From Metaplanning to PSS 2.0

Exploring the architecture of Geodesign as a process

MICHELE CAMPAGNA

Campagna, M. (2016). From Metaplanning to PSS 2.0: Exploring the architecture of Geodesign as a process. *Research In Urbanism Series*, 4(1), 57-70. doi:10.7480/rius.4.819

Abstract

This paper explores the perspective of geodesign as a process. As such, it is argued methods and tools are needed to manage the process complexity, including the definition of the involved parties, of their roles and responsibilities, as well as all the steps to be undertaken to unfold the process, together with their underlying methods and enabling technologies and tools. A metaplanning operational approach based on Business Process Management is proposed to deal with the process complexity and eventually as a means to support the construction of a second generation of process-oriented Planning Support Systems. The overall discussion is supported by practical examples aiming at demonstrating how the Business Process Modelling and Notation language can be used to represent the planning processes from high level overview models to detailed ones which can express geodesign methods and enabling technologies.

KEYWORDS

Metaplanning; Geodesign; Planning Support Systems; Business Process Management; Planning Process Modelling

1. INTRODUCTION: GEODESIGN AS A PROCESS

Since the last decade, the concept of Geodesign has been attracting growing attention of scholars and practitioners worldwide as a way to achieve more sustainable spatial planning and design practices. While several definitions of Geodesign have been given, many of them refer to a process – not necessarily but most likely based on extensive use of (spatial) information technologies – which would enable environmentally sustainable collaborative design and decision-making in the governance of the territorial evolution, limiting the possible negative impacts on the communities and the territories. In most of the definitions, as the name recall, the focus is on the design part of the governance process, which, depending on the scale, may correspond to the creation of spatial plans (e.g. regional planning, local land-use planning, or large-scale development project design).

Much research have been devoted to formalise methods and enabling technologies for the implementation of Geodesign in practice and a growing number of case studies can be found documented in literature (McElvaney, 2012). However, less research attention has been devoted so far to study Geodesign as a process, with the notable exception of the Steinitz's framework (2012). Indeed the framework entails the perspective of Geodesign as a process consisting of three iterations along which six models are envisioned, designed, and implemented, with the final aim of constructing a spatial plan or design, depending on the scale. The six models are used to represent, study, and evaluate on-going territorial processes, and to design possible change scenarios, to analyse their impacts, and eventually to create consensus about which scenario among them should be implemented. While the Steinitz's framework may offer a general outline of the main steps which should be carried on within a geodesign study, and it may be valuable in guiding a geodesign team in defining how to develop the six models, the latter should be detailed by the participants in each contextual case.

Unlike it often happens in real world plan-making processes, where the role and the responsibilities of some or many of the participants may be not clearly defined, as well as the underlying workflow which drives it, and the method and tools to be used, Steinitz's framework for Geodesign requires in the second iteration to detail the working plan for the process, defining in reasonable details how the six models will be implemented in the third iteration. It should be noted that this definition may remain flexible and blurred, but still this should be a well-considered choice and a documented responsibility. Whatever underlying approach is chosen to inform the process, most recent communicative planning theories acknowledge the importance of driving the process according to a roadmap which may be understood and accepted by those involved, and possibly changed along the way if needed (Healey, 1993). Hence, in order to enhance the communicative rationality of the planning process methods and tools for ensuring its comprehensibility, integrity, legitimacy and trustfulness should be put in action. To address these issues, an operational approach to metaplanning is proposed in this paper.

2. FROM METAPLANNING TO PROCESS-ORIENTED PLANNING SUPPORT SYSTEMS

In broad terms metaplanning can be defined as the design of the planning process. Spatial planning in general, and Geodesign as specific way to design spatial plans, involves a sequence of activities to which a different set of actors may participate. Actors, which may include decision-makers, planners and other experts, as well as other stakeholders, and in some cases the wider public, may play different roles and perform different tasks within the same or different activities. Performing a task may require the implementations of different methods, the application of different (analogue or most likely digital in the case of Geodesign) tools, and different ways of processing information to produce knowledge and make decisions. As such, plan-making can become a fairly complex process which should be appropriately managed; the objective is to achieve awareness and mutual understanding among the actors on the procedural workflow as well as on the purposes, the objectives, and the outcomes of each activity, and of the overall process. Thus, metaplanning should be intended as a preliminary design step which returns an agreed 'to-be' model to be used for the management of the planning process. Such model should be as flexible as to be iteratively updated along the process life-cycle, if needed.

Often in spatial planning (e.g. Regional Planning or Local Land Use Planning), no or little attention is paid to concept of metaplanning, and in such cases taming complex multi-actors planning processes and procedures may be confusing. A lack of common understanding among the actors may arise, implying difficulties in collaboration and in reaching consensus; understanding how, why, when, by whom planning decisions are made, may result in being unclear to both the internal participants and the external observers. The latter should be considered not a minor pitfall as both propositions from advances in planning theory (Healey, 1993; Innes, 1996; Khakee, 1998) as well as binding regulations on Strategic Environmental Assessment (SEA) require to evaluate, explain and document not only the product (i.e. the final plan) but also the process of plan-making.

Although not as commonly acknowledged as one might expect, the importance of metaplanning has been advocated in several disciplines spanning from artificial intelligence (Bhargava et al.,1997), to management science (Emshoff, 1978), to spatial planning (DeBettencourt et al.,1982). According to Bhargava et al. (1997) a metaplanner can be defined as a computational program which, when executed, produces a plan of actions. In a similar vein with regards to spatial planning, metaplanning can be defined as a design process which produces a plan of the (plan-making) process. With more specific regards to urban and regional planning, DeBettencourt et al. (1982) claimed that metaplanning as a structured process for constructing both responsive as well as ethically sound approaches to planning should be integrated into the planning function to increase its usefulness and viability.

Central to the operational implementation of the concept of metaplanning is the description of the planning process. Several attempts have been proposed by scholars to formalize the description of the planning process for diverse purposes (McLoughlin, 1969; Hall, 2002), however these results appear not to have much affected either the planning practices or the design of a Planning Support System (PSS). The latter implication is not of minor relevance, for a PSS in broader terms represents information systems which support the planning process. As an information system, a PSS should integrate all the enabling technologies for a given workflow, implement Geodesign methods and techniques, and offer all the data resources, the interfaces and the processing tools to support the different actors which take part in the process activities. Thus the definition of the process and the Planning Support System architecture should be strictly tied, and the latter should be derived from the model of the process workflow. Indeed, undoubtedly, limitations in current PSS diffusion may be addressed to lack of flexibility and of adaptability to contextual planning process settings, showing an implementation gap between planning research and practice.

The first generation of PSS were developed in the last two decades or so on the base of the seminal model proposed by Harris (1989) as computer systems able to integrate sketch planning, GIS and spatial models as well as visualization tools to support the planning functions. Notwithstanding the success of several implementations such as What-if? (Klosterman, 1999), Criterion Planners' Index (Allen, 2001), or Placeways's Community Viz. (Kwartler and Bernard, 2001) still this first generation of PSS, or PSS 1.0, faced limited diffusion in the planning practice. Indeed if we make reference to the Steinitz framework many of them may be used to implement a specific part of the process within the process, the evaluation or the impact models, none of them alone is fully able to support the overall process along the six models and the three iterations. Hence, a change in PSS design perspectives would be required.

According to Champlin et al. (2014), PSS design should be seen as a socio-technical process involving their users. Likewise it is argued here that PSS design should be process-driven, rather than methods- or technology-driven, and since metaplanning concerns the design and formalisation of the actual planning process, metaplanning should also inform the design of the information systems for planning support.

To address this challenge, Business Process Management methods and tools have been applied by the author to implement the metaplanning concept in the urban and regional planning, and SEA domain, aiming at demonstrating that metaplanning may both improve the process and ease the customization of PSS development accordingly: together the latter results entail the concept of a second generation PSS, or PSS 2.0. Hence in this contribution, the author proposes the concept of metaplanning as a formal step to be introduced at the head of the planning and design process, and proposes as original method for its practical implementation the application of Business Process Management (BPM) techniques. The resulting process orientation in PSS 2.0 not only would allow the flexible integration of Geodesign, enabling technologies for implementing the first five Steinitz' frameworks models – i.e. representation, process, evaluation, change and impact (Steintiz, 2012) –, but would also support the management and the evaluation of the decision model, that is the workflow through which decisions are made in the three iterations.

3. IMPLEMENTING METAPLANNING WITH BUSINESS PROCESS MANAGEMENT: BUILDING THE FRAMEWORK

In line with the above assumptions, metaplanning consists of the task of specifying actors, activities, methods, tools, inputs and outputs, workflows, or, in other words, the ex-ante iterative and adaptive design of the planning process. Metaplanning should start at the very beginning of the process and accompany it until the end of its implementation, starting with the proposition of draft 'to-be' process models, and following with their consolidation and monitoring along the process life-cycle. For the sake of clarity and to avoid unnecessary complexity, it is assumed here that the process lifecycle starts with the decision to make a plan and ends with the adoption of the plan by the relevant authority. In metaplanning, the process models should firstly be used to achieve consensus on how to proceed and to carry on the activities, then to coordinate the collaboration among all the participants, or actors, and eventually to document how the process developed, which for several respects is a due product within the Environmental Report in the SEA of a spatial plan.

If the aims of metaplanning are both the improvement of the process and of its outcomes as well as its management and implementation, hence the needs arise for a representation language which can describe the process with regards to its components and to their relationships, and for a technology framework able to support the integration of the necessary tools into process-oriented PSS.

Business Process Management (BPM) offers both methods and technical tools which can be used for metaplanning operational implementation, in spatial planning in general, and in Geodesign more specifically, given the extensive use of Information Communication Technology (ICT) tools. BPM includes concepts, methods and techniques to support the design and analysis, as well as the administration, the configuration, the enactment of business processes (Weske, 2012). In general, the success of the emerging field of BPM is due to the facts that it may both support the improvement of the processes offering design and analysis tools (i.e. business perspective), while at the same time it can also support the integration and deployment of the enabling technology (i.e. IT perspective). Many Business Process Management Systems (BPMS) have been developed in the last decade to enable business processes design, analysis, configuration and enactment on the base of explicit process model representations. Indeed, the basis for BPM is the explicit representation of processes, or process models, with their actors, activities and execution constraints among them.

Hence the opportunity to investigate to what extent the BPM approach can be applied to urban and regional planning processes. Indeed as demonstrated later in this paper, process models can be built to describe the planning process in terms of its constituting elements including actors, activities, workflows, as well as data sources and processing tools. To this end, Business Process Model and Notation (BPMN) thanks to its rich semantics can be used as a standard graphical notation for representing planning processes and sub-processes in form of diagrams.

In BPMN the process participants or actors are represented as pool and lanes; the activities are represented as tasks or sub-process, which can be carried on with or without the support of ICT services or tools. Moreover a variety of executions constraints including gateways, message flows, and other events can be used to coordinate the workflow execution. Although BPMN is not primarily designed for data modelling, still it offers a set of notations that allows modelling the data involved in a process. Moreover, BPMS manage external data sources used as input or output of the activities such as documents, data tables or spatial data layers, and other internal data and parameters used to configure the workflow execution, such as the involved actors' addresses or preferences information.

A major advantage of BPMN is that it is both a human- and machine-readable language, so that it can be used by humans in a socio-technical metaplanning exercise to define the process, and by BPMS to enact the process, that is to orchestrate the ICT services integration to support the various planning tasks. The latter capability is enabled by process configuration, when settings are defined in a BPMS to invoke external digital data (e.g. standard Web Feature/Coverage Services, or W F/C S) and processing services (e.g. standard Web Processing Services, or WPS) when a task is executed by the BPMS workflow engine. Most of the off-the-shelf BPMS feature a BPMN diagram editor for design and analysis, a repository where models are collected, and a process engine which orchestrates the integrated execution of services and serve them to the relevant actor interfaces to support the implementation of planning tasks at run time. In the remainder, some simple planning process examples are presented as proof of concepts, aiming at demonstrating the reliability of BPMN to build planning and geodesign process models, which can be used in metaplanning and may constitute the core of the approach on the base of which the paradigm of process-oriented second generation Planning Support Systems, or PSS 2.0, can be implemented.

4. METAPLANNING IN PRACTICE: TOWARD SECOND GENERATION PSS

As introduced in the previous section, planning process modelling is proposed here as main tool for implementing metaplanning in practice. As a first simple example to show planning process modelling with BPMN, let us consider the following excerpt from Khakee (1998, p. 364) describing a general Rational Comprehensive Planning (RCP) process model in natural language:

"The rational planning [...] is based on instrumental rationality, whereby decision-makers decide on goals and put questions about policy measures to professional planners and other experts who then formulate alternative plan proposals."

This very high level description of a RCP process may apply to a number of real world processes. Needless to say, a planning process might assume many other very different forms in practice, which in this case will be modelled accordingly. Anyway, the RCP process description in natural language specifies a number of actors, activities, a sequence flow, inputs, and outputs of the process.

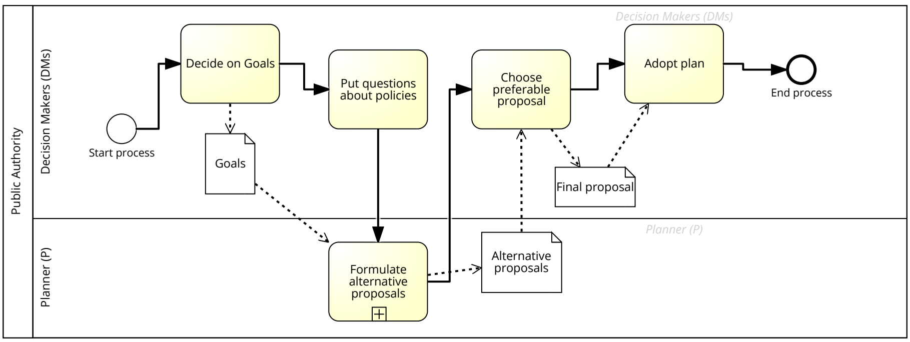

Figure 1. Planning Process Model of a generic Rational Comprehensive Planning process (as in Khakee, 1998, p. 364) represented in Business Process Model and Notation language (BPMN 2.0).

The Planning Process Model (PPM) shown in Figure 1 represents the same process in BPMN. More precisely, with some additional information, it shows how the process is carried on by a public authority (i.e. the pool) within which the two main roles or actors, the planner 'P' and the decision-makers 'DMs' (i.e. the lanes) perform their activities or tasks (i.e. rounded rectangles). Data or documents (i.e. rectangles with folded corner) can be input or output for certain tasks. The high-level process representation can be further detailed using sub-processes (i.e. rounded rectangles with '+' sign). The diagram in figure 2 shows a possible sub-process – among the many which could be chosen – which can be executed to unfold the 'Formulate Alternative Proposals' activity.

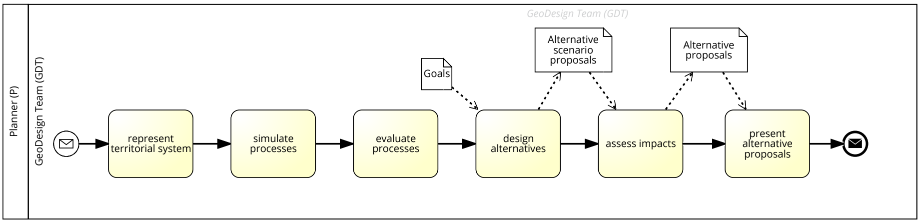

Figure 2. Representation of a sub-process of the RCP process model (see Figure 1) in BPMN 2.0.

In the example, the 'Formulate alternative proposals' activity model (Figure 2) recalls the workflow of a Geodesign study involving the creation of representation, process, evaluation, change, impact and decision models (Steinitz, 2012).

The sub-process decomposition can be further detailed until elementary tasks are defined. Thus, process modelling can describe the planning process down to the finest details.

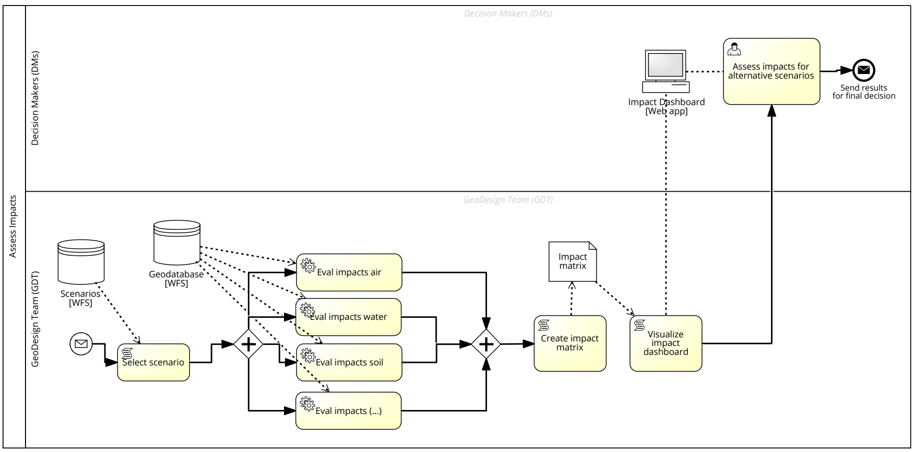

Figure 3. Decomposition of a sub-process of the RCP process model in BPMN 2.0.

In figure 3, the ‘assess impacts activity’ is further decomposed. Together with actors, activities, and gateways which describe the sequence flows, data objects (i.e. standard Web Feature Services) and other artefacts (i.e. an impact dashboard web app) are shown in this example sub-process model. As by the model, after alternative scenarios are built in the ‘design alternatives’ activity, a software script selects one by one each scenario from a database, and for each scenario a number of processing models available in a remote server as standard Web Processing Services (WPS) are run to evaluate the scenario impact on air, water, soil and all the other natural and anthropogenic subsystems which may have been considered important by the participants. Afterwards, the results are saved and visualized for the decision-makers to make their assessments, which will be the base for the final decision.

The examples shown in figure 1 to 3, while depicting only one possible way by which a part of a planning process may unfold, show how the BPMN language may effectively represent the process elements needed to fully document both the activity workflows, the role of the actors, and the required enabling technologies.

Using light-weight BPMN web editors such as Signavio (www.signavio.com) or ProcessMapper (www.processmapper.com) process can be designed and analysed in order to avoid inconsistencies. Planning process models can be also created collaboratively and stored in repositories for sharing and reuse (e.g. in real world metaplanning exercises, for research purposes, for education and training exercises).

Moreover, with full-featured BPMS, the planning process models can be used for process-oriented second generation PSS deployment. Indeed, professional BPMS after configuration can automatically turn graphical process models into desktop or mobile applications. That is, with reference to the previous examples, when a task is instantiated, the BPMS can supply to the responsible users the necessary ICT services (e.g. desktop applications, apps, or even atomic web data or processing services) as demonstrated by Campagna et al. (2014a, b).

5. ONE MORE PRACTICAL EXAMPLE OF PLANNING PROCESS MODELLING

As one more example from a real-world planning process, this section proposes the Planning Process Model in BPMN of Geodesign workshop held in Belo Horizonte (BR) in 2015. The Geodesign workshop process was structured according to the Steinitz Framework for Geodesign (Steinitz, 2012) and was supported by the Geodesign Hub PSS (http://www.geodesignhub.com/). The workshop was coordinated by a team led by the author (i.e. the Coordination Team), and a group of 21 academics, students and public administration officials participated, representing the local stakeholders. The schedules lasted three days within which the participants were firstly introduced to the

Geodesign approach and to the PSS, and then carried on a collaborative conceptual design of future scenarios for the Pampulha urban region. The workflow was intense and the sequence of activities sometimes frantic under the pressure of tight schedules within the available time. From the organisational perspective documenting the process in BPMN beforehand was very helpful first to achieve mutual understanding among the Coordination Team and then to guide the group successfully towards the end, where three future final scenarios were chosen and presented by the participants. The base BPMN workflow of the Geodesign workshop is given in figure 4.

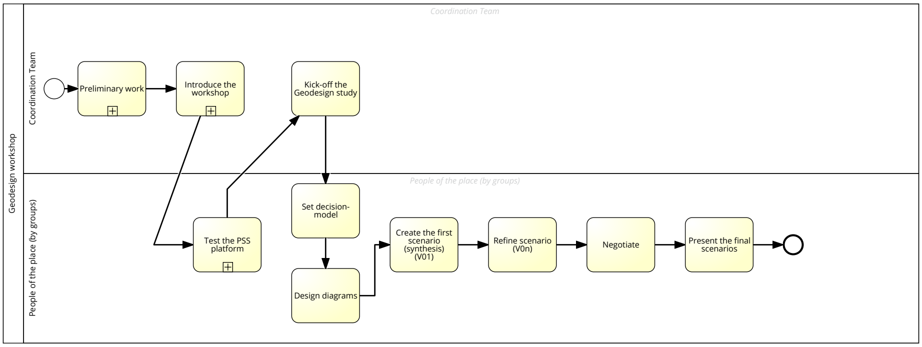

Figure 4. The main activities of the Geodesign workshop.

In the PPM depicted in Figure 4 all the main activities of the Geodesign workshop are given in sequence. Each of them can be further defined adding details about sub-tasks, data input/output of each activity, and supporting technology adopted. The sequence can also be described with a higher level of details as in Figure 5.

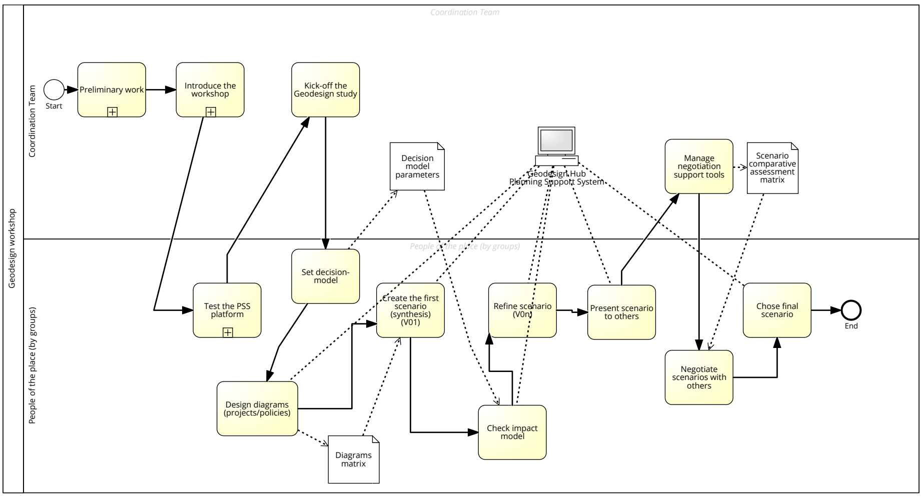

Figure 5. Detailed sequence of the Geodesign workshop.

Both of the PPM show just one possible way to implement the process and can be used as to-be or as-was model to guide or to document the process unfolding respectively. In both cases, planning process modelling contributes to develop a better understanding of the process among the participants with benefits for the coordination and the transparency.

6. CONCLUSIONS

As discussed in this paper, BPM methods and tools may offer several advantages for the implementation of metaplanning in practice. However, more research should be devoted to test the reliability of the BPM approach to metaplanning and PSS 2.0 design and implementation in complex real world planning processes.

On the opportunities side, it seems reasonable to expect that the use of BPMN as a semantically-rich graphical language to represent the planning process may be useful both for creating better mutual understanding among the process participants in the plan-making phase, as well as to make the process accountable to the community when the results are presented during the SEA information and consultations, or anytime after the plan adoption. 'To-be' planning process models in BPMN can also be used to share process templates, such as often happens with regional regulations which define specific actors and phases to be implemented in planning processes at the local level. To further demonstrate these opportunities more on-the-field research should be devoted to compare the communicative power of BPMN with other languages. However, unlike with texts, a process model in BPMN to be valid should have a start, an end, and a sequence flow of activity between them, making easier to detect bottlenecks, deadlocks, or any lack of definition which may undermine the effectiveness of the process instances. Early experiments carried on by the author on regional planning regulations and guidelines already demonstrated that the translation of textual process guidelines to BPMN may help to detect possible issues and pitfalls in the process definition which can prevent the achievement of mutual understanding among the different players in spatial government.

From an operational perspective, to put metaplanning in practice with BPM, especially in complex planning processes, the full representation of the process would require possibly a high number of models. However, well-structured repositories can be used not only to orchestrate the process, but also after its implementation to share plan-making knowledge. Thanks to a powerful query mechanism, model repositories could be used ex-post to understand how tasks were implemented and by whom. Such information would broaden the assessment of the decision-making process, which already should be part of SEA, but most of the time is limited to such issues as the reliability of data sources for decision-making. This way, not only the effect of data accuracy but also the way data are used to support decisions could be documented and evaluated ex-post. In addition, the planners and the other actors with their organisational roles and skills, as well as the methods and the enabling information technology landscape of the geodesign firm, can be represented accurately, and shared with other actors for re-use for professional, research or education and training purposes.

While it has been already demonstrated that simple routine planning tasks can be represented in BPMN, and that those models can be used to enact the automated orchestration of the supporting technology, it would be desirable that more empirical research would be devoted to understand to what extent it is possible to reach similar results and advantages in more complex planning activities, or eventually in the full planning process life-cycle.

Other underlying issues, which should be more deeply investigated, might also be related to how BPM may deal with possible informal characteristics of a planning process, and on the actual opportunity and willingness to make the planning process as structured as business processes in other domains.

To conclude, as concisely claimed in this paper, BPM method and tools can be used both to implement metaplanning with the aim of improving the planning process, and, at the same time, to deploy process-oriented second generation PSS. Indeed further research is needed to apply this approach to deal with the complexity of real world planning practices, and it should include both the business and the technology perspectives in order to bridge the gap between PSS research and practice, and eventually develop robust BPM platform for process-oriented PSS deployment. However the foundation seems to be already set to advance metaplanning implementation in practice and second generation PSS research.

ACKNOWLEDGEMENTS

The work presented in this paper was developed by the author within the research project "Efficacia ed efficienza della governance paesaggistica e territoriale in Sardegna: il ruolo della VAS e delle IDT" [Efficacy and efficiency of landscape and environmental management in Sardinia: the role of SEA and of SDI] CUP: J81J11001420007 funded by the Autonomous Region of Sardinia under the Regional Law n° 7/2007 "Promozione della ricerca scientifica e dell'innovazione tecnologica in Sardegna".

REFERENCES

Allen, E. (2001). INDEX: software for community indicators. In R. K. Brail, & R. E. Klosterman (eds.). Planning Support Systems: Integrating Geographic Information Systems, Models and Visualization Tools (pp. 229-261). Redlands, CA: ESRI, Inc.

Bhargava, H.K, Krishnan, H. & Muller, R. (1997). Decision Support on Demand: Emerging Electronic Markets for Decision Technologies. Decision Support Systems 19.3: 193–214.

Campagna, M., Ivanov, K., & Massa, P. (2014a, June). Orchestrating the spatial planning process: from Business Process Management to 2nd generation Planning Support Systems. In: Proceedings of the 17th AGILE Conference on Geographic Information Science, Connecting a Digital Europe through Location and Place. Castellón, Spain.

Campagna, M., Ivanov, K., & Massa, P. (2014b). Implementing metaplanning with Business Process Management. Procedia Environmental Sciences, 22, pp. 199-209.

Champlin, C., Hartmann, T. & Dewulf, G. (2014). Negotiating PSSs as Epistemological Objects: An exercise in sociotechnical model development for planning support. Manchester, UK. Retrieved from www.revitaplan.com/preview/31

DeBettencourt, J. S., Mandell, M. B., Polzin, S. E., Sauter, V. L , & Schofer, J. L. (1982). Making planning more responsive to its users: the concept of metaplanning. Environment and Planning A, 14(3), 311-322.

Emshoff, J. R. (1978). Planning the process of improving the planning process: A case study in meta-planning. Management Science, 24(11), 1095-1108.

Hall, P. (2002). Urban and Regional Planning. London: Routledge (fourth ed.).

Harris, B. (1989). Beyond geographic information systems: Computers and the planning professional. Journal of the American Planning Association, 55, 85-90.

Healey, P. (1993). The communicative turn in planning theory and its implications for strategy formation. In F. Fisher, & J. Forester (eds.), The Argumentative Turn in Policy Analysis and Planning (pp. 233-253). Durham, NC: Duke University Press.

Innes, J. E. (1996). Planning Through Consensus Building: A New View of the Comprehensive Planning Ideal. Journal of the American Planning Association, 62(4), 460-472.

Khakee, A. (1998). Evaluation and planning: inseparable concepts. Town Planning Review, 69(4), 359-374.

Klosterman, R. E. (1999). The What if? Collaborative planning support system. Environment and Planning B: Planning and Design, 26(3), 393-408.

Kwartler, M., & Bernard, R. (2001). CommunityViz: an integrated planning support system. In R. K. Brail, & R. E. Klosterman (Eds.). Planning Support Systems: Integrating Geographic Information Systems, Models and Visualization Tools (pp. 285-308). Redlands, CA: ESRI, Inc.

McLoughlin, J. B. (1969). Urban and Regional Planning: a Systems Approach. London, United Kingdom: Faber.

Steinitz, C. (2012) A framework for Geodesign. Redlands, CA: ESRI, Inc.

Weske, M. (2012) Business Process Management: Concepts, Languages, Architectures. Berlin/Heidelberg: Springer-Verlag.