TOWARDS A SEMANTIC STANDARD FOR ENTERPRISE CROWDSOURCING – A SCENARIO-BASED EVALUATION OF A CONCEPTUAL PROTOTYPE

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Abstract

To cut expenses and save time, enterprise crowdsourcing is more and more used to disseminate corporate tasks, which are traditionally performed by a small group of people, to an undefined large workforce within and beyond the boundaries of a company. However, harnessing the positive effects of crowdsourcing faces several challenges, such as the efficient and proper assignment of a crowdsourcing task to an available and competent group of workers, or the securing of the integration and reuse of crowdsourcing data across heterogeneous business applications. To overcome these challenges, a semantic standard for enterprise crowdsourcing is developed and its applicability is shown by evaluating it against three diverse scenarios that may occur in real business environments. The proposed standard finally includes fifteen semantic elements to describe a crowdsourcing task and eight elements to define a user.

Keywords: Enterprise Crowdsourcing, Crowdsourcing System, Standardization, Design-Science Research, Scenario-based Evaluation

1 Introduction

Crowdsourcing is a vigorous research area and a powerful mechanism for outsourcing tasks that are traditionally performed by designated employees to a large and undefined group of potential contributors (Das and Vukovic, 2011). Enterprise crowdsourcing in particular involves both harnessing the collective intelligence and workforce inside – across business divisions and hierarchical structures – and outside the company (Jayakanthan and Sundararajan, 2011). It can be used for a variety of applications, such as collecting and evaluating ideas, creating knowledge repositories, or collaboratively developing new products. The main advantage of crowdsourcing lies in the way how it significantly changes the business processes by harnessing the skills, knowledge, or other resources of a distributed crowd of workers to achieve an outcome at lower cost and in shorter time (Vukovic and Bartolini, 2010). The development of a crowdsourcing system as well as its integration into an existing information and communication technology (ICT) infrastructure, however, can be a risky and challenging undertaking. First, the relevant tasks have to be reallocated to an undefined large group of corporate internal and external workers. Identifying an appropriate worker or a well-organized working group to whom to propose either manually or automatically a certain crowdsourcing task is a complex process that requires a lot of additional context-sensitive information, such as the task requirements, users' qualifications, or underlying social network relationships. Second, some of the data, which are required for an efficient crowdsourcing, already exist in other business applications and should be reused. Third, several attributes of the task specification, such as the target audience, the type and nature of the reward, or the confidentiality, determine the success of a crowdsourcing initiative and should be carefully configured by the requester of the task. In order to meet these challenges, a semantically rich standard for enterprise crowdsourcing is proposed in this article. The standard includes a well-defined set of semantic elements that are commonly shared and equally understood among software developers and architects. It aims to support the automation of an enterprise crowdsourcing system as well as the interoperability with other ICT systems. As the standard is based on knowledge about the best or most appropriate practices it also helps to raise the overall quality of the enterprise crowdsourcing system that will be developed (Sommerville, 2011).

The remainder of this article is structured as follows: Crowdsourcing faces a lot of challenges that must be addressed in practice. Thus, a selection of these challenges that motivates for a standard are depicted in chapter 2. The subsequent chapter 3 describes how design-science research is applied to develop and evaluate a standard for enterprise crowdsourcing. After that, the two concepts of the standard, the crowdsourcing task and the user, are described in-depth. For each of the two core concepts, several semantic elements and corresponding values are specified. Finally, in chapter 5, three different scenarios are built to evaluate and to demonstrate the applicability of the suggested elements of the standard. The article concludes with a summary of the main insights that are derived from the scenario-based evaluation and gives future prospects in the research and standardization of enterprise crowdsourcing.

2 Challenges

Current research literature in the domain of crowdsourcing poses several challenges that have to be addressed when developing crowdsourcing systems in practice. To further motivate and to emphasize the necessity for a semantic standard, five of the main challenges of enterprise crowdsourcing are explained in detail:

1. *Allocation of Tasks*. Proposing the right task to the right person at the right time is a key challenge for the success of a crowdsourcing initiative (Nielsen, 2011). In this regard, Liu et al. point out two aspects to improve the appropriateness of the task allocation: the capacity and availability (Liu et al., 2010). Whereas the capacity denotes to the issue if a worker has the ability to accomplish the task, the availability indicates if a worker has the time to do the work and if the task is proposed at a convenient time. Both aspects have to be considered for an intelligent task

routing mechanism that suggests a crowdsourcing task to the most likely audience. This mechanism should be based on an elaborate specification of task requirements and user expertise that increase the efficiency and the quality of the provided solutions (Cosley et al. 2007). A standard for enterprise crowdsourcing may provide elements to support the semantically rich representation of data that are required for an appropriate task assignment.

2. *Dynamic Team Formation*. Group formation or self-organization of people with either similar or diverse, cross-functional skills, knowledge, or experiences is often a prerequisite to solve large and complex tasks. Unfortunately, most of the existing crowdsourcing systems fall short of facilitating the flexible, dynamic, and proactive assembly of globally distributed teams (Vukovic, 2009). A first step towards an improvement may include detailed descriptions of the workers' qualifications or information that is derived from their social networks. A semantic standard may support the structured recording of experiences, skills and knowledge.
3. *Data Integration and Exchange*. Data integration across diverse social software, business, and crowdsourcing applications as well as data exchange between them remains a key issue for future research. Crowdsourcing solutions often require the most recent data that exist in external business applications, such as enterprise dictionaries, knowledge repositories, or expert systems (Vukovic, Laredo, et al., 2010). Therefore, when developing crowdsourcing systems, careful attention should be paid to the seamless integration of such applications. The introduction of a generic semantic standard for enterprise crowdsourcing may support this integration.
4. *Structured Task Specification*. The quality of the contributions of the crowd is highly dependent on the quality and detail of the task design. To improve quality it is necessary to provide a structured task specification and integrate the task with other business processes (Vukovic, Lopez, et al., 2010). A well-defined semantic standard may guide the issuer of a crowdsourcing task towards a better task design.
5. *Transaction Transparency*. Crowdsourcing is often a complex process that addresses diverse participants who range from amateurs to experts, requires a variety of resources, involves several incentive methods, and uses various schemes to evaluate a user as well as their contributions. Most crowdsourcing workflows require a lot of experimentation, performance evaluation, and adjustment to work efficiently (Kittur et al., 2012). Thus, to increase the success and the quality of a crowdsourcing effort, a designer of these workflows needs an appropriate degree of transparency. A semantic standard for enterprise crowdsourcing helps to improve the transparency of a crowdsourcing process. It allows to track the status of the contributions of the crowd and provides a foundation for a clear visualization of all elements within a crowdsourcing process.

3 Methodology

In this article, the design-science research (DSR) approach is applied to develop a semantic standard (design artifact) that can be used to describe two of the main concepts in an enterprise crowdsourcing process: the task and the user (Hevner et al., 2004). Data that are stored in databases of either the crowdsourcing system itself or other external applications are currently not sufficiently represented and exchanged between different crowdsourcing systems and business applications. Furthermore, an efficient mapping of submitted tasks onto available users is based on semantically rich descriptions of tasks and users (problem relevance). Therefore, to improve the allocation and self-selection process of crowdsourcing tasks and to increase the interoperability between enterprise crowdsourcing and other ICT systems, a standard is proposed and evaluated against heterogeneous scenarios that may occur in real business environments (research contribution and design evaluation). The rigor in this article is guaranteed from the diligent and effective use of knowledge that was gained by a previously undertaken literature review as well as from an appropriate selection of the research method, which is in this case, an evaluation through scenario building (research rigor). The reason for choosing a scenario-based evaluation as a first proof of concept lies in the fact that the development of a standard is highly complex and cost intensive. However, this paper presents just the first cycle in a development process of a semantic standard for enterprise crowdsourcing. Further cycles will follow to improve the

applicability of the standard successively. The examination of real business case studies and practical examples will give insights for future improvements. Additionally, the prototype creation of a metadata schema using a schema definition language, such as the Extensible Markup Language (XML) schema or the Resource Description Framework (RDF) schema as well as the evaluation of the prototype through creating instances of real business examples are the next necessary measures to meet the challenges (search process). This article provides results to the technical-oriented as well as the management-oriented audiences. On the one hand, software developers get a detailed description of elements and attributes that can be consulted to construct own instances of the two main concepts: the crowdsourcing task and the user. On the other hand, managers acquire the basis for decision-making towards the standardization of enterprise crowdsourcing solutions (research communication). All DSR guidelines that are addressed in this article are summarized in Table 1.

DSR Guideline	Embodiment
Design as an Artifact	Building a semantic standard for enterprise crowdsourcing
Problem Relevance	Addressing the above mentioned challenges, such as task allocation, data integration and exchange, or transaction transparency
Research Contribution	Standardization to improve the allocation and self-selection of crowdsourcing tasks as well as the interoperability between the enterprise crowdsourcing system and other business applications
Design Evaluation	Scenario building is used as a method
Research Rigor	Based on results of previous studies in crowdsourcing
Search Process	First step in a development process of a unified semantic standard for enterprise crowdsourcing; further cycles will follow to improve the applicability of the standard successively
Research Communication	Research results for technical-oriented and management-oriented audiences are communicated through conferences, journals and prototype implementations

Table 1. Application of design-science research guidelines according to Hevner et al., 2004

4 Semantic Standard

This section introduces the two core concepts of the proposed semantic standard: the crowdsourcing task (section 4.1) and the user (section 4.2). From an extensive study of literature in the field of crowdsourcing, fifteen elements for specifying a crowdsourcing task and eight elements for defining a user are derived.

4.1 Task Concept

A meaningful *task description* is efficient for implicit crowd filtering as potential workers select tasks that are most appropriate to them (Eickhoff and De Vries, 2011). It contains initial states, detailed instructions, the goal to be reached, possible constraints as well as certain acceptance criteria (Robertson, 2001). Each crowdsourcing task can be addressed exclusively to the employees of the enterprise, to the public domain, i.e., people who are not employees of the company, or to both the employees and the public community. Thus, the *target audience* of enterprise crowdsourcing can be set as an internal, external or hybrid crowd (Vukovic and Bartolini, 2010). Crowdsourcing tasks often differ in *complexity* and range from mundane to complex tasks (Brabham, 2008). Other classification

schemes group crowdsourcing tasks into simple, moderate and sophisticated tasks (Rouse, 2010), or in simple, complex and creative tasks (Schenk and Guittard, 2010). A division into three complexity degrees is adopted in this standard, namely simple, moderate and complex. Besides the level of complexity, each task is also classified regarding its *type of action* that is performed, such as share, create, evaluate or organize (Doan et al., 2011). Moreover, a task may be assigned directly or indirectly to the crowd. In some cases, two or more tasks are bundled to one collection before assigning it to a potential worker, and in other cases, the task is split in several subtasks so that multiple workers can process each of them independently at the same time (Vukovic and Bartolini, 2010). This aspect is indicated by the element *modularization*.

The next two elements of the standard refer to the nature and type of the reward. The *nature of the reward* describes how the contribution of a worker is rewarded. A reward may either be fixed, such as a certain amount of money after completing a task, or performance-based, such as a prize that depends on the ranking in a competition. If no reward is stated, the task is marked as voluntary. In contrast to the nature of the task, the *type of the reward* specifies what is rewarded. On the one hand, a reward may be of immaterial value, such as providing virtual points that improve the worker's reputation, money in the form of a bonus that increases the salary, or access to a resource, which may or may not be related to the actual crowdsourcing initiative itself. On the other hand, physical goods can be chosen to compensate workers for their spent efforts and resources (Corney et al., 2009).

Four elements of the crowdsourcing task relate to the time aspect. For some tasks, such as the collaborative creation of a knowledge repository, the focus lies on the accuracy of the contribution. In this case, the *latency* between issuing a task and getting an answer to the task does not matter. These tasks are defined as waitable. In other cases, such as an instant translation during a meeting, receiving an immediate reply is critical for the quality experience of the requester (Liu et al., 2010). This element addresses particularly the increasing role of real-time crowdsourcing (Bernstein et al., 2011). In addition to the latency, the *submission time* when the task is accessible for the crowd, the *duration* of how long the task takes to complete, and the *closure time* when the task expires may be set (Hirth et al., 2011).

Another important issue when designing a crowdsourcing task is the choice, whether the workers can see each other's contributions. This decision regarding the *visibility* is critically for the outcome of the task, as it may either foster collaboration to incrementally approach a better solution or promote greater diversity of contributions (Aparicio et al., 2012). Enterprises that want to exploit crowdsourcing also have to challenge the issue of *confidentiality* as it is one of the biggest risks when involving the public community (Corney et al., 2010). For current purposes, low and high confidential tasks are distinguished. However, if new requirements have to be met in future, the graduation will be adopted. Crowdsourcing systems may use these two values to decide if the task and the associated documents can be shared with third parties.

Finally, the last two semantic elements point to the human requirements and the technical resources that are needed to accomplish a task. A detailed description of the human requirements and the technical resources is an inevitable prerequisite for an intelligent and automatic allocation between the task and the crowd. *Human requirements* are comprised of, for example, the job tenure, professional positions, academic titles, certificates, or other qualifications, whereas *technical resources* refer to software applications, documents or datasets (Vukovic, 2009).

All introduced elements of the task concept are summarized in the following Table 2, whereas the first column refers to the element name, the second column gives a description to the element, and the third column makes a suggestion for possible data types (string, date, time, dateTime, anyURI) or element values. The data types are derived from the XML Schema specification (Biron and Malhotra, 2004).

Element	Description	Value
Task description	A meaningful *task description* contains the instructions, the initial states, the constraints, the acceptance criteria and the goals of a task.	<string>
Target audience	The element *target audience* describes the selection of people who form the crowd. They are recruited inside the company, outside the company, or both.	intern, extern, hybrid
Complexity	The element *complexity* specifies the amount of skills, experiences and knowledge that is required to solve the task.	simple, moderate, complex
Type of action	Every task is mapped to a *type of action* that the crowd performs.	create, evaluate, organize, share
Modularization	The element *modularization* states if the task is assigned directly or indirectly to the crowd. A task is assigned indirectly by bundling several tasks to one task or by splitting one task in several subtasks beforehand.	directly, bundled, split
Nature of the reward	The element *nature of the reward* describes how a contribution is rewarded.	voluntary, fixed, performance-based
Type of the reward	The element *type of reward* specifies what is rewarded.	none, virtual points, money, goods, access to resource
Latency	The element *latency* specifies if the answer is waitable or if an immediate reply can be expected.	immediate, waitable
Submission time	The element *submission time* states the time when the task is accessible for the crowd.	<dateTime>
Closure time	The element *closure time* sets the time when the task expires.	<dateTime>
Duration	The element *duration* specifies the approximate time required to solve the task.	<time>
Visibility	The element *visibility* configures if the problem solvers can see the contribution of other workers.	hidden, visible
Confidentiality	The element *confidentiality* classifies if the task and the associated documents can or cannot be shared with third parties.	low, high
Human requirement	The element *human requirement* contains qualifications and characteristics that are needed to fulfill the task.	<string> or <anyURI>
Technical resource	The element *technical resource* specifies sources, e.g., database feeds or existing spreadsheets that are required to accomplish the task.	<string> or <anyURI>

Table 2. Semantic elements to specify a crowdsourcing task

4.2 User Concept

The users of any crowdsourcing system are mainly divided in those who submit crowdsourcing tasks (requester, client) and those who solve these tasks (recipient, participant, crowd, worker, provider). Both types of groups have particular characteristics that should be considered for efficient enterprise crowdsourcing. The *user identity*, such as the real name or a reference to an existing public profile on social networking sites, is the first element that is taken into account to describe a user. It improves the trustworthiness of the relationship between the worker and the requester (Klinger and Lease, 2011). Furthermore, the success of many crowdsourcing efforts, such as product innovations for certain markets or translation tasks, depends on the cultural background and the language skills of the recruited users. Thus, if legally possible, the information about the *nationality* of the user are added to the standard (Antin and Shaw, 2012). Next, finding and selecting the right experts for a crowdsourcing task is a highly nuanced and context-sensitive problem that requires, besides the user's *qualifications*, also information about the *job title*, the *entry date* (job tenure), the associated *department* and the geographic *location* (Yarosh et al., 2012). Finally, to preserve and improve the quality of future crowdsourcing contributions, Eickhoff and de Vries propagates for a more sophisticated worker grading system than just a prior acceptance rate (Eickhoff and De Vries, 2011). The types of accomplished tasks as well as the frequency distribution of certain input types, such as check boxes or free text fields, give insights into the quality of future engagements of the worker. Therefore, the user is also characterized by his or her references to prior *accomplishments*. Table 3 recapitulates the elements that are appropriate to describe a user of an enterprise crowdsourcing system.

Element	Description	Value
User identity	The *user identity* is either a real name or a reference to an existing social networking service.	<string> or <anyURI>
Nationality	The element *nationality* describes the legal relationship between the user and a state.	<string>
Qualification	The element *qualification* defines the skills, expertise or competencies of a user. It contains references to credentials, certificates, academic degrees, or even to an entire electronic portfolio of qualifications.	<string> or <anyURI>
Job title	The element *job title* characterizes the domain expertise as well as the leading position of a user.	<string>
Entry date	The element *entry date* defines the date of joining the company. Out of this, the job tenure can be derived.	<dateTime>
Department	Each user may be associated to a *department* of the company. It determines the organizational position of a user.	<string>
Location	The element *location* describes the place where the user is currently situated in. It determines the geographical position of a user.	<string>
Accomplishment	The element *accomplishment* refers to prior completed tasks.	<anyURI>

Table 3. Semantic elements to describe a crowdsourcing user

5 Evaluation

To demonstrate the utility of the designed artifact, three different scenarios are constructed around the proposed semantic standard. The construction of these scenarios according to the designed standard is a first descriptive evaluation and proof-of-concept. Each scenario contains all elements introduced in the standard. In order to show the applicability of the standard, most of the elements of the task concept are used heterogeneously across the three scenarios (see Table 4).

Element	Scenario 1	Scenario 2	Scenario 3
Task description	Evaluate product design	Translate technical specification	Build company-wide virtual library
Target audience	Hybrid	Intern	Intern
Complexity	Simple	Complex	Simple
Type of action	Evaluate	Create	Share
Modularization	10 subtasks (bundled)	Each section equals one subtask (split)	<unspecified>
Latency	Immediate	Waitable	Waitable
Nature of the reward	Fixed and performance-based	Fixed	Voluntary
Type of the reward	15 reputation points plus bonus or discount of 5 (point-based)	80 Euro (payment)	http://example-company.com/virtual-library (access to resource)
Submission time	After release	2012-09-03 9:00 am	2012-09-30 10:00 am
Closure time	After 20 reviews for each product design	2012-09-17 4:00 pm	<unspecified>
Duration	1 minute	Half an hour	<unspecified>
Confidentiality	Low	High	Low
Visibility	Hidden	Visible (company-wide)	Visible (department-wide)
Human requirement	Job tenure of more than two years OR master in engineering, product design, marketing OR sales	Native German speaker OR GDS certificate in German language	<none>
Technical resource	http://www.flickr.com/photos/new-product-xyz	https://docs.google.com/document/d/123456789/edit	http://example-company.com/virtual-library/book-form

Table 4. Use of the semantic elements of the task concept across three example scenarios

As a subset of an example crowd, four users are introduced as shown in Table 5. Not all values are used in the description of the three scenarios below. However, the example users give the reader an idea of how the elements of the user concept are applied in practice.

Element	User 1	User 2	User 3	User 4
User identity	Alan Coulter	Adèle Girard	Markus Schmidt	https://www.xing.com/profile/Francesco-Carlone
Location	Cork	Lyon	Berlin	Turin
Nationality	Irish	French	German	Italian
Job title	Chief product designer	Junior product engineer	Senior product engineer	Junior software developer
Entry date	1993-04-01	2010-02-09	2003-09-01	2009-05-18
Department	Product development	Product engineering	Product engineering	Software development
Qualification	Master of Product Design and Development	Bachelor of Engineering	Master of Engineering, Certificate in Quality Management	PhD in Software Engineering, Java, C++, HTML, CSS
Accomplishment	http://example-company.com/cs/task/3241	<none>	<none>	<none>

Table 5. Example users based on the proposed standard

5.1 Evaluate Product Design

In this scenario, a rather simple enterprise crowdsourcing task (complexity) of evaluating several product design proposals (task description) is presented.

Alan Coulter (user identity), the chief product designer (job title) of the product development (department), requires an immediate (latency) assessment of hundreds of product design proposals that were collected inside the product design department and outside the company through an open innovation competition last month. For the evaluation task (type of action), he also wants to address both the employees inside the company and the workers of the public community (target audience). Therefore, he first uploads all pictures of the drawn prototypes to a photo sharing community (technical resource). Furthermore, he decides to bundle ten subtasks of evaluating the product design to one single task that is going to be assigned to an individual user (modularization). The crowdsourcing task takes approximately one minute to accomplish (duration), is submitted to the crowd directly after the task is released in the crowdsourcing system (submission time), and is closed when each product design has at least 20 reviews (closure time). A worker receives 15 reputation points for each bundle of subtasks that he or she finishes. Additionally, the worker gets a bonus or discount of five points if the task meets or does not meet the end result of the evaluation task (nature and type of task). As the design task is in a very early stage of the product development cycle and customer integration is highly desirable, Alan does not to worry about issues of confidentiality. However, to receive independent answers, the design rating of the crowd cannot be seen by each other (visibility). Another attempt to get high quality results is the reasoned selection of human

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requirements. Therefore, Alan forms a crowd of workers that have either worked at least two years within the company or have a master's degree in engineering, product design, marketing or sales. After submitting the task, Markus Schmidt, who is situated in the German office, gets an inquiry to rate ten different product design proposals as his qualifications meets the defined human requirements. Additionally, numerous external voluntary workers and freelancers with the required qualifications are requested to engage in the crowdsourcing task.

5.2 Translate Technical Specification

The enterprise crowdsourcing process that is illustrated in this scenario is the translation of a technical specification (task description).

Adèle Girard (user identity), who recently engineered a successful product for the French market, is instructed by her supervisor to send the technical specification for further assessment to Markus Schmidt, who is responsible for the German market. Adèle's as well as Markus' level of proficiency in either of the both languages is unfortunately not sufficient enough to communicate precisely with each other. She also does not know anyone in the narrow circle of colleagues who might help her. Fortunately, she has heard of an enterprise crowdsourcing solution that was integrated in the intranet of the company last week and allows to outsource complex translation tasks to other colleagues around the world (complexity, type of task, technical resource). She soon decides to use this new application for her own purposes. For that, she first splits the translation task in several sections (modularization) and sets the target audience to internal only (target audience) due to the high confidentiality that has to be guaranteed (confidentiality). She also wants that the distributed team of translators can correct each other's sections and therefore makes the contribution visible for every translator involved in the crowdsourcing task (visibility). Furthermore, to increase the probability of interaction between the potential translators, she decides to delay the submission time to the beginning of September, when the peak time of holiday in France and Germany will be over (submission time). She estimates a processing time of half an hour for each section (duration) and keeps the translation task open for the next two weeks (closure time). She further does not expect an immediate reply (latency). The system suggests a fixed reward of 80 euros that is added as a bonus to the current salary (nature and type of reward). To address only colleagues with an appropriate level of German, the potential worker has to be either a native German speaker with French language skills or needs to have a GDS certificate in German language (human requirement).

5.3 Build Company-Wide Virtual Library

In the last scenario, the idea of building a company-wide virtual library is depicted (task description).

Francesco Carlone (user identity) is employed as a junior software developer (job title) in a medium-sized company that is characterized with flat hierarchies. Because of the difficult market situation, he has unfortunately little work to do and would like to educate himself to issues of economics and information systems via self-study. He believes that literature on these topics might be available in other departments, that other colleagues might also want to know about their existence, and that they will probably support him (target audience). Therefore, Francesco makes an announcement to his colleagues that he wants to record all technical books and magazines that are physically available within each of the departments and put them in a knowledge repository. He soon starts to develop a crowdsourcing system for the simple task of collecting bibliographic references (complexity and type of action). Fortunately, he knows that most of his colleagues will provide him voluntarily with the necessary information, as they will get access to the repository in return (nature and type of reward). For the moment, he sets the visibility of the data records to department-wide, so that others can correct and do not add again an already existing bibliographic item (visibility). As the new knowledge repository prospers, he already thinks about integrating additional features in the system, such as collecting interests and experiences of his colleagues and experts from outside the company as well as integrating existing social networking sites, e.g., LinkedIn or XING.

6 Summary

The main purpose of this work is to foster the standardization in the domain of enterprise crowdsourcing by providing a first conceptual prototype. As far as the author knows, this is the first attempt towards a semantic standard that improves the allocation of crowdsourcing tasks to employees and increases the interoperability between the enterprise crowdsourcing system and other business applications. To highlight the significance of the topic and to justify the efforts of developing a semantic standard, the article starts with an overview of current challenges that have to be addressed when deploying crowdsourcing systems in business environments. After briefly describing the design-science research approach in the context of this work, the principal outcome – a semantic standard for enterprise crowdsourcing – is presented. It contains the key semantic elements of two of the main concepts in any crowdsourcing activities: the crowdsourcing task and the user. To show how these elements are used in real business environments and to prove the applicability of the standard, three distinct business scenarios are created. This can be referred as a first evaluation of the designed standard. Even though the scenario-based evaluation demonstrates the general applicability of the proposed standard, it still reveals some starting points for future improvements and research. First, certain elements require further refinement in their level of detail. For example, the element that describes the modularization of the crowdsourcing task consists of two sub-properties: the type (bundled, split or unspecified) and the actual value (number of subtasks). Second, the value of an element can be the result of the crowdsourcing itself, for example, the closure time can be specified not only by the time but also by the number of provided contributions. Thus, a semantic standard has to facilitate the definition of conditional expressions. Third, some of the elements are currently oversimplified, although they are complex in nature. For instance, the type of reward can be either a fixed value or even a function that allows calculating a dynamic value based on a sophisticated bonus scheme.

Although the current version of the semantic standard for enterprise crowdsourcing leaves room for improvement, it offers already some support for the technical-oriented as well as the management-oriented audiences. On the one hand, software developers and architects obtain detailed descriptions of elements and attributes that support the construction of their own instances of the core entities. On the other hand, managers acquire the basis for decision-making towards the standardization of enterprise crowdsourcing as the consistent representation of the proposed elements not only supports the integration with other business applications but also improves the efficient and appropriate assignment of the crowdsourcing task to the user. The current version of the standard contains only the two essential concepts: the task and the user. In future development cycles, additional concepts, such as a detailed description of the users' contributions or a specification of the varied incentive mechanisms, are integrated into the standard. Additionally, as this proposal is primarily based on theoretical findings that are gained from an extensive literature study, other sources, such as business case studies, expert interviews, surveys, and real practical examples, have to be considered to refine and extend the standard where necessary.

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