Collaborative Decision Constructing Supported by Cross-Pollination Space

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Abstract—**This paper studies the problem of collaborative decision constructing in the context of services society. Starting by identifying the characteristics of services society and new challenges it should face, we present the problem of collaborative decision making and discuss creativity aspects of multi-domain collaboration. We analyze the main risks related to collaborative decision making and propose their initial classification. By having identified the related gaps in science and business practices, not addressed by classical techniques on collaboration modeling, we introduce our approach for supporting collaborative decision processes that replaces the traditional viewpoint of decision-making by a dynamic participative process of decision constructing. This approach is based on ontological modelling to represent the knowledge necessary for discussions, and on services to enable collaborative decision-making. We show how the proposed conceptual approach allows actors to achieve a richer understanding of discussed topics thanks to ontologies without changing their own working practices, and thanks to services that encourage actors' initiatives in decision constructing and facilitate their collaboration. Our approach is concretized by the development of the platform for collaborative decision constructing, Cross-Pollination Space, which conceptual architecture we briefly describe. A case study on possible implementation of this conceptual approach for service innovation in Long-life exploration is finally discussed.**

Keywords – decision constructing; service innovation; information kernel; collaborative environment; creative collaboration.

I. INTRODUCTION

During the last decades, the complex problem of decision making has been in the centre of interest of both academicians and business entrepreneurs. Its importance has been increased in the context of services society that allows creating services in trans-disciplinary domains, where people not only use their static bases of knowledge, but also turn out to be active participants in the process of services creation. Naturally, in services society, services constitute a major component of the enterprise development and they become much more efficient when they are supported by ICT. Besides, ICT, in particular Internet technologies, set off a huge field of new services to be immersed in any enterprise process and to become relevant conceptual instruments for production, development and management, especially when they result the decision-making processes based on collaboration of different experts from various domains and disciplines.

Indeed, it is one of the requirements of the services society when the actors of collaboration are both providers and consumers of different types of knowledge and services, even if they keep their own languages, ways of thinking and/or working and are not obliged to change their daily working practices. From a different point of view, the complexity of current business and academic processes also requires a more powerful approach for supporting its semantics – the multi-disciplinary knowledge used, retrieved and created as the result of decision-making processes should be modeled and maintained in a more expressive way that would allow not only its better representation, but also organization and reasoning, not only decision-making, but dynamic decision-constructing leading to the creation of new domain services.

We make here a distinction between domain services and information system services. Domain services are part of the business activities, such as, for example, electricity provision, medical consultation or car rental. On their side, information system services are autonomous coherent and interoperable components of an information system which we specify by a static, a dynamic, a rules and a responsibility space. Domain services are supported by one or more information system service(s).

It thus becomes crucial to offer an approach aiming to support the process of decision constructing by integrating the services-oriented approach and ontologies. Our research is in the middle of the complimentary domains of meta-modeling, economics of the enterprise, management sciences, knowledge engineering, collaborative decision-making, services science (SS) and artificial intelligence (AI). It reflects the new sustainability requirement for information systems and services: the ability to dynamically adapt to ever-changing environments; and offers an answer of an integrated approach, which is (i) generic enough to be implemented in different fields of business and research, and (ii) scalable and interoperable to be easily concretized for a applied use case (e.g., developing an enriched base of conformity construction rules).

By justifying the necessity of a new complex approach for collaborative decision constructing and by identifying missing meta-models, knowledge bases, tools supporting

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existing working practices throughout different collaborative environments and/or working groups, in this paper we introduce our approach and discuss the conceptual schema of the corresponding practical tool.

In the next section, we present the current state of the art related to collaborative decision making. In Section 3, we identify the main underlying risks and propose their first classification. Section 4 introduces our services-oriented approach for supporting decision-constructing processes and underlines the role of ontologies that enable to generalize a traditionally defined problem of decision-making by a semantically richer problem of decision constructing. A practical tool implementing this approach, the Cross-Pollination Space is introduced in Section 5 and its conceptual framework is presented. Finally, conclusions and perspectives of this research are argued in Section 6.

II. RESEARCH ON COLLABORATIVE DECISION-MAKING

The problem of the collaborative decision making has been in the centre of interest of both academicians and business entrepreneurs during the last decades. Its importance has only increased in the context of the knowledge- and services-oriented society and especially, thanks to the development of the information and communication technologies, social networks and thematic clouds, which facilitate decision making processes and remove their geographical boundaries.

While speaking about process modeling, in general, and modeling of the collaborative decision making, in particular, one should underline the growing role of services-oriented approaches [10]. Service orientation allows studying modeling principles that rely on the interactive exchange and functioning of interoperable services. In its complexity, such service orientation is introduced at different levels of services science [22]: services are incorporated into the core of all economic processes, and in addition to this, they are widely used in paradigms of conceptual modeling and technical implementation.

Indeed, the multitude and variety of complementary activities in an enterprise has recently proved to be an important challenge: the traditional approaches seem to be no longer appropriate (and/or corresponding) to the heterogeneous business environments. The level of complexity of enterprise ontologies and/or knowledge bases, the new working situations the enterprise should face, as well as the active participation of actors in decision making and creation processes require new ways for managing enterprise activities.

This trans-domain research primarily focuses on several aspects of science: the artificial intelligence, the intelligent automation, the idea management, the knowledge discovery and capitalization, the services science, the collaboration psychology and the process modeling, to mention but a few. The business aspects of it, especially those characterizing the collaboration in innovation, are also taken into consideration. Multiple works aiming various aspects of this situation [8], [16] were successfully conducted. However, the complexity of the domain offers greater opportunities for more profound studies.

Another aspect of the current economic and business development is the fact that services society is also based on the knowledge that becomes the main source for value creation. Such a knowledge society becomes rapidly self-sustaining [12], as it reflects the current needs and the corresponding ICT infrastructure, which can meet these needs, as well as the role of actionable knowledge [3] in its evolution for different contexts.

Among other challenges our society faces today, a particular importance should be given to diversity, since it concerns a large amount of human activities, the multitude of actors, both experts in specific domains and non-professionals that are involved in creating, consuming and transforming information and knowledge (in social networks, for example), the trans-disciplinarity of topics and situations of innovation, the cultural diversity and the independence of geographical boundaries, etc. Thus, it becomes a current practice to have a team of international experts, each of them a professional in her highly specified domain and has a very specific knowledge, that collaboratively work on a complex problem requiring processing and transforming of information and knowledge.

The general discussion on the possibility to support collaborative creation can thus be characterized as trans-disciplinary: from the management-oriented vision of [19], which perceives creation as a dynamic process in which an organization creates, maintains and exploits different kinds of knowledge, to models of collaboration discussed in [7]. The complexity of the phenomenon of creativity offers wide possibility for its modeling: from defining conflicts of interdisciplinary collaboration [20] to the development of creativity support tools [1].

As it is generally admitted, collaboration between different actors requires a certain level of collective intelligence, which working definition is described in [18] by the following aspects. It is viewed as the ability to learn, understand and reason and is exercised by a group of individuals doing things collectively that seem intelligent. In most cases, the collective intelligence is aimed to address new or trying situations and specifically applies knowledge to adapt to a changing environment.

Based on knowledge as a key value-added instrument lead to the increasing importance for knowledge modeling and management, the problem of supporting decision constructing can also benefit from applying the methods and technologies of the artificial intelligence (AI), particularly aimed to increase the semantics of the described knowledge. Indeed, in this case, knowledge provides a complex static-dynamic contribution to value creation: statically, by stocking the knowledge and managing information and knowledge flows [13], and dynamically, by capitalizing the practices of usage of this knowledge for the target applied task, as well as for complementary trans-disciplinary purposes.

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In the field of collaborative engineering, [6] identifies seven layers of collaboration which aim at supporting the designers: goals, products, activities, patterns, techniques, tools and scripts. They represent an organizing scheme for the collaboration science which may represent a theoretical ground for the next generation of collaboration support systems. In the patterns layer, the group activities are classified under: generate, reduce, clarify, organize, evaluate and build commitment.

Another area of investigation is thus semantics and context modeling in collaboration processes. Different ontology-based approaches [27] and context-oriented models [23] have recently proved the effectiveness of ontological modeling, which is also one of the key points of our approach.

III. RISKS AND RESEARCH GAPS

The analysis of the current state of the art highlights a number of risks of the currently used approaches for supporting collaborative decision making, which we schematically organized in nine groups.

A. *Decision making as limited choice*

Traditionally, decision making processes are seen as a choice between several already identified and (partially) formalized alternatives. In other words, collaborative discussions are focused around choosing a (partially) pre-defined solution, but not really constructing a new solution.

In this case, decision making risks being rather limited and not using advantages of multi-disciplinarity of the knowledge bases of involved actors. It is thus necessary to restructure decision making processes in the way that they would allow constructing a decision during – and not before – discussions.

B. *Risks of group thinking*

Generally speaking, groupthink can be seen as any type of thought within a deeply cohesive in-group whose members try to minimize conflict and reach consensus without critically testing, analyzing, and evaluating ideas. This kind of conformism might be the result of different reasons [14], [21]: (i) illusions of invulnerability encouraging risk taking and/or unquestioned belief in the morality of the group encouraging member to ignore the consequences of their decisions; (ii) direct pressure and excessive warning that might challenge the group's assumptions; (iii) stereotyping of the importance and roles of different members: from underestimating certain points of view to excessive presence of mind guards, as well as self censorship of ideas that deviate from the apparent group consensus; (iv) eliciting individual views; (v) conformism of participants due to their anonymity; and (vi) lack of motivation for participating in decision making when passiveness (or silence) is viewed as agreement. As the result, groupthink might lead to defective decision making and disables almost any types of decision constructing.

C. *Influence of propaganda on collaborative decision*

Another important source of influence on collaborative decision could be found in the phenomena of propaganda and spamming, which are typical for Web environments and online communities. Indeed, the practice of introducing additional information and its emotional evaluation by some actors of communities might lead to propagating the unreliable information and to increasing the general distrust in collaborative decision making processes, as well as to questioning the trustworthiness of the process in general, and its members in particular (as sources of unreliable information). Several successful researches [11], [26], [17] have been carried out recently that have demonstrated some techniques for preventing spamming in Web environments, and as such for increasing the quality of the exchanged information. However, the risks of semantic noise in collaborative decision constructing due to spamming, society (or environment) distrust or personal direct influence of certain actors are still among the main causes of its possible untrustworthiness.

D. *Risks related to cognitive and professional security*

It is also one of the particularities of processes of human collaboration that people prefer to keep their traditional ways of acting and are sometimes resistant and/or not willing to change them even for the reasons of efficiency and quality. This phenomenon might be explained by the fact that innovations are sometimes associated with the risk of losing the clear vision of the work to be implemented and even with the risk of losing (or not possessing) the necessary skills for this work. In this context, it becomes obvious that any approaches aiming to support multi-domain collaboration should take into account the established common practices and domain requirements [15] and is very likely to fail if for its implementation it requires important (or even partial) change of "know-how" knowledge of decision-making actors.

E. *Conservation of traditional roles of providers and consumers of information*

A different type of risk, which has emerged in the context of services society, concerns the conservation of traditional roles of providers and consumers and projecting these roles to actors of collaborative decision making. It should thus be taken into consideration that the new approaches for supporting decision constructing view all actors as both providers and consumers that could simultaneously exercise different types of information exchange, dissemination and integration.

F. *Ontological modeling: formalization, maintenance and search for the unique solution*

Current decision-making practices are characterized by the multitude and complexity of the involved knowledge, which in many cases is non-formalized, tacit and even non-identified. This requires implementing powerful approaches that are able to support the semantics of this knowledge and to make it (partially) formalized, for example, ontological

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modeling. It is important to underline, however, that ontological modeling is not aiming at giving the only unique and absolute approach for knowledge formalization, and neither could it provide a definite answer applicable in all domains and contexts. Ontology-enabled modeling could be effective only thanks to the constant dynamic integration of new knowledge related to specific domains, usage-based practices and feedback from implementation in different contexts [27]. Furthermore, there should always be found a compromise between the expressiveness of the modeled knowledge and the effectiveness of its maintenance and possibility to use for different tasks: e.g., reasoning.

G. *Private and public data in the context of open environments*

Open environments that motivate their members to create, link and share knowledge face the dilemma of public and private data, available for large communities or protected for the specified usage. In its ultimo form, this is characteristic for open governments that optimize the usual trade-off between the expense and difficulty of getting wide agreement, and the practicality of working in a smaller community [5]. The essential concern is the privacy of data which contains personally identifiable information. Despite an important research in this domain and a variety of proposed approaches – by defining for example so called platforms of liberation and platforms of control (depending on how they support or tend to limit creativity and innovation) [24], by introducing self-regulating mechanisms within environments where its members define themselves which information should be protected or public, by identifying the necessary balance levels between public and private knowledge [9], to mention but a few – the question of developing an open environment by guaranteeing the security of private data still remains open.

H. *Limitations of a chosen collaboration model*

The selection of different models supporting collaboration, in general, and collaborative decision-making, in particular, is rather wide. It is obvious that all of them have some limitations in application and usage, some are more efficient and some require more strict conditions to be implemented. The group of risks relating to a choice of one particular collaboration model combines thus a number of risks [21]: (i) low model acceptance by members of collaboration; (ii) necessity to verify a model – or prototyping with the vast interaction with participants; (iii) limited model comprehension when, from one hand, participants have problems in acting in the model's boundaries, and from the other hand, they feel misunderstood due to the bad translation of their perceptions into the model language; (iii) low technical model quality; (iv) low perceived model quality – when the model itself is developed by not taking in consideration the context of collaboration and/or without allowing integrating evolving changes of the environment; (v) difficulties in traceability and eventual storage of rejected ideas (in case some ideas are decided to be useless for a particular decision-making process, but are considered as important for further processes of decision constructing).

I. *Paradoxes of innovation in collaboration*

This group unites different risks that characterize the dualistic nature of innovation and reflect, to some extent, the controversial nature of collaborative creativity [25]. It is the point of finding a balance between polar aspects of collaborative decision making: from its innovative (or even creative) side to organizing and scheduling decision-making activities. In its complexity, the risk is to identify an approach that would (i) unite goal-oriented and exploratory idea constructing; (ii) establish a connection between universally accepted common sense and specific domain knowledge; (iii) allow a structured approach for a priori unstructured innovative ideas; and (iv) offer participants personal motivation to benefit from the results of collaborative decision constructing [2]. This schematic classification of risks was taken into consideration in our analysis for supporting collaborative decision constructing. In our approach, we envisage them as the main challenges to be addressed and to offer an approach that aims to reduce the corresponding research gaps in supportive collaborative decision processes, as well as to involve participants directly into constructing the process of collaboration.

IV. OUR SERVICES-ORIENTED APPROACH

Our services oriented approach for supporting collaborative decision constructing tends to answer the main challenges identified in the previous section

A. *General presentation*

Generally, the process of decision constructing can be schematized at Figure 1. It allows managing business and science knowledge (structured and non structured, formalized and non formalized, etc.), provides semantic techniques and tools for its representing and reasoning, and offers an approach for managing collaborative processes related to decision constructing.

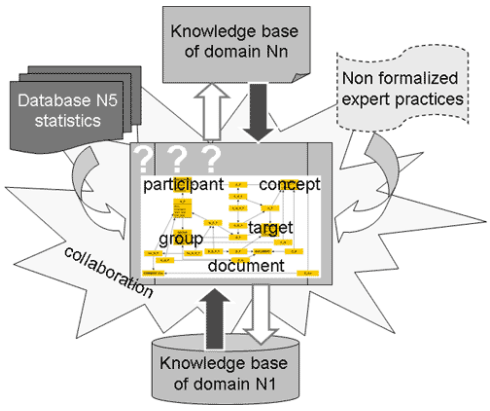

Figure 1. Collaborative information kernel .

The key elements of this approach are: Participants, Groups of participants, Concepts, Targets and Documents.

The participants are the individuals taking part in the decision constructing. In this collaborative process, the participants are directly involved. The groups of participants are unions of people which gather spontaneously around a target. A group arises after the initiative (or target) of one participant.

The targets are the objects of the decision constructing. They can take several forms: “request for discussion” (tacit need and not yet defined problem, such as an intuition), “request for solution” (defined problem without a proposed solution) or “direct proposition of action” (problem with a possible solution to be discussed and validated).

The concepts are general and abstract representations of an object (or group of objects). In our context, they originate either from the participants knowledge bases or from the participants collaborative knowledge co-construction. Interrelated to form ontologies, concepts are to be carefully handled. As a matter of fact, they carry a consensus (sometimes tacit, partial or yet to be assessed) on a knowledge serving a group’s target. The usage of knowledge bases serves multiple purposes: knowledge sharing among trans-disciplinary group members, linkage with necessary, permanent and unquestionable concepts (such as legal concepts), domain of expertise expression, positioning decisions and usage validation for the most important. Either internally or externally produced, documents are, for example, deliverable, memorial, white paper, report, proceedings or minutes. They serve the decision construction.

The participation in the decision constructing is characterized as follows: it is an outside-in and a bottom-up approach. Indeed, for the creation of domain services, we take our inspiration from open innovation experiences [4] where boundaries are blurred: the users/customers as well as the employees are empowered.

B. From risks and challenges to answers

In order to demonstrate how the proposed conceptual approach allows the actors to achieve a richer understanding of the discussed subject without changing their own working practices and domain terminologies, we analyse it from the point of view of the identified risks of collaborative decision making (cf. Section 3). We underline, however, that we do not claim the uniqueness of the proposed solution, but show its contributions to the complex problem of supporting collaborative decision constructing.

- Decision constructing aimed to overcome the limitations of decision making.

We have identified the limitations of the decision-making process that concludes with a choice of one of (partially) defined solutions (cf. Figure 2).

Thanks to the process of knowledge actionalizing and dynamic constructing of the information kernel, which are the key core of our approach, it is now possible to support the process of constructing the collective decision, while taking into consideration the environment of collaboration as well as the usage and practices. Thus the identification of possible choices of decision is done in parallel with discussions: predefined solutions are enriched with new ideas expressed during the discussions.

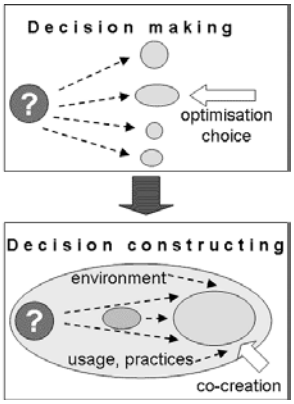

Figure 2. From decision making to decision constructing

- Risks of group thinking

The variety of risks caused by group thinking complicates the task of reducing them, especially by admitting the fact that the majority of them sources in social and psychological aspects of collaboration. In our approach, we do not particularly address these issues; however, we propose a number of solutions to be implemented in the corresponding framework, which combination will positively influence on group thinking.

First, supporting decision constructing with the help of information systems and services provides a certain level of anonymity of online societies, which weakens the direct pressure to certain members of real-time offline decision processes. Second, we offer a system of roles that encourages the participation in discussions and/or access to protected knowledge bases. Third, our approach is based on personal motivation to collaborate, which can be shown in results of decision constructing. For example, actors could be declared as authors in white papers, joint publications, new trans-disciplinary connections exceeding this current task are likely to be established, to mention but a few. Fourth, the ontological background of our approach provides the technical solutions necessary for actors to be understood without changing their terminology, and as such the knowledge is disseminated easier and can be used more effectively.

- Influence of propaganda and spam on collaborative decision

While having identified this risk, our ongoing work is currently not focused on it. Nevertheless, the task of reducing the influence of propaganda and spam in decision constructing within collaborative communities is one of the main perspectives of our future research.

- Risks of cognitive and professional security

Our previous work on capitalizing domain knowledge [27] has demonstrated the resistance of domain experts in changing their work routine: they could integrate new

knowledge and ways of doing in their current work only if they were described in their own terminology and did not require an effort from their part. For this reason, one of the starting points for this research is to develop an approach allowing such a simplicity – that we have proposed with the help of ontological knowledge modeling, from one side, and services enabling collaboration, from the other side.

The process of decision constructing is naturally characterized by the risks of cognitive and professional security: new ideas proposed by some domain professionals can be hardly understood by experts from different domains and as such, the corresponding innovations might face some cognitive resistance of decision-making actors. However, by emphasizing the importance of allowing "domain" terminologies and by supporting them by ontologies, we allow jargon-free discussion around new ideas, which are constructed in multi-domain collaboration.

- Conservation of traditional roles of providers and consumers of information

Following the spirit of services society, it is crucial to allow the actors of collaboration to be both providers and consumers of different types of knowledge and services. By putting our prior attention to this requirement, our approach is designed as services-oriented. Indeed, we promote the initiator's role taking and, more generally, the stakeholders' empowerment by supporting the initiative taking. The main roles engaged in the collaborative decision constructing are: the initiator, the facilitator, the domain expert.

- Ontological modeling for the unique solution

In our general model, we do not particularly address the problems of formalization, maintenance and optimization of the related ontologies. Currently, this aspect is set to be issued in the implementation level, according to the concrete use case.

- Private and public data for open environments

The dilemma on the balance between private and public data in open environments (social networks, clouds, etc.) has recently been in the centre of research and practical interest. Without primarily focusing on this problem in the context of our model, we however offer a solution of balance between public and private data thanks to the roles of actors of decision constructing. It means that the access to data is defined in the scope of different roles, and the coherence and non-contradiction of the exchanged and created knowledge are maintained with the help of ontologies related to the process of decision constructing. A more profound study of this risk and its reducing are also one of our research perspectives.

- Limitations of a chosen collaboration model

It is obvious that it is not possible to completely overcome all the limitations of any collaboration models. In our research, we show that its level of acceptance could be increased thanks to the following reasons: (i) it is based on services aiming to dynamically take into consideration the changing environment; (ii) the knowledge bases are described by ontologies that allow integrating the results of the usage of the model; (iii) the model aims at supporting existing collaboration processes, but not to force new working practices and ways of collaboration. Improving the model also constitutes a perspective of this research, including implementing techniques for evaluating idea effectiveness and traceability of innovative ideas.

- Paradoxes of innovation in collaboration

The complexity of the paradoxes between innovation and collaboration leaves a vast field for research, which are our ongoing and future work. More precisely, we focus on the approach for self-motivation of actors taking part in collaboration, as well as developing a framework for organizing, disseminating and capitalizing repositories and knowledge bases related to decision constructing.

V. CROSS-POLLINATION SPACE

The cross-pollination space (CPS) is a platform for enabling the creation of new domain services. CPS represents a collaborative space that brings together experts and non professional users from different domains working together on the co-creation process. As the result, it supports a group of participants in their collaborative decision-making and guides them in constructing the future, by conceptually creating innovative services.

CPS is thus an intermediate tool that allows a group of various participants to conceptualise, share and explicit ideas that will be used for creating new services, as well as to contribute to the development of the ontology-enabled knowledge base by capitalising the mutual understanding of the knowledge expressed and shared by participants in the process of CPS functioning.

A. CPS Boundary model

While developing the CPS framework [28], a particular attention is given to identifying roles of CPS participants and the main boundaries of CPS (cf. Figure 3). Schematically, CPS is based on three main components: (i) end-user services; (ii) data; and (iii) administration services.

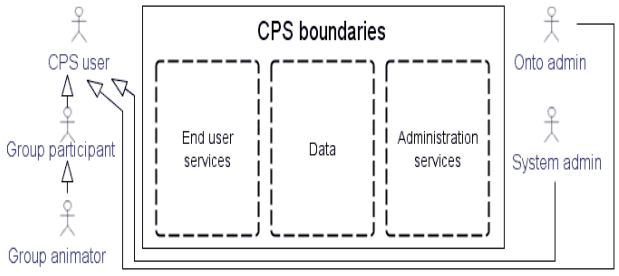

Figure 3. CPS boundary model

End-user services include but are not limited to account and group management, target launch, processing and management, social networking, CPS animation and documents management.

The main use cases identified in the boundary model allow us to identify services that the CPS has to provide to the end-users: (i) CPS user; (ii) group participant; (iii)

group animator; (iv) ontology administrator; and (v) system administrator.

The *CPS user* (guest) is the most general type of a CPS actor, has access to discussed topics and public shared documents, and creates a new theme for discussion (group). The group participant is a CPS user, who is a member of one or many groups, takes part in CPS discussions, offers a target, joins a group, invites another participant to join the group, votes, etc. The *group animator* (self-declared or chosen by a group) is a CPS group participant who facilitates the process of CPS decision constructing within a group: s/he synthesizes the discussed problems/solutions, moderates the process of discussion, and initiates events: to vote, to sum up, to open deeper discussion, etc. The *ontology administrator* manages the ontologies, their concepts and relationships involved into CPS functioning. The *system administrator* manages different technical aspects of the CPS platform: accounts, CPS-produced documents, technical issues of the CPS platform, etc.

The data related to CPS consist of two main knowledge bases: (i) operations repository that comprises the data concerning the information on current CPS operations (e.g., user profiles, history of negotiation, group description, etc.); and (ii) ontologies repository that contains formally represented concepts and ontologies related to the discussed target(s). The knowledge bases and data are supported by administration services that allow the ontology administrator to maintain both the ontologies and operations repositories.

B. Usage scenario: constructing CPS for the system of Long-life exploration

In order to demonstrate how our approach can be applicable for practical issues, we chose an example of creating a CPS platform that enables the collaborative decision-constructing around Long-life exploration.

First, we note that the notion of Long-life exploration origins in traditional e-Learning. However, it will be a mistake to envisage it as only an extended e-Learning from a "provider-consumer" point of view. Long-life exploration represents a complex dynamic process which actors are involved in collaborative processes of discovering, sharing, acquiring new knowledge without any division on teachers and students, on knowledge producers and consumers. In this case, we de not divide the exploration process on units, but insist on the exploration environment that gives the necessary tools for knowledge discovery and motivates collaboration in decision constructing.

In this case, the CPS platform can largely facilitate the construction of a system, which supports Long-life exploration, but is not this system itself. CPS offers an environment for multiple actors that would like to participate in dynamic defining Long-life exploration scenarios, but is not limited for only this concrete purpose and context.

For example, a collaborative decision construction usage scenario can be drawn in the context of decision constructing around the idea to allow a university "student" (or an actor in terms of Long-life exploration) to gather on his/her own platform space a personalized toolset made of direct access to his/her exam results, to various news feeds, to the library catalog search tool, to his/her social network pages and to video lectures by example. For such a decision constructing, the stakeholders are: students, teachers, librarians, administrative staff, jurists, IT division staff. As knowledge bases, there are the university laws/regulations and platform exchange protocols among others.

However, by simply launching a collaborative platform and defining these roles, we often support the "producer-consumer" model: e.g., a student "consumes" the "know-what" knowledge "produced" by a teacher; a librarian "consumes" the "know-how" knowledge on disseminating academic literature, which was "produced" (i.e., formalized by internal rules) by a rector and other decision-makers. As a result, different users have the possibility only to make the decision, but not to take part in its constructing. A collaborative platform itself only supports the existing way of collaboration between stakeholders, but does not provide the environment for its dynamic development.

In contrast to this, our approach envisages the "knowledge creation and dissemination" vision. The actors are seen not as producers and consumers, but as partners who participate in exploring, discovering and creation of new knowledge, in exchange that leads to sharing and constructing new knowledge during the process of their collaboration. It means, for example, that students are participating in defining the scope of their courses, librarians are introducing their current practices to be capitalized as "know-how" knowledge of the establishment and the corresponding knowledge bases are updated as the result of such collaboration.

Obviously, a tradition notion of e-Learning is replaced by the approach for Long-life exploration for all actors of such a decision-constructing process. The CPS platform thus is designed not only for facilitating the exchange, but mostly as an environment that creates the necessary conditions for creativity in this exchange and assists the decision-constructing process.

Let us consider this example scenario from the point of view of practical implementation. In this scenario, a group of the IT division staff launches an initiative proposing a CPS platform building for Long-life exploration. It is a direct proposition for action. Then, different stakeholders join the initiative. They define the initiative objects, extract its main concepts and identify a set of shared concepts. It follows then with active debates with proposals/counter-proposals, questions/answers, arguments/counter-arguments which requires discussion and validation. When participants feel they are ready to vote, the initiative validation is put to vote. Once the decision is positively validated (and it is already updated by various knowledge from multiple stakeholders that was acquired during such decision constructing), the specification activities of a new system around Long-life exploration can start.

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VI. CONCLUSION

In this paper, we discussed the issue of collaborative decision constructing in the context of the services society and defined some risks and challenges it faces today. In order to answer these challenges, we introduced our approach for supporting collaborative decision constructing and described the collaborative platform for facilitating this process: the cross-pollination space (CPS). We furthermore showed how CPS allowed overcoming certain risks and defined the axes for our future research.

REFERENCES

[1] P. Adamczyk, K. Hamilton, M. Twidale, and B. Bailey. "Tools in support of creative collaboration", Proc. 6th ACM SIGCHI conference on Creativity & Cognition, (Washington DC, USA, June 13-15, 2007). pp.273 – 274.

[2] M. Ahonen, M. Antikainen, and M. Mäkipää, "Supporting Collective Creativity within Open Innovation". Proc. EURAM Conference. (Paris, France, May 16-19, 2007), accessed online.

[3] C. Argyris, "Actionable knowledge: Design causality in the service of consequential theory". Applied behavioral science, 1996, vol. 32, no 4 (114 p.), pp. 390-406

[4] B. Bergvall-Kareborn, M. Hoist, and A. Stahlbrost, "Concept Design with a Living Lab Approach". Proc. HICSS '09, (Waikoloa Village, Hawaii, January 5-8, 2009), pp. 1–10

[5] T. Berners-Lee, "Putting Government Data Online". Available at http://www.w3.org/DesignIssues/GovData, last accessed 19/10/2010

[6] R. Briggs, G. Kolfschoten, G.-J. de Vreede, C. Albrecht, D. Dean, and S. Lukosch, "A Seven-Layer Model of Collaboration: Separation of Concerns for Designers of Collaboration Systems". Proc. ICIS 2009 (Phoenix, Arizona, USA, December 15-18, 2009), accessed online.

[7] P. Brna, "Models of Collaboration". Proc. Workshop on Informatics in Education, XVIII Congresso Nacional da Sociedade Brasileira de Computação Rumoa Sociedade do Conhecimento, (Belo Horizone, Brazil, August 3-7, 1998), accessed online.

[8] K. Church, and R. Smith, "An Ontology-Based Enterprise Model for Managerial Planning and Control". Proc. REA-25 (Newark, Delaware, USA, June 13-15, 2007), accessed online.

[9] J. Clippinger, L. Garrison, D. Attwood, and H. Ward, "Is it Possible to Share and Protect Sensitive Information?" In: video Proc. Gov 2.0 summit (Washington, DC, USA, Sept 7-8, 2010), accessed online.

[10] H. Demirkan, R. Kauffman, J. Vayghan, H. Fill, D. Karagiannis, and P. Maglio, "Service-oriented technology and management: Perspectives on research and practice for the coming decade". Electronic Commerce Research and Applications 7(4): pp. 356-376, 2008

[11] R. Guha, R. Kumar, P. Raghavan, and A. Tomkins, "Propagation of trust and distrust". Proc.13th International conference on World Wide Web, (New York City, NY, USA, May 17-22, 2004), accessed online.

[12] C. Harrison, "Enabling ICT Adoption in Developing Knowledge Societies". Education and the Knowledge Society, Springer Boston, DOI 10.1007/b100734, 2005, accessed online 10/12/2009

[13] D. Hensler, and F. Huq, "Value creation: knowledge flow, direction, and adaptation". Intl Journal of Learning and Intellectual Capital 2005 - Vol. 2, No.3 pp. 278 – 287

[14] I.L. Janis, "Victims of groupthink". Boston, Houghton Mifflin, accessed online.

[15] N. Maiden, "Acquiring requirements: a domain-specific approach". Domain Knowledge for Interactive System Design, Chapman & Hall for IFIP, 1996, pp. 90-101

[16] B. Makni, K. Khelif, R. Dieng-Kuntz, and H. Cherfi, "Semi-automatic Creation of an Ontology and of Semantic Annotations from a Discussion Forum of a Community of Practice". Proc. EKAW 2008, (Acitrezza, Catania, Italy, 29 Sept-3 Oct 2008), accessed online.

[17] P. Metaxas, "Using Propagation of Distrust to Find Untrustworthy Web Neighborhoods". Proc. ICIW '09 (Venice/Mestre, Italy, May 24-28, 2009), pp. 516 - 521

[18] MIT Center for Collective Intelligence. 2010. Handbook of Collective Intelligence, available online at http://scripts.mit.edu/~cci/HCI/index.php?title=What_is_collective_intelligence%3F last accessed 07/06/2010

[19] I. Nonaka, R. Toyama, and N. Konno, "SECI, Ba and Leadership: a Unified Model of Dynamic Knowledge Creation". Long Range Planning, vol. 33, pp. 5-34

[20] J. Prophet, and M. d'Inverno, "Creative conflict in interdisciplinary collaboration: interpretation, scale and emergence". Edmonds, Ernest and Gibson, Ross, (eds.) Interaction: systems, theory and practice. Creativity and Cognition Studios, pp. 251-270.

[21] P. Rittgen, "Collaborative Business and Information Systems Design", Intl Journal of eCollaboration, 5(4), 2009, pp. 1-15

[22] J. Spohrer, P. Maglio, J. Bailey, and D. Gruhl, "Steps Toward a Science of Service Systems", IBM Almaden Research Center, IEEE Computer 40(1): pp. 71-77 (2007)

[23] A. Sheth, C. Ramakrishnan, and C. Thomas, "Semantics for the Semantic Web: The Implicit, the Formal and the Powerful". Intl Journal on Semantic Web & Information Systems, 1(1), 1-18, Jan-March 2005, accessed online.

[24] N. Vitalari, "Collaborative platforms and open data as keys to the new public-private ecosystem". Wikinomics, september 2009, accessed online.

[25] T. Ward, S. Smith, and R. Finke, "Creative cognition". R. Sternberg (Ed.) Handbook of Creativity, New York: NY, Cambridge University Press, 1999, accessed online.

[26] B. Wu, and B. Davison, "Detecting semantic cloaking on the web". Proc. 15th WWW (Edinburgh, Scotland, UK, May 23-26, 2006). pp. 819-828, 2006.

[27] A. Yurchyshyna and A. Zarli,. "An Ontology-based Approach for Formalisation and Semantic Organisation of Conformance Requirements in Construction". Automation in Construction, Volume 18, Issue 8, December 2009, pp. 1084-1098

[28] A. Yurchyshyna, and W. Opprecht, "Towards an Ontology-based Approach for Creating Sustainable Services". Proc. IESS 1.0, vol. 53 (2010), pp. 136-149, 17-19 February 2010, Geneva, Switzerland

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