Extending Enterprise Architectures to Capture Consumer Values: The Case of TOGAF

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Abstract. This paper explores how to make Enterprise Architecture (EA) aware of consumer values. Current proposals in enterprise modeling recognize the need for user needs, although often without taking explicit account of the consumer values that are at the root of the exchange process. Enterprise architecture provides a roadmap for the development of systems that can support the creation and delivery of products of interest. First, a survey of enterprise architecture practitioners highlights the importance and significance of integrating consumer values into enterprise architecture through. Next, the survey results are used to enhance a consumer value meta-model for better integration with enterprise architecture, specifically The Open Group Architecture Framework (TOGAF).

Keywords: Value · Consumer value · Enterprise modeling · Enterprise architecture

1 Introduction

Consumer values are the interactive, preferential experiences that power commerce: the catalysts leading to the value exchanges between consumers and businesses. A priori to the exchange itself, consumer values are foundational to the well being of enterprises because without them, the reason for that business would not exist.

However, for all of their importance, consumer values are little studied within the realm of information science and are most often left to research communities in marketing and psychology. It is the contention of this paper, however, that their inclusion in the design of information technology (IT) is crucial for its ultimate success; without taking the values of consumers into account from the earliest stages of their design, IT artifacts risk irrelevance and purposelessness.

Indeed, as consumers are requiring more qualitative experiences than ever before, the future of successful information systems (IS) design requires greater alignment between business and its supporting IT infrastructure. These in turn lead to the need for new and novel means and methods to capture real values of consumers and then relate such values to requirements for information technology.

Concurrent to this shift towards a more consumer focus is the need for complex software to coordinate the activities of modern enterprises. This has become a necessity for their success, with the competitive conditions of today, where business sectors are

© Springer International Publishing Switzerland 2015
A. Persson and J. Stirna (Eds.): CAiSE 2015 Workshops, LNBIP 215, pp. 221–232, 2015.
DOI: 10.1007/978-3-319-19243-7_22

rapidly reshaping, organizations are becoming global, and consumers have seemingly endless choices, requiring software engineers to incorporate consumer values—personal judgments based on comparative, preferential experiences—into the design of such supporting software.

This research addresses the problem of the lack of consumer values awareness within enterprise architecture by first establishing a conceptual link between the values of consumers and system requirements. It accomplishes this by engaging directly with the enterprise architecture framework TOGAF [21]. A survey of practicing enterprise architects demonstrates the need for consumer values to be included into enterprise architecture, while also evaluating an initial attempt at integrating consumer values into EA. Next, a known meta-model for working with consumer values—the Consumer Preference Meta-Model [19, 20, 24]—is utilized to capture consumer values and provide them to TOGAF.

This paper is structured accordingly: Sect. 2 introduces information relevant to this research from two areas: consumer values as understood through the Consumer Preference MetaModel; and enterprise architecture through TOGAF framework. Section 3 details the process involved in this research's primary contributions, first by presenting a survey of practicing enterprise architects, and then utilizing its results to restructure an existing consumer values model for integration with TOGAF. Section 4 demonstrates the contributions of this research through a case example of an online education system, and Sect. 5 concludes the paper with a discussion and preview to future work.

2 Background

2.1 Values, Consumer Values, and Value Frameworks

At the highest level, value is viewed as the relative status of a thing, or the esteem in which it is held, according to its real or supposed worth, usefulness, or importance. As evidenced in the previous section, this is very different from the business view of values (e.g., value transfers of resources) and, for Holbrook, a value is simply a preference judgment represented by distinct types within the consumption experience [8]. Value is also the perception of a need-satisfying capability in an object. In this guise, value has a "parasitical" existence; it depends on an object as its value carrier.

To clarify the concept of value, frameworks for its description and discussion, as well as means to measure it, are utilized throughout this research. There are a number of possibilities, from various fields such as psychology and organizational theory, including the three needs theory [13] and retailing, including Servqual [15], among others. For illustrative purposes, this report relies on three: Maslow's Hierarchy of Needs [11], Schwartz's Value Theory [16], and the Typology of Consumer Values [8]. These were selected because of their wide acceptance, application across a variety of industries, and robust conceptual frameworks.

In [24] the Consumer Preference-aware Meta-Model (CPMM) is proposed to explicitly address consumer preferences as an important requirement for information systems development. It accomplishes this by addressing preferences—for example, the Needs of Maslow and Basic Values of Schwartz are seen as generic drivers of

human actions, while Holbrook's value framework (Consumer Value) concerns preferences on consumption, i.e. Value Objects. In Sect. 3.3 the CPMM, and its relationship to EA is presented.

2.2 Enterprise Architecture

Architecture is defined as the fundamental organization of a system, embodied in its components, their relationships to each other and the environment, and the principles governing its design and evolution [21]. As the master plan for the whole enterprise, one that takes into account the business in its totality, enterprise architecture enable communication among different stakeholders and promotes a shared terminology. Its primary goal is to align the IT-related activities within the enterprise [21].

TOGAF. The Open Group Architecture Framework (TOGAF) is a framework—a detailed method and a set of supporting tools — for developing an enterprise architecture.

In TOGAF, "architecture" has two meanings depending upon the context:

- A formal description of a system, or a detailed plan of the system at component level to guide its implementation
- The structure of components, their inter-relationships, and the principles and guidelines governing their design and evolution over time.

TOGAF's Architecture Development Method (ADM). TOGAF's Architecture Development Method (ADM) contains nine iterative phases, and is the formalized process of populating the elements of an enterprise's architecture. Key to this research is Phase B: Business Architecture, whose pertinent tasks are: to describe the product and/or service strategy, and the organizational, functional, process, information, and geographic aspects of the business environment, based on the business principles, business goals, and strategic drivers; to select and develop the relevant architecture viewpoints that will enable demonstration of how the stakeholder concerns are addressed in the Business Architecture; and, to select the relevant tools and techniques to be used in association with the selected viewpoints.

TOGAF's Motivation Extension. TOGAF's Content Meta Model (CMM) provides a basic enterprise architecture model with a minimum feature set, one that supports the inclusion of optional extensions during engagement tailoring. One of these is the Motivation Extension, which supports linking drivers, goals, and objectives to organizations and services [21].

Drivers are an external or internal condition that motivates the organization to define its goals. Goals are high-level statements of intent or direction for an organization, typically used to measure success. Objectives are time-bounded milestone for an organization used to demonstrate progress towards a goal. A service is a logical representation of a repeatable business activity that has a specified outcome.

3 Contribution

The values of an individual have an effect on their behavior as consumers through their attitudes, which in turn impact on their choices within the value exchange [1, 10, 17, 23]. Additionally, it has been shown that values relate to real-life choice, and may also influence behavior through different manifestations, such as habits [18].

Many authors have pointed out that cultural and psychological dimensions of consumer behavior should be seen as the core of retail strategy [4, 24] as such data could allow marketers to create new consumer experiences [2, 3].

Consumer values within enterprise architecture are an area that has been discussed but never completely addressed. This is borne out by several facts: first it is known that consumer values are the a priori ingredient necessary for a value exchange to occur. Additionally consumer values are covered tangentially within the Motivation Extension of TOGAF's Content MetaModel, and as well consumer values having been explicitly included in the latest version of Archimate [9], the enterprise architecture modeling language designed around TOGAF. Finally the survey of enterprise architecture practitioners conducted as part of this research indicated a strong belief in the importance of including consumer values into TOGAF (see Sect. 3.2).

Accordingly, the solutions presented in this work focus on capturing consumer values and introducing them into the development of enterprise architectures that support businesses intent on providing goods, services, and experiences to satisfy consumers' needs, on the basis of their values.

Section 3 discusses the creation of the artifacts that are the main contributions of this research study. Section 3.1 provides theoretical and practical justifications for the importance of including consumer values in enterprise architectures. Section 3.2 details a survey of practicing enterprise architects that justifies the inclusion of consumer values within enterprise architecture. The section is concluded Sect. 3.3 in which the results from this survey are used to restructure an existing model—the Consumer Preference Meta-Model—for integration with TOGAF as the CPMM-EA.

3.1 Consumer Values in Enterprise Architecture

The process closest to consumer values that TOGAF provides can be considered the completion of the two viewpoints necessary to complete the Core Content Metamodel's Motivation Extension: the Driver/Goal/Objective Catalog and the Goal/Objective Service Diagram.

Created within Phase B, Business Architecture, of the ADM, the Driver/Goal/Objective catalog provides a cross-organizational reference of how an organization meets its drivers in practical terms through goals, objectives, and (optionally) measures.

The Driver/Goal/Objective catalog contains the following metamodel entities: Organization Unit, Driver, Goal, Objective, Measure (optional) [21].

Also found in Phase B, Business Architecture, the Goal/Objective/Service diagram defines the ways in which a service contributes to the achievement of a business vision or strategy.

Services are associated with the drivers, goals, objectives, and measures that they support, and the Goal/Objective/Service diagram allows the enterprise to understand which services contribute to similar aspects of business performance. It also provides qualitative input on what constitutes high performance for a particular service [21].

TOGAF's ADM is self-admittedly agnostic to the methods employed to fulfill its stepwise and cyclic approach to architecture development. The single process steps are described very generically and hence are not easy to implement without consulting. This flexibility becomes problematic when a topic is considered sufficiently important to include in the framework but concrete methods for fulfilling it are under-researched or are simply not extant.

The purpose of the Motivation Extension is to influence the company's products and services. A problem similar to the ADM is that the Motivation Extension contains no guidelines for how customer values should be captured and classified in order to influence the company's products and services, but is rather a set of to-be-completed entities with no guidance on how to capture them, let alone make them consumer values aware.

3.2 Empirical Study: Consumer Values Potential in TOGAF

In April 2014, a survey of 18 career enterprise architects who are employed by Tieto, the largest IT services company in Scandinavia, was conducted. Founded in 1968, Tieto employs approximately 15 000 people in twenty countries with headquarters in Helsinki, Finland, and through those employees offers IT services that include consulting, operation and maintenance services, system integration, and industry solutions. Tieto uses TOGAF as its primary enterprise architecture framework, both for itself and for its clients. As a large IT consultancy that supports TOGAF internally and externally, the survey respondents were ideal candidates based on their work as practitioners.

Survey Structure. The survey consisted of 12 questions, five covering basic demographic information, five assessing the proposed artifact, and two assessing the inclusion of consumer values within TOGAF. The survey, along with a complete data set, can be downloaded from http://svee.blogs.dsv.su.se/CAME-2014.zip.

Demographic Information. Table 1 summarizes the demographic information collected by the survey: gender, age, job title, education, and experience using TOGAF, for the survey cohort.

Consumer Values Within Enterprise Architecture: Questions 8, 12. These answers highlight the potential benefit of including consumer values within enterprise architectures as seen by experienced practitioners (Table 2).

Artifact Assessment: Questions 6–7,9–11. The artifact that was developed for the survey was named the Consumer Aware Motivation Extension (CAME). It was designed to work within TOGAF's Motivation Extension and was proposed as a way to introduce the concept of consumer values within enterprise architectures that also

Table 1. Summary of survey demographic information

Gender of participants	22.2 % Female 78.8 % Male
Participants' ages	Avg.: 46.1 years Max.: 65 years
Participants' job titles	
Architect (Systems/Software)	44.4 %
Enterprise architect/Enterprise consultant	16.7 %
Technician/Manager/Consultant	38.9 %

Table 2. Summary of consumer values within enterprise architecture

Consumer values should be included in TOGAF	22.2 % Female 78.8 % Male
Level of expertise	44.5 % Experienced/ Expert

would elicit feedback from TOGAF experts: they would be familiar with TOGAF's vocabulary, but the method was completely new.

CAME was developed by mapping concepts from the value frameworks of Schwartz [16] and Holbrook [8], as used in the CPMM, to the Motivation Extension of TOGAF's Content Meta Model. This allowed for a structure based on TOGAF, but that included a known mechanism for both capturing and describing consumer values. The goals of comprehensibility and ease of use for the survey participants were accomplished by designing CAME using terms from TOGAF, along with a notation similar to what was contained within its standards documentation (Table 3).

Table 3. Summary of artifact assessment

Is CAME understandable?	88.8 % Partly/fully
Is CAME appropriate to use for capturing CV?	83.3 % Yes
Would you use CAME?	66.7 % Probably/definitely

Summary of Results. Analysis of the results leads to the following conclusions: consumer values do and should affect the company's Drivers, Goals and Objectives; CAME is understandable; CAME is informative/instructive; CAME is partly a good model for capturing consumer value and further affect the company Drivers, Goals, and Objectives; it is not clear how CAME can be used in practice; CAME needs to be tested in practice.

The outcomes of the survey were sufficient to conclude that proceeding with integrating consumer values into enterprise architecture was a useful goal, and that using a tested tool for accomplishing the integration would be the preferred means to accomplish this. Additionally, the survey supports the primary contention of this research: that consumer values should be included in the design of enterprise architectures.

3.3 Consumer Preference Meta-Model for Enterprise Architecture

CPMM was then adapted to the findings of the survey and to the vocabulary of TOGAF, becoming CPMM-EA. Its foundational concept is Holbrook's view consumer values as interactive, preferential experiences. Several entities were renamed, and complete definitions can be found in Table 4.

In the original CPMM, following business value modeling studies [6, 7, 14], the exchange of a product, a good, or a service is a transaction involving two primary actors: a provider and a consumer, economically independent entities. The exchange assumes transfer of the value object—the product's ownership or rights for its use—from the provider to the consumer, in return for direct or indirect compensation.

Consumer is a role representing a group of people in the consideration for the evaluation of the value object, based on individual preferences. Any value framework can be taken into consideration, and can categorize its values as a measure; these can be quantitative and/or qualitative. For example, REA could be applied in its standard form [12], or through the use of an enterprise architecture ontology [6].

A segment encompasses the information characterizing a subclass of consumer, further distinguishing it from demographics and context of use properties. A segment is used to refine the measures to elicit a variety of subclasses of consumers. Demographics encompass consumer characteristics, such as age, ethnicity, education, and similar. Context of use reflects an individual's context [5, 9], where the main attributes for context of use are location, where the consumer will use a value object and environment, and which objects, devices, services, and regulations and under which weather conditions the value object will be used. Finally, identity is covered by demographics, i.e., who the consumer is.

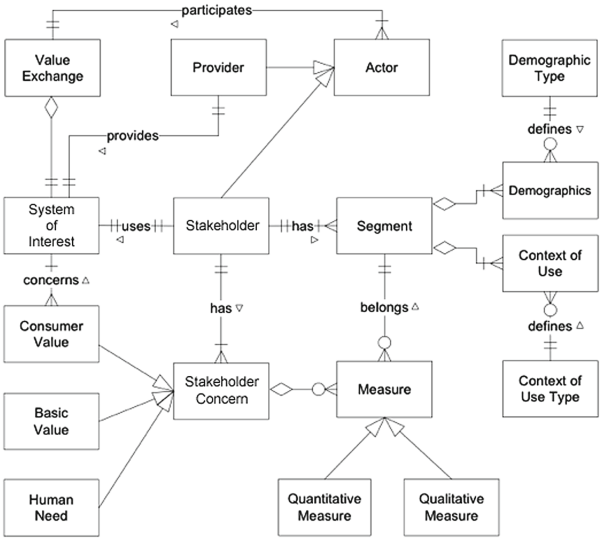

Fig. 1. Consumer preference MetaModel for enterprise architecture [CPMM-EA]

In the transition from CPMM to CPMM-EA, *Consumer* became *Stakeholder*, and because there is no *Value Object* per se in enterprise architecture, TOGAF's term *System of Interest* was adopted. *Value Exchange* is still utilized, though only for the

Table 4. Summary of CPMM-EA classes, with descriptions

Class	Description
Actor	Contains the independent entities that are the primary participants within the exchange of goods, money, rights, or services
Consumer value	Examples of value types that CPMM-EA is capable of utilizing, in this case Holbrook. Basic Values [] and Human Needs [] are also instances in this particular example
Context of use	Information based used to classify the segment sub-class of stakeholder
Context of use Type	Information specifically tailored to suit the needs identified in Context of Use
Demographics	Information based on aggregated data used to classify the segment sub-class of stakeholder
Demographic type	Information based on aggregated data, specifically tailored to suit the needs identified in demographics
Measure	Quantifies and conceptualizes values, with sub-classes of means contained within each of the various frameworks that can be used for conceptualization and quantification
Provider	An independent entity that participates in the value exchange by providing the goods, money, rights, or services in exchange for compensation
Quantitative measure	Information that measures the stakeholder's preferences that is quantitative in nature and supports the stakeholder's concerns
Qualitative measure	Information that measures the stakeholder's preferences that is qualitative in nature and supports the stakeholder's concerns
Segment	Encompasses the information characterizing a subclass of stakeholder, refining the measures used to elicit a variety of subclasses of consumers
Stakeholder	An independent entity that participates in the value exchange by consuming the goods, money, rights, or services in exchange for compensation
Stakeholder Concern	Captures the preferences that drive a stakeholder's evaluative process as they seek fulfillment. Key interests that are crucially important to the stakeholders in the system-of-interest, and determine the acceptability of the system. Concerns may pertain to any aspect of the system's functioning, development, or operation, including considerations such as performance, reliability, security, distribution, and ability to evolve. Used in place of the more commonly known Value Driver
System-of-Interest	Constitutes the focus of the process wherein the stakeholder evaluates whether the system-of-interest satisfies the motivation, value, or need driving their desire to participate in the exchange process. Generally a collection of components organized to accomplish a specific function or set of functions
Value Exchange	Captures the transaction between two parties (a stakeholder and a provider) where ownership is exchanged

appraisal of the *System-of-Interest/Value Object*, as per the interactive, preferential experience derived from Holbrook.

Constraints Within CPMM-EA. Apart from the cardinality constraints included in the meta-model, a set of constraints is also introduced to capture the permissible instantiations of concepts found in the frameworks.

At least one instance of both *Stakeholder* and *Provider* must belong to the same context. Moreover, an instance of *SystemOfInterest* provided by an instance of *Provider* which is an instance of *Actor* which belongs to an instance of *Context* is the same instance of *ValueObject* obtained by an instance of *Stakeholder* which is an instance of actor that belongs to the same instance of *Context*.

Additional constraints include that at least one instance of both *Stakeholder* and *Provider* classes must belong to the same *ValueExchange*. Moreover, Provider provides an instance of *SystemOfInterest* that is part of *ValueExchange*, that is the same instance of *SystemOfInterest* that a *Stakeholder* uses.

An example of the differences between the two populations can be seen in their understanding of the value Universalism/Ethics. Not only was the value prioritized differently (the non-master's students consider it their most important value, whereas for master's students it is their third), but also the ways they choose to express it are quite different. Master's students are more inclined to see ethical lapses as something that the university should manage.

4 Discussion

Enterprise architecture frameworks such as TOGAF [21], etc. are aligned with the concepts of the ISO/IEC 42010 architecture description model. Because of this close relationship TOGAF carries forward concepts from that standard; for example, its definition of stakeholder is nearly identical— "people who have key roles in, or concerns about, the system" [21]. They also share a problem: both lack an explicit consumer value-aware orientation. Certain EA standards do address this issue, though not explicitly, containing concepts which can contain consumer values but which do not explicitly call for them. Prior work has been done to align the ISO standard with consumer preferences [19].

TOGAF is an excellent exemplar of an awareness of consumer values without a concrete implementation; several TOGAF concepts relevant to this research are *Motivation Extension* which contains *Drivers*, or external or internal conditions that motivate an organization to define its goals; *Goals*, or high-level statements of intent or direction for an organization that are typically used to measure success; and *Objectives*, which are time-bounded milestones for an organization used to demonstrate progress towards a goal. The logical progression is that the *Organization* is motivated by the *Driver*, which creates the *Goal*, which is realized through the *Objective*. These benefits can only be accrued when the values are properly elicited and captured, a critical advantage provided by the use of CPMM-EA.

One additional benefit of CPMM-EA is that it both provides means to model those consumer values that are discovered. Archimate, the enterprise architecture modeling

language for TOGAF, recognizes the importance of CV: it adds the consumer values concepts that TOGAF is missing: it models *TOGAF:Concern* as *Archimate:Driver*, which leads to *Archimate:BusinessGoal*. These goals are realized by *Archimate: Principle*, which are in turn sharpened as specific *Archimate:Requirement* [9]. However, because it is used for representation, it also does not contain a method of capturing consumer values, something that CPMM-EA does.

5 Conclusions and Future Work

This work proposed to assist in the development of enterprise architectures by modeling values of consumers as a starting point. The presented consumer values-aware requirements framework consists of a value-based Consumer Preference Meta-Model for Enterprise Architecture (CPMM-EA), and a method for its use to capture preferences of stakeholders.

A survey of practicing enterprise architects designed around a simplified version of CPMM-EA (CAME) lead to the following conclusions: consumer values do and should affect the company's Drivers, Goals and Objectives; CAME is understandable; CAME is informative/instructive; CAME is partly a good model for capturing consumer value and further affect the company Drivers, Goals, and Objectives; it is not clear how CAME can be used in practice; CAME needs to be tested in practice.

Future work in the area of enterprise architecture will focus on further developing CPMM-EA into a tool that will address needs indicated by the practitioners in the survey: although it addresses their desire to have consumer values introduced to enterprise architecture, the tool itself must be straightforward as well as lightweight and easy to use in the field. Such a tool would necessarily need to be evaluated on a conceptual level, as well as its usefulness in practice.

The outcomes of the survey were sufficient to conclude that proceeding with integrating consumer values into enterprise architecture was a useful goal, and that using a tested tool for accomplishing the integration would be the preferred means to accomplish this. Additionally, the survey supports the primary contention of this research: that consumer values should be included in the design of enterprise architectures. Future work in these areas is already being planned.

Additionally, the survey of experienced enterprise architects is unique in the literature: any explicit inquiry about the incorporation of consumer values into enterprise architectures in general, and TOGAF specifically, is not extant in the literature. This supports the novelty these initial explorations in the area of enterprise architecture, first from the ISO 42010 standard, next to its framework as expressed in TOGAF, and furthermore with its modeling language Archimate. CPMM-EA is the next vital step in bringing consumer value awareness to enterprise architectures by both providing such values into a conceptual model, but also by having that model be useful for populating the artifacts of the larger enterprise framework.

Future work in the larger subject of consumer values includes their further introduction, integration, and development into areas such as requirements engineering and software engineering, among others.

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