

Innovative Ideas in Requirements Engineering For E-Commerce Applications

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ABSTRACT: Innovative ideas are characterized by commercial products yet unknown to the market, enabled by information technology. How to develop such products is hardly known. We propose a interdisciplinary approach, e3-value, to explore an innovative Ideas with the aim to understand such an idea thoroughly and to evaluate it for potential Profitability. Our methodology exploits a requirements engineering's way of working, but employs concepts and terminology from business science, marketing and axiology. It shows how to model business requirements and improve Business-IT alignment, in sophisticated multi-actor value constellations that are common in electronic commerce.

I. INTRODUCTION

A challenge in putting e-commerce ideas into operation, in addition to satisfying a profitability requirement, is that business and technology closely interlock. This greatly expands the e-commerce 'design space'. A new technological feature enables more than one business idea, while new business ideas are only possible if technological constraints are satisfied.

This close interaction between on the one hand designing a sound value proposition and on the other hand designing an information system enabling this proposition is very typical for e-commerce projects, and results in more than only an information system or business design problem. Moreover, Innovative e-commerce ideas tend to be formulated very vaguely initially. Such an idea is a statement about a combination of an innovative value proposition utilizing a new technological possibility, but it often lacks a precise description. As a result, many innovative e-commerce ideas are somewhat unfocused and inaccurate. This makes it different to put the idea into operation, and to develop a supporting information system. What is needed is an in-depth exploration process of an e-commerce idea, to understand the idea better as well as to formulate it more precisely, and to focus the idea into a direction that is feasible from an economical and technical perspective.

This paper, discusses how such an innovative e-commerce idea can be explored taking into account business and technological perspectives. Our e3-value approach to do so is on the one hand based on the analysis of economic value creation, distribution, and consumption in a multi-actor network. On the other hand, e3-value is founded on requirements engineering and underlying conceptual modeling techniques, borrowed from the information systems community.

Requirements engineering is the process of developing requirements through an iterative co-operative process of analyzing the problem, documenting the resulting observations in a variety of representation formats, and checking the accuracy of the understanding gained. In this thesis, we focus on the use of a requirements engineering and conceptual modeling approach to articulate, analyze and validate a value proposition more thoroughly. One of the observations we have made during e-commerce idea exploration tracks is that initially these tracks are about finding an Internet enabled value proposition. Therefore, in this thesis much attention is paid to finding, representing, analyzing and evaluating such a value proposition. We describe a value proposition using a conceptual value model that shows how actors create, distribute, and consume objects of economic value.

The motivation to use a more formal, conceptual approach for exploring a value proposition is two fold. First, modeling a value proposition explicitly, may contribute to a common understanding of the proposition by all stakeholders involved. While doing so, special attention should be paid to stakeholders with an information technology interest. Such stakeholders should understand the proposition well, because they have to design and implement an information system that puts the proposition into operation. Moreover, these stakeholders often have in-depth technological knowledge and thus can provide valuable input for designing an Internet enabled value proposition. Because this stakeholder group is used to more formal conceptual models, we hope that a conceptual value proposition model may help their understanding of the e-commerce idea. Second, a more formal model of the e-commerce idea allows for evaluation of the idea, which is in our case biased towards assessment of potential profitability of the idea. In addition, e3 value is a lightweight approach. In our experience, e-commerce idea exploration tracks typically may take a few weeks to a month, so an approach supporting idea exploration should facilitate a relatively short exploration track.

II. Innovative Ideas for Requirements engineering

Values for requirements engineering exploits the concept of economic value during the requirements engineering process and is especially useful when doing requirements engineering for innovative e-commerce information systems. Such systems have in common that they presuppose a new, hardly understood, e-commerce idea with which actors potentially can make a profit, or when put into operation, produces something of economic value for actors. In fact, a new and profitable information technology intensive value proposition has to be invented, and stakeholders have to agree on this. In this paper, i concentrate on the very first phase of developing innovative e-commerce information systems. Typically, such a track starts with one or more, often vaguely articulated, innovative ideas, utilizing new technological possibilities.

III. Requirements engineering

Requirements engineering stands for an approach, often used by information technologists, to develop information system requirements, which can be used as a Starting point for system design and implementation. We think that requirements engineering as an approach can be of help in finding, formulating and assessing e-commerce requirements. Requirements engineering is the process of developing requirements through an iterative co-operative process of analyzing the problem, documenting the resulting observations in a variety of representation formats, and checking the accuracy of the understanding gained. Figure1 shows the process of requirements engineering in general.

IV. E-Commerce idea exploration observations

Observation 1: Exploration of innovative e-commerce ideas is initially about finding a value proposition. Explanation. As defined before, innovative e-commerce information systems have in common that they exploit a new value proposition. Consequently, e-commerce development tracks start with a new e-commerce idea, which is often articulated vaguely and is subject to change and refinement. Compare this to the development of more traditional systems, which can rely on a known enterprise mission and enterprise goals to derive system requirements.

Observation 2: Knowledge of information technology plays a crucial role in e-commerce idea exploration.

Observation 3: A concern of stakeholders regarding an e-commerce idea can sometimes be addressed on the business level and on the technical level. Explanation. If a concern comes up during the exploration of the e-commerce idea, it may be possible to address this issue by technical measures, but sometimes it is possible to solve this issue by changing the value proposition slightly. This results in an explosion of the design space: in traditional system development tracks it is difficult enough to make system design decisions in a systematic way; in an e-commerce development track even more design options become available because we can easily change the value proposition.

Observation 4: e-Commerce models are created rather than elicited. Explanation. Elicitation of e-commerce models supposes that stakeholders have dormant knowledge of an innovative e-commerce idea. It is our experience that in most cases, such an idea has to be invented rather than that such an idea can be elicited. It requires a paradigm shift of stakeholders. The paradigm shift theory recognizes that people think within an accepted frame of reference and that to be able to find new ideas, people have to step out of that frame of reference.

Observation 5: A wide range of stakeholders is involved, thereby mixing up discussions. Explanation. In a typical innovative e-commerce exploration track stakeholders range from CxO's (e.g. Chief Executive/Financial/Operation Officers) to information technology persons. The first group of stakeholders is involved because innovative e-commerce projects are about new value propositions which touch the core of companies: how they are making money. The information technology oriented stakeholders play a role to ensure that the enabling or enforcing role of information technology is accounted for.

These stakeholder groups have very different foci, which result in mixed-up and inefficient discussions between those stakeholders.

Observation 6: An e-commerce model is often specified very informally, thereby leading to different interpretations by stakeholders, and hindering analysis and evaluation. Explanation. Specification of an e-commerce model, if done at all, tends to be very informal. Often, especially for the value proposition perspective, natural language is used. Such a specification leads to different interpretations by various stakeholder groups. Also, it makes a specification more difficult to analyze and to evaluate. Moreover, information technology oriented stakeholders require a more precise specification to develop e-commerce information systems.

Observation 7: A model-based specification mechanism for the value proposition is lacking. Explanation. Model-based specification techniques, such as the Unified Modeling Language (UML) exist to represent various information technology requirements from different angles, but there is no technique available for representing a value proposition in such a way. Modeling a value proposition is needed, amongst others to reach common understanding, to be able to evaluate the e-commerce idea more thoroughly, and to allow for a more detailed system requirement elicitation track.

Observation 8: Innovative e-commerce idea exploration is to be carried out in a limited timeframe; typically a few weeks. Explanation. To bring an initial e-commerce idea into execution a limited timeframe (typically three to six months) is available. Consequently, the exploration of the idea can take only a fraction of this timeframe. This limitation is caused by rapidly increasing technological possibilities, which cause ideas to become obsolete fast. Moreover companies want to create a high volume operation fast, before a competitor takes market share by developing a similar idea. Therefore, companies typically demand a quick, first execution of the e-commerce idea comprising the essentials of the idea, rather than a long-term implementation track, which delivers a full blown operation.

Observation 9: Validation of an e-commerce model initially focuses on feasibility. Explanation. The main concern of stakeholders is the issue whether the e-commerce idea is feasible from an economical, but also from a technical perspective. Feasibility study can also mean an investigation of other major concerns, e.g. security.

V. Requirements engineering for e-commerce applications

The key question to be answered in the early phases of requirements engineering for innovative e-commerce applications is the feasibility of the e-commerce idea. This question must be answered for new and fuzzy e-commerce ideas, with many different types of stakeholders involved, and in a short timeframe. Also, stakeholders must have a common understanding of the e-commerce idea, before they can start a more detailed requirements engineering track. In this section we discuss how we address these issues in this thesis. Elements of our solution are:

- A lightweight approach to carry out the exploration track in a limited timeframe;
- A graphical conceptual modeling approach to create a common understanding of an e-commerce idea, and to allow for evaluation of an e-commerce idea;
- A multi-viewpoint approach to deal with a wide range of stakeholders;
- A scenario approach to create a more common understanding of an e-commerce idea, to capture a value proposition, and to evaluate such an e-commerce idea;
- An economic value aware approach to capture a value proposition and to evaluate a value proposition.

VI. A lightweight approach

E-Commerce tracks are characterized by short development times. A typical timeframe is three to six months: from idea to a first implementation. Only a portion of this timeframe is available for exploration of e-commerce ideas. So, within a certain timeframe, only limited manpower is available. Consequently, the first phase of e-commerce requirements engineering should be a lightweight approach.

VII. A graphical conceptual modeling approach

A conceptual modeling approach comprises the activity of formally defining aspects of the physical and social world around us for the purpose of understanding and communication. Formal in this context means the abstraction, structure, and representation of knowledge. The activity of modeling is well known and accepted in the requirements engineering community for describing information system requirements, but it is our experience that business-oriented stakeholders are often unaware of this approach. Such stakeholders use natural language requirement representations. There are a number of drawbacks with such representations, such as noise (irrelevant information), silence (omission of important information), over-specification, contradictions, ambiguity, forward references.

Conceptual modeling approach can be useful for the exploration of e-commerce ideas, provided that models can be easily communicated to business-oriented stakeholders. Goals to exploit a conceptual modeling approach are:

- To enhance the common understanding of an e-commerce idea amongst stakeholders (compared to informal, textual outlines of the e-commerce idea)
- To be able to evaluate an e-commerce idea with respect to economic feasibility. For both purposes, it is necessary to have a language, which can be used to express conceptual models, specifically for the value viewpoint. The semantics of this language should be well and commonly understood by stakeholders to facilitate a common understanding of models expressed in the language.

Moreover, to facilitate a common understanding, we choose our language constructs in such a way, that they closely resemble the perspective stakeholders have on the e-commerce idea. To allow for evaluation of the e-commerce idea, semantics should be chosen in such a way that assessment of economic feasibility is possible. In doing so, we use a semi-formal conceptual approach rather than a strictly logical approach because many stakeholders involved in this phase of idea exploration do not understand very formal models well. To allow for easy communication with stakeholders, we opt for a lightweight approach, but also a language with a graphical syntax. Many approaches used in the realm of information systems employ a graphical approach for representing requirements to contribute to an easy communication with stakeholders.

VIII. A multi-viewpoint approach

It is widely accepted that the exploration of requirements can be very complex, amongst others caused by a wide range of perspectives taken by various stakeholders. These perspectives are grounded in differences in skills, responsibilities, knowledge and expertise of stakeholders. This holds even more for the development of innovative e-commerce information systems, where besides stakeholders with a technical or traditional business background, also value proposition oriented stakeholders like marketers and Chief x Officers (where x=Executive, Financial, Operational, Information, Technical) are involved. It is our experience that during innovative e-commerce projects.

The development of an IT-intensive value proposition requires the involvement of amongst others strategic decision makers, Requirement engineers deal with such a unfocused group stakeholders by developing multiple viewpoints.

Viewpoints deal with the aforementioned multi-perspective problem by decomposing complicated requirement issues into self-contained perspectives, which can be addressed and decided on relatively independent from each other, According to them, a viewpoint is a loosely coupled, locally managed object which representation scheme, and partial knowledge of the process of design. One of the problems with viewpoint approaches is to find suitable viewpoints in the first place, because we want to use viewpoints as a way to clarify and organize stakeholder discussions, we use the various kinds of stakeholders as an important driver for viewpoint identification.

The value viewpoint: The top-level viewpoint of our electronic commerce framework concerns the value viewpoint. The value viewpoint focus is the (new) way of economic value creation, distribution and consumption. The contribution of this viewpoint to the evaluation of an e-commerce idea is a statement of revenues and expenses, caused by the exchange of valuable objects between actors.

The business process viewpoint: The business process viewpoint focuses on business processes, which are needed to put into practice, a new value proposition, and focuses on ownership of these processes, to be able to contribute operational and capital expenses to the performing actor.

The information system viewpoint: The information system viewpoint focuses on constituting components of an information system to be developed at course granularity. Techniques are available to represent this viewpoint, such as the UML.

A scenario approach: A scenario approach distinguishes in to 2 types:

- Operational scenarios
- Evolutionary scenarios.

By describing system behavior, operational scenarios may contribute to a better understanding of such a system by stakeholders. Evolutionary scenarios are used to envision events in the life of a system that may cause the system to change. The notion of system should be interpreted in a broad sense; we see a network of actors exchanging things of value with each other as a system also. The e3-value methodology utilizes both types of scenarios.

IX. An economic value aware approach

In most cases, requirements engineering focuses on information system requirements. Over the past few years it has been understood that is also important to know the business goals an information system should contribute to. This is reflected in the realm of goal-oriented requirements engineering. In goal-oriented requirements engineering approaches.

X. Conclusions

This paper is about the exploration of innovative e-commerce ideas, which utilizes principles from both requirements engineering and conceptual modeling, and focuses on the exploration of an information technology intensive value proposition. We call such an exploration track value-based requirements engineering. Based on observations made during e-commerce idea exploration tracks, we motivate the need for an e-commerce model, rather than a vaguely described idea. Development of such a model serves two goals: (1) Enhancing agreement and a common understanding of an e-commerce idea amongst a wide group of stakeholders, and (2) Enabling validation of the e-commerce idea in terms of evaluating economic feasibility. Additionally, an e-commerce model can be used as a starting point for a more detailed requirements engineering process. Based on experiences in exploring e-commerce ideas, such a model-based approach should be:

1. A lightweight approach to address the only limited time-span available for doing exploration tracks;
2. A graphical conceptual modeling approach to enhance a common, more precise understanding of the idea amongst stakeholders, and to allow for validation by evaluation of the e-commerce idea;
3. A multi-viewpoint approach to deal efficiently with the different interests of a multi-stakeholder group. We distinguish three viewpoints, being (1) the business value viewpoint, (2) the business process viewpoint, and (3) the information system viewpoint.
4. A scenario approach, which can be subdivided in an operational scenario approach and an evolutionary scenario approach. Operational scenarios are used to relate stakeholder viewpoints, and to express viewpoint specific semantics. We employ evolutionary scenarios to do a what-if assessment for an e-commerce idea.
5. An economic value aware approach, to explicitly account for the financial effects of the execution of an e-commerce idea, thereby gaining insight and confidence into the feasibility of an e-commerce idea. To present the model in such a way that stakeholders reasonably can understand the model; we have also developed a way to visualize value models. Furthermore, based on economic value-based modeling approach is sometimes confused with business process modeling approaches. A value model is about who is creating something of value for whom, in a profitable way, while a business process model shows the activities, the sequential ordering of these, and resources needed to put a value model into practice.

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