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Innovation and evolution of services: role of initiatives

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Abstract. This paper discusses the role of initiatives in dynamic collaborative processes of services innovation and evolution in the organizational context of an enterprise. The research is based on the current state of the art on modeling initiatives and services and studies phenomena of innovation and evolution for supporting services. Within our approach, we propose definitions for the key concepts related to modeling processes of services innovation and evolution, and define their main characteristics, stakeholders and roles. Furthermore, we introduce our services-oriented approach for initiatives management and show how it could be used for the process of services innovation through knowledge actionalizing. This theoretical founding is then discussed from the implementation viewpoint: we introduce a trans-disciplinary collaboration platform, Cross-Pollination Space, and briefly describe its framework. We conclude with the scope of current work and identify some context limitations of this research and reposition them as perspectives for our future work.

Keywords: Initiatives, services innovation, services evolution, information systems, services creation, collaborative innovation, services science.

1 Introduction

The general interest to service innovation and evolution has increased in the context of services society. Services constitute a major component of the enterprise development: no wonder that innovation and evolution in services are envisaged as the main instruments allowing the development of an enterprise.

This research question and its practical importance have been thoroughly studied by different research teams and innovation entrepreneurs and a number of impressive results have been acquired. However, the complexity of this issue and the interdependence of different aspects of innovation in multiple contexts leave a vast field of more profound investigation.

In this paper, we distinguish between two main concepts – service innovation and service evolution – and discuss their main characteristics, by positioning our research in the organizational context of an enterprise. It is important to underline that we envisage an enterprise not only from a most traditional business-based point of view as a company or a firm. In our research, an enterprise is seen in its broader meaning as

a working environment, “a unit of economic organization or activity” that is characterized by “industrious, systematic activity, especially when directed toward profit” and includes all internal and external (e.g. economic, social, etc.) activities of providing goods and services undertaken by a service, commercial, industrial entity.

We furthermore discuss the role of initiatives in processes of innovation and evolution in services, and underline the essential impact of collaborative decision constructing for services innovation. By underlying the dualistic nature of initiatives, we make a parallel between initiatives, which are traditionally seen as a part of information systems, and initiatives related to and analyzed from the point of view of informational services. Consequently, their role varies from integrating (and positioning) services into existing information systems to identifying the knowledge, which could be actionalized and as such would lead to creation of new services.

In order to illustrate the feasibility of the theoretical findings, we aim at developing an applied tool that supports innovation and evolution in services, and enriches it by capitalizing the practical results of the related projects [4].

The paper is structured as follows. In Section 2, we propose the genesis and the state of the art related to this complex question. Section 3 concretizes some key definitions and shows the complimentary interdependence between them. Section 4 focuses on processes on innovation and evolution and Section 5 describes our conceptual approach for supporting these collaborative processes. In Section 6, we introduce the cross-pollination space developed according to our services-based approach and discuss its keystones. Practical aspects of the implementation of our approach are discussed in Section 7 on the example of the use case of the CTI project [4]. Finally, we conclude with ongoing and future works and underline the perspectives of this research.

2 Genesis and State of the Art

From its **political background**, the initiative might be seen as the ability to begin and follow through with a plan or task, the willingness to take the first step, or the act of taking the lead [13]. The semantics of initiatives might differ, according to the context. Therefore, one should consider country- and usage-related aspects of the notion of an initiative. For example, in Switzerland, the initiative is often seen in its political context, as the right of citizens to propose laws, or constitutional amendments, for approval (or rejection) by the voters. This understanding cannot be generalized in different contexts (e.g. most European countries or USA) where the political system has different ways to support this type of citizens’ activity. Another broad – and more common – understanding of an initiative comes from business that perceives it as “the drive to achieve results” or a complex of different activities and tools leading to the desired result. Such a rich understanding of an initiative explains a variety of approaches for research and modeling: by evaluating the degree of its credibility and polarization [14], by concretizing a general approach for modeling politics-oriented collaborative processes [18], by analyzing a case study of integrating few collaborative initiatives within the governance framework [15].

Speaking of **economic, business and technological facets of services**, in the recent years the role of services can hardly be underestimated. It refers from one hand to increasing importance of the services sector in the global economy in a large scale and of service component in any product – up to designing products through services – in a small scale. From the other hand, services have gained the key role in business and technological processes that has led to the creation of a new interdisciplinary approach to the study, design, and implementation of services systems that provide value for others – Service Science [8]. In this context, it is important to underline the growing role of services-oriented approaches [5] in modeling current business and economic processes that rely on the interactive exchange and functioning of interoperable services. In its complexity, such service orientation is introduced at different levels of service science [17]: services are not only incorporated into the core of all economic processes, but also are widely used in paradigms of conceptual modeling and technical implementation.

With the phenomenon of **Living Labs and multiple collaborative interactions**, it is important to note that services can be seen as the main components that enable different types of collaborative working groups and social networks, and lead to the creation of new types of collaborative environments.

One of such environments whose growth has marked the development of the last decades is a Living Lab. Generally speaking, a Living Lab is a user-driven open innovation ecosystem based on a business – citizens – government partnership which enables users to take an active part in the research, development and innovation process [12]. Living Labs are also often referred as open living labs, in order to emphasize the openness and motivation to collaborate within such environments. The importance of the phenomenon of living labs can be explained by different factors. For us, the most significant one is the fact that it is strongly related to the concept of initiative. Indeed, open living labs represent triggering and promoting environments for initiatives that are based on a sustainable strategy for enhancing innovation on a systematic basis. Open Living Labs aim to create a shared arena in which digital services, processes, and new ways of working can be developed and tested with user representatives and researchers. It is an environment where businesses, researchers, authorities, and citizens work together for creation, validation, and test of new services, business ideas, markets, and technologies in real-life contexts [1].

The general discussion on the possibility to support collaborative innovation is trans-disciplinary [10] supporting the idea that the knowledge origin goes within and beyond the scientific disciplines, and involves arts, culture, etc. In the services domain, we understand trans-disciplinarity as a capacity of building knowledge, methods and tools for creating a new service discipline from the intertwinement of several existing disciplines and domains (which may find themselves enriched in the process of such creating, as well as by users of a service itself). In [11] innovation is perceived as creation, i.e. a dynamic process in which an organization creates, maintains and exploits different kinds of knowledge. Some conflicts of interdisciplinary collaboration are defined in [18], whilst [3] distinguish between task and dialogue initiatives and discuss different aspects of collaboration related to each type of initiative (e.g. direct proposition of actions for task initiative or establishing mutual beliefs between agents for dialogue initiative).

3 Key Definitions

This section introduces our definitions for the main concepts of the studied research question. By having defined the concepts of *initiative* and *service*, we show their impact on the complementary nature of *innovation* and *evolution*, and contextualize our analysis in the scope of *enterprise*. We furthermore concretize the concept of *ontology* for innovation and evolution of services and propose its enriched definition, according to our approach for supporting innovation and evolution.

We underline that these definitions are developed and used in the context of the services domain, and referred as such in the whole text of this paper.

Initiatives. Our definition of an initiative in the services domain, or more precisely of an e-government initiative, is based on and enriches the definition developed in our previous research [13]. E-government initiative is seen as a proposal leading to actions and mechanisms allowing placing the stakeholders concerned by the development of e-government information systems in a situation of exploration for the discovery of new e-government services. According to this definition, it is important to distinguish two types of initiatives, which are defined by their origin: (i) initiative as a part of information systems; (ii) initiative as an informational service. An initiative that is a part of information systems, which already exist and function, aims to improve and maintain existing services by being integrated into them and, as such, to improve the relationships between involved actors/stakeholders (e.g. State and citizens). An initiative that is considered as an informational service, aims at creating new services. Supporting such initiatives is one of the main elements of an innovative approach to create value through information.

Services. We consider that a service should be defined at the junction of the organizational domain, the ontological domain, the technological domain and the informational domain. Consequently, we define a service as the result of a process of acquiring knowledge in the **context** of the IS engineering. It can correspond to an action or series of actions to characterize the relationships or the interaction between the involved actors/stakeholders (e.g. State and citizens). It is based on four dimensions: (i) *ontological* dimension; (ii) *informational* dimension; (iii) *technological* dimension; and (iv) *organizational* dimension. Let us briefly introduce each of these dimensions.

We envisage the ontological dimension of a service as the one that describes not only all the invariants of the information system domain, in particular knowledge and concepts, but also some business rules, roles of actors which are independent of the information system development. The informational dimension of a service describes the information semantics necessary for defining services. This dimension of a service describes the static aspects, the dynamic aspects and the integrity constraints aspects.

The organizational dimension of a service relates to the business rules, the organizational roles, the responsibility zones and business processes inside an enterprise/organization. It allows one to clarify the decisions and responsibilities inside the enterprise/organization. The technological dimension of a service permits to study the implementation of the specified entities. It is a question then of choosing the appropriate technology, the informatics architecture and the corresponding environment, in order to implement this service.

Complimentary Nature of Innovation and Evolution of Services. In correspondence to two main types of initiatives, we can establish two main types of their impact on services. Indeed, initiatives are substantially useful for enabling: (i) evolution of services – when they define the principles of the integration and positioning of services into existing information systems [4]; and (ii) innovation of services – when they help to identifying knowledge that could become actionable and as such would lead to creation of new services. We underline that in its complexity, the processes of innovation and evolution of services are complimentary. Indeed, whilst creating a new service based on an initiative, it becomes a part of an existing information system and/or creates its own environment as an informational service with additional value and knowledge.

Innovation Context: Enterprise. Generally speaking, services constitute a major component of the enterprise development. They become relevant conceptual instruments for the management. In the same way, the processes of innovation and evolution are context-dependant: they are envisaged in the context of an enterprise and can be supported only by taking into consideration the enterprise environment. It is important to underline that we envisage an enterprise not only from a most traditional business-based point of view as a company or a firm. According to our approach, an enterprise is seen in its broader meaning as a working environment that is characterized by industrious, systematic activity directed toward profit and includes all internal and external (e.g. economic, social, etc) activities of providing goods and services undertaken by a service, commercial, industrial etc. entity.

Ontologies in Services Innovation. To avoid the ambiguity in using special terms that might execute different semantics, we find it important to concretize our definition of ontologies within the scope of this research.

Ontology is used here in the meaning of "a formal, explicit specification of a shared conceptualization" [7]. For our research, we enriched the definition of ontologies as knowledge bases that have the following characteristics: (i) ontologies are defined as a conceptual information model that describes some specific domain in terms of concepts, facts and business rules; (ii) ontologies allow the formal representation of the knowledge, which is mandatory for developing an information system and/or service; (iii) the knowledge defined by ontologies is non contradictory and shared by domain experts; and (iv) the design principles of information systems/services supported by ontologies are sustainable in the meaning that they cannot be doubted during the development of information systems/services and their functioning. In other words, this knowledge is valid during the whole lifecycle of information systems/services. Therefore, ontologies supporting the processes of services innovation and evolution should correspond to these characteristics.

Moreover, in our approach for supporting services innovation and evolution (described in Section 5), we show that they are based on the process of knowledge actionalizing that allows enriching ontologies during innovation and evolution. For this reason, the proposed complex definition of ontologies should also be enriched by the following characteristics: (v) ontologies are enriched and updated by the knowledge actionalized during the processes of innovation and evolution of corresponding services, as well as by the knowledge retrieved from their usage.

In other words, the processes on innovation and evolution should include the techniques for knowledge actionalizing and ontology management, in order to allow

continuous sustainable development of ontologies. In Section 5, we briefly discuss how we propose to do it in the context of our research.

4 Processes of Innovation and Evolution

Traditionally, there is a certain ambiguity in understanding of the phenomenon of innovation. Usually it is seen as introduction of something new: a new material, way of doing, a new concept, etc. This definition is however different from the widely used meaning of the notion of innovation – the process that aims at bringing new features into an existing thing (concept, good), renewing something that already exists, i.e. evolution of an existing thing. To distinguish between these aspects, in our research we study two interdependent phenomena: innovation and evolution. Innovation, as the process that allows the change of state from the component of a system, in so forth emerging a system, which its characters or behaviors are different from the previous time [6] can be viewed as the source of evolution. Innovation can be thus defined as a dynamic and participative process that leads to co-creation and value creation of a product (artifact, method, etc.) thanks to its evolution.

We note also that these *dynamic* and *collaborative* processes generally lead to *sustainability* of a product (good, process, service, etc.), as well as to enriching the related services and knowledge bases (for example, in the process of evolution of e-government services, the corresponding regulatory ontologies and organizational context are also enriched). In other words, innovation and evolution result with added value to a product, service, related knowledge bases, information systems and services in their dynamic environment.

According to the type of such added value as the result of innovation and evolution, it is also possible to distinguish between two types of initiatives [13]: (i) initiatives which aim to improve and maintain existing services and to improve the relationship between different stakeholders; and (ii) initiatives which will create new services. Such initiatives are particularly aimed at creating value through information.

It is important to underline the multitude of stakeholders involved in the process of services innovation. They include but are not limited to the following groups: (i) a citizen (in a broad sense, an individual who interacts with an enterprise or the government); (ii) public administration; (iii) private enterprise; (iv) association - political party - interest group; (v) government; and (vi) international organization.

Indeed, stakeholders are all those individuals and groups who have a strong motivation and interest to participate in services innovation and could provide relevant information – from business, non-profit activities, organizational context, strategy of an enterprise, etc. Their roles are defined according to three main criteria. Firstly, they are designed to reflect responsibilities of stakeholders over the environment of an initiative. Secondly, there is a strong interdependence between the knowledge provided and co-created by a stakeholder and the created service itself. Thirdly, roles of stakeholders in the innovation process should guarantee their authorizations over the informational space of initiatives.

Without focusing on particular scenarios, the stakeholders' roles can be grouped into the following types: (i) initiator: any stakeholder disregarding her actual position

and/or hierarchical level in the enterprise. This role represents the power to initiate, which is particularly important for the bottom-up initiative origination. An initiator owns the initiative throughout the initiative process; (ii) domain expert: a stakeholder who provides valid information about the initiative and its domain(s) and has valid actionable knowledge on identifying relevant aspects for this initiative and the corresponding service under creation; (iii) facilitator: a stakeholder who designs and conducts collaboration processes to support a specific group in achieving its specific goals [2] by taking into consideration viewpoints of all stakeholders.

5 Towards Supporting Innovation and Creation in Services

Our approach for supporting innovation and evolution in services is based on two main ideas. First, we find it important to implement ontological modeling for content-based analysis of an initiative that might lead to creation of a new service. Second, we aim at modeling the lifecycle of initiatives during their discussion by interested stakeholders, as well as the environment of such collaboration. For these purposes we adopt services thinking and aim at modeling decision constructing for innovation in services, as a dynamic sustainable co-creative collaboration process.

5.1 Content-based Analysis and Development of Information Kernel

One of the most important phases of the process of innovation in services is the content-based analysis of an incoming initiative that might lead to service creation. We need thus to analyze the semantics of this initiative, identify its concepts and their interdependencies, and to create the necessary relationships (i.e. `relatedTo`, `isDefinedBy`, `hasResultedFrom`, etc.) with the corresponding categories.

By identifying the main semantics of an initiative, such content-based analysis allows one to define and construct its information kernel. Generally speaking, the information kernel was introduced in [9] as "*a conceptual model which is derived from the ontological level. It represents the static aspects, the dynamic aspects and the integrity constraint aspects of an information system*".

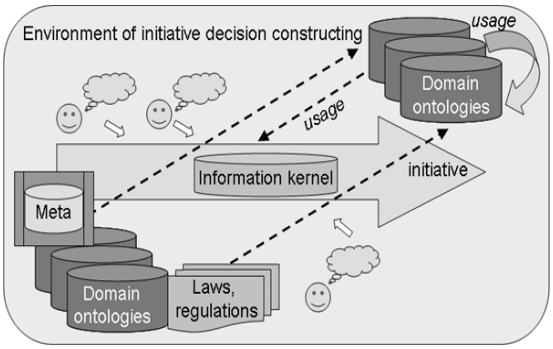

Fig. 1. Constructing information kernel.

In our current work, the information kernel is viewed as the conceptual model of the exchanged knowledge, which will trigger the proposition of an initiative to be implemented as a new service.

Let us demonstrate how the information kernel of a proposed initiative can be developed (cf. Figure 1). For analyzing the content of an incoming initiative, it is important to identify the knowledge, which will be used to create the corresponding service: initial domain ontologies, expert knowledge, common practices in the field, rules and regulations, etc. Generally, they all represent the *ontological level* on which information kernel of an initiative, i.e. the conceptual model of the exchanged knowledge, is build. In the process of discussions and implementation of this knowledge in different contexts, or in usage of the kernel, it becomes clear that certain ontologies should be modified, according to *usage-based knowledge* retrieved in practical situations. Consequently, there will be corresponding changes in the conceptual model of the initiative-related knowledge, and as such, in the information kernel itself.

Based on such interdependent reciprocal exchanges, our approach thus allows concretizing the information kernel as the conceptualized knowledge necessary for defining and implementing services, which is shared by main stakeholders and participants of the process of decision constructing.

5.2 Management of initiatives through knowledge actionalizing

The development of the information kernel is based on the process of knowledge actionalizing that we enrich and adapt for the task of services development.

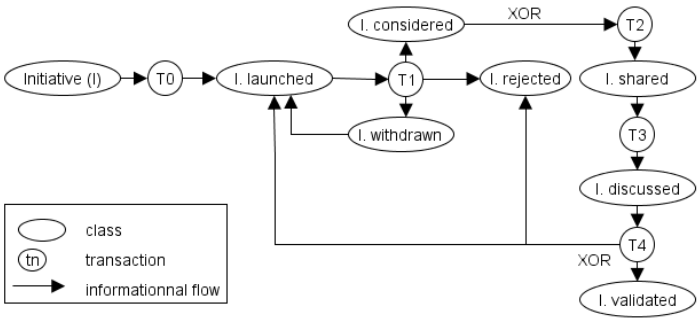

Fig. 2. Lifecycle of initiatives

Actionalizing of the knowledge of an initiative is done during its lifecycle (cf. Figure 2) in the perspective of collaboration between actors taken part in discussions.

The initiative lifecycle starts with the occurrence of an event or of a requirement. An initiative `In` has an initiator who owns the initiative. To make it understandable by other actors, this initiative should be actionalized: the knowledge describing it is formalized, modeled and published on a collaborative platform.

After the initiative has been launched, the initiative is analyzed and positioned in one (or more) activity domain (or context) through the Repository of ontologies. This

leads the initiative's owner to call for participation domain's experts. Once participants are gathered around initiative In, they define the initiative objects: they extract its main concepts and relationships to end with a shared pool of concepts and relationships that define the information kernel. The discussion around the initiative also allows actors to identify the scope of different knowledge, which is necessary for this initiative to be actionalized and to define the ontological rules for actionalizing this knowledge. Comments of various forms arise such as: arguments, counter-arguments, proposals, counter-proposals, questions, answers. This process ends when a new version of initiative In is ready. Finally, the actors of collaborative discussions vote to find a consensus. At this stage, either the initiative In is validated, or rejected, or re-launched. Its validation leads the initiative to become a specified service, and thence, the development of the corresponding service can begin.

This process also requires the development of supporting services allowing the usage of actionalized knowledge of an initiative. These services contribute to creating the environment facilitating initiatives management and allow integrating a newly developed service (based on a discussed initiative) into the services environment.

5.3 Supporting Continuous Development of Services-related Ontologies

The development of the information kernel helps to enrich the initial ontologies by the knowledge coming from their usage (cf. Section 5.1), and by the knowledge actionalized during the process of initiatives management (cf. Section 5.2). In this perspective, we underline that such development contributes to sustainability of the related ontologies and services. Indeed, a sustainable service is envisaged as a service that is capable to adapt to its environment, to dynamically integrate the ever-changing conditions of this environment, and as such to be sustainably coherent with its evolving challenges. Analogically, the enrichment of underlying ontologies is also provided in a sustainable way – by capitalizing the dynamic changes of the environment and by enriching the initial ontologies by their usage in different contexts and practices. Thus, we argue that the information kernel is in fact the tool and the environment for developing sustainable services and supporting continuous development of services-related ontologies, according to the results of creative collaboration of involved actors.

6 Implementation: Cross-Pollination Space

For the practical implementation of our approach, we are currently working on the development of the cross-pollination space (CPS). We note that this term has also a *cross-pollination* character adapted from genetics: cross-pollination is the pollination of a flower with pollen from a flower of a different genotype.

CPS represents a platform for enabling the creation of new domain services and is, in fact, a collaborative space that brings together experts and non professional users from different domains that work together on innovation in services. It gives them the possibility to collaboratively participate in creating services from an initiative (represented in a formal or – more often – informal way) by offering a complex tool

for conceptualizing, sharing and expliciting ideas. During this process, the CPS knowledge base is also enriched by capitalizing the mutual understanding of the knowledge expressed and shared by participants in the process of CPS functioning. The CPS framework is based on 5 main keystones: (i) participants; (ii) groups; (iii) concepts; (iv) targets; and (v) documents.

For this research, we focus on the notion of targets: the description of initiatives in the process of services innovation. Targets can be seen as important subjects of discussions that require a response and are in the centre of CPS interactions. The prospect to use them as ideas for service creation motivates participants to take part in these conversations, while approaching it from different spheres of interest, domains and business practices for collaborative decision constructing. According to the type of a target, there are different scenarios of its processing by CPS.

For targets of the type "request for discussion", CPS allows the actors to formalize this non explicit and not yet defined problem, or in other words to concretize an intuition of a participant that CPS negotiation might help in a particular field. CPS thus concentrates on the tasks of collecting the most diverse ideas from a variety of interested participants, of reducing the semantic noise around these targets and of formalizing them. For targets of the type "request for design", the main CPS activities are around concretizing the well defined situation, identifying scenarios for creating and evaluating possible designs, as well as reducing the semantic noise from different complimentary views to possible/proposed designs. The most concretized targets are of type "direct proposition of actions" where CPS activities focus on formalization of an initiative and a proposed scenario and discussions around it. If it is evaluated as consistent and agreed by the corresponding CPS group, this initiative enters the next phase of its implementation as a service.

The CPS is supported by underlying ontologies and is enabled by services that simplify the exchange of experts around the proposed initiatives and adapt the corresponding ontologies according to the results of their interactive collaboration.

7 CTI Project

In this section we explain how we can use the proposed approach for supporting innovation and evolution in services in the context of our project, which aim is "the analysis of semantic interoperability of ISs associated to businesses domain in Geneva" [4]. We believe that this practical example contributes to illustrating the feasibility of our conceptual approach.

This project was done in collaboration with the Center of Information Technology at the Canton of Geneva (Switzerland). A Working Group within the Center of Information Technology has analyzed the issues concerning the exchange of information between the institutions on businesses in the Canton of Geneva (CTI, 2009). In the Canton of Geneva, several information systems (ISs) co-exist, handling data about businesses at the cantonal level: (i) Commercial Register (RC): its aim is to build and identify the legal entities in the State of Geneva and to register their associated legal events; (ii) Tax IS (R-Fisc): its aim is to store the taxation data about businesses at the cantonal level; (iii) Business Repertory (REG): This repertory

contains administrative information on businesses. REG permits to centralize the update data on businesses and companies located in the canton of Geneva, to make them usable for administrative purposes and to disseminate the data to public and private sectors. These ISs interact already with each other's and with two other information systems at the federal level: (i) Federal Commercial Register: its aim is to build and identify the legal entities and to register their legal events associated at the federal level, and (ii) Federal Business Repertory (REE): its aim is to store addresses for statistical or administrative purposes.

In the context of this project, we consider an initiative as a part of information systems from one side and as an informational service from the other. For each service we describe its different aspects: (i) its organizational contexts (describing describes business rules, legal constraints and the capability of the organization to enforce laws and policies) and the ISs concerned; (ii) the information that is necessary for its implementation (data and processes); as well as (iii) the roles associated with it. In fact, initiatives in the context of this project promote knowledge intertwinement allowing the collaboration of multiple business and Stakeholders involved in the process of services innovation and services evolution. These initiatives are important for: (i) evolution of services: as positioning of services upon existing information systems; and (ii) innovation of services: as identifying knowledge that could be actionalized and as such would lead to creation of a new service.

A complete validation of this approach, which is in the scope of this project, requires the development of an environment facilitating initiative management in a particular context. The process of its management requires the development of supporting services that allow the usage of actionalized knowledge of an initiative. These both axes represent the ongoing work within Working Group of the Center of Information Technology at the Canton of Geneva.

8 Conclusions

In this paper we introduced our approach for supporting innovation and evolution in services, while identifying the key role of initiatives in these processes. We discussed the complementary nature of innovation and evolution in services and showed their interdependence in processes of knowledge actionalizing for collaborative decision constructing. For the purposes of practicality of this conceptual contribution, we introduced the cross-pollination space, the collaborative environment for managing initiatives, followed by a practical context of business ISs in Geneva that implements this approach and illustrates its feasibility.

Inspired by the first theoretical findings and a successful pilot implementation, we further focus on the contextual implementation of the proposed approach in different domains. Among the main scientific perspectives, we envisage developing more semantically powerful formal characteristics of the related concepts and further formalization of the methodology for defining a set of guidelines to support the evolution and the innovation of services through knowledge actionalizing. Ultimately, we aim at developing a set of services implementing this methodology.

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