of Business Logistics, 29(1), pp. 133–155 (2008)
43. Berio, G., Vernadat, F.: Enterprise modelling with CIMOSA: functional and organizational aspects. Production planning & control, 12(2), 128–136 (2001)
44. Lankhorst, M.M., Proper, H.A., Jonkers, H.: The Architecture of the ArchiMate Language. In: Business-Process and Information Systems Modeling, LNBIP, vol 29, Springer (2009)
45. Feltus, C., Grandry, E., Fontaine, F.X.: Capability-Driven Design of Business Service Ecosystem to Support Risk Governance in Regulatory Ecosystems. CSIMQ (10), 75–99 (2017)
46. Dietz, J.L.G.: Understanding and modelling business processes with DEMO. In: Conceptual Modeling — ER '99, LNCS, vol. 1728. Springer, pp. 188–202 (1999)
47. U.S. DoD: DoDAF framework, version 2.02 (2010). Online: https://goo.gl/WCA46s
48. Scheer, A.W., Nüttgens, M.: ARIS architecture and reference models for business process management. Business Process Management, LNCS, vol. 1806. Springer, pp. 376–389 (2000)
49. Cox, A.: Business relationship alignment: on the commensurability of value capture and mutuality in buyer and supplier exchange. Supply Chain Management, 9(5), 410–420 (2004)
50. Nyman, J.: What is the value of security? Contextualising the negative/positive debate. Review of Int. Studies, 42(5), 821–839 (2016) DOI: 10.1017/S0260210516000140
51. Korkman, O.: Customer value formation in practice: a practice-theoretical approach. PhD thesis, Swedish School of Economics and Business Administration, Sweden (2006)
52. Ziemba E., Eisenbardt M., Mullins R.: Use of Information and Communication Technologies for Knowledge Sharing by Polish and UK-Based Prosumers. In: E. Ziemba (ed.) Information technology for management: New ideas and real solutions, Lecture Notes in Business Information Processing LNBIP, vol. 277, pp. 49–73 (2017)
53. Feltus, C., Proper, H.A.E.: Towards a Security and Privacy Co-Creation Method. In: Proc. of 12th IEEE International Conference for Internet Technology and Secured Transactions (ICITST 2017), Cambridge, United Kingdom (2017)