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Delivering Evidence-Based Management Services: Rising to the Challenge Using Design Science

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Abstract

Evidence-based management (EBMgt) concerns making complex managerial decisions by combining the decision maker's knowledge and experience with scientific knowledge. A major obstacle to this practice is the lack of support. In this paper, we employ design science to develop an ensemble of conceptual, information and IT artifacts that support EBMgt. The approach is instantiated and validated in a case study using a combination of methods, including proof of concept, laboratory experiment, satisfaction survey, and focus groups. The proposed approach turns EBMgt into a repeatable practice, supported by reusable tools, and brings some degree of automation to the process. To our knowledge, EBMgt services have not yet been realized in a concrete manner, and not with concrete empirical results. Therefore, this study provides a first-of-a-kind demonstration and assessment of the viability of EBMgt services.
Keywords Evidence Based Practice; Evidence Based Management; Decision Tools; Design Science.

1. Introduction

Evidence-based practice (EBP) concerns making complex decisions by combining the decision maker's knowledge and experience with knowledge synthesized from scientific research (Rousseau and Gunia, 2016). EBP has emerged in the field of medicine with the purpose to increase decision quality and efficiency (Rynes and Bartunek, 2017). The practice is widely taught in medical schools and practitioners have grown accustomed to integrating research reviews with their practice (Slavin, 2002). As a result, more than eleven reviews in medicine are published every day (Djulbegovic and Guyatt, 2017).

In the mid 2000's, several researchers proposed bringing EBP into management, an approach known as evidence-based management (EBMgt) (Briner and Walshe, 2013; Pfeffer and Sutton, 2006; Rousseau, 2006). EBMgt can be seen as an organizational decision-making practice, which helps making informed business decisions (Allen *et al.*, 2010; HakemZadeh and Baba, 2016). Proponents of EBMgt suggest that it provides the basis to answer many complex questions that managers may ask, which may have been explored by researchers (Wainwright *et al.*, 2018). EBMgt also contributes to decrease the research-practice gap by simplifying access to scientific knowledge (Rynes and Bartunek, 2017; Wainwright *et al.*, 2018; Wright *et al.*, 2016).

Even though the EBMgt value proposition seems compelling, we cannot expect managers to repeatedly engage in that practice. To increase buy-in, EBMgt must be supported by digital services, which would make the evidence more accessible to non-academics, speed up the process, and promote quality and reuse (Bates *et al.*, 2003; Wainwright *et al.*, 2018). However, in contrast to the field of medicine, where

practitioners have easy access to a variety of digital services, including databases (Rynes and Bartunek, 2017), screening tools (Zeng *et al.*, 2015), and decision tools (Bates *et al.*, 2003), we are not aware of similar services being offered to managers.

Exploring the domain, we find a few prior studies that have attempted to increase the buy-in of EBMgt. Barends and Rousseau (2018) provide guidance and a framework to understand EBMgt in practice. In a similar vein, Daouk-Öyry et al. (2020) propose a model "to understanding the specific competencies necessary for the practice of core EBMgt activities" (p. 1397). Further, The Centre for Evidence-Based Management (CEBMa) and the Chartered Institute of Personnel Development (CIPD) offer educational resources, guidelines and consulting services related to BPM. CEBMa also offers a tool that helps appraising the trustworthiness of cause-and-effect relationships reported in scientific studies (CEBMa, 2017). Though these efforts contribute to understand EBMgt, most of them mainly stay at the conceptual level. Therefore, the domain would benefit from a EBMgt service at the operational level.

In this paper, we develop an approach for EBMgt services that helps to operationalize evidence-based practices. Inspired and guided by Design Science Research (DSR) (Hevner *et al.*, 2004), we design and develop EBMgt services as a set of conceptual, information and IT artifacts supporting EBMgt. We accomplish several actions to validate the approach. We instantiate the approach in a case study (Yin, 1994), which gives proof of concept. We also conduct empirical research and focus groups to assess the effectiveness of some key artifacts required by the approach. Therefore, our study provides feedback on both the viability and effectiveness of the EBMgt services.

We structure the remainder of this paper as follows. In the next section, we discuss and justify the research approach. Section 3 reviews the literature and elaborates an EBMgt service model. Section 4 explains the proposed EBMgt approach. Section 5 instantiates and validates the approach. Section 6 discusses the implications and contributions of this study. Finally, Section 7 provides concluding remarks.

2. Research Approach

Our research approach is based on the DSR paradigm, which seeks to extend knowledge through problem solving and creation of innovative and useful artifacts (Hevner *et al.*, 2004). Adopting design science to help resolve EBMgt is not a new idea (Van Aken and Romme, 2009), but in this paper we develop this idea both conceptually and practically. As design science comprises two main activities: develop/build and justify/evaluate (Hevner *et al.*, 2004), we first develop an ensemble of artifacts, which together provide prescriptive knowledge on how to deliver EBMgt services (Iivari, 2007). The developed artifacts are then evaluated and illustrated through case study. The development activities are depicted in Figure 1. We start by developing an EBMgt service model, which structures applicable knowledge about EBP. Such knowledge is then used to develop an EBMgt approach. The approach is then materialized using information and IT artifacts. The evaluation activities are also depicted in Figure 1. They comprise a case study, which applies the EBMgt approach, and a set of validation actions including proof of concept, laboratory experiment, satisfaction survey, and focus groups.

We further note that our research approach is centered on a specific strategy for conducting DSR, which concerns meta-design. Meta-design contributes general methods for solving a class of problems, rather than offering bespoke solutions to specific problems found in practice (Iivari, 2015). We adopt this strategy in our research because:

- We regard the provision of EBMgt services as a general problem, which must address a diversity of decision-making needs;
- The general problem can be solved by developing an ensemble of artifacts, which together deliver EBMgt services to business decision makers;
- The ensemble of artifacts contributes a general method on how to realize EBMgt.

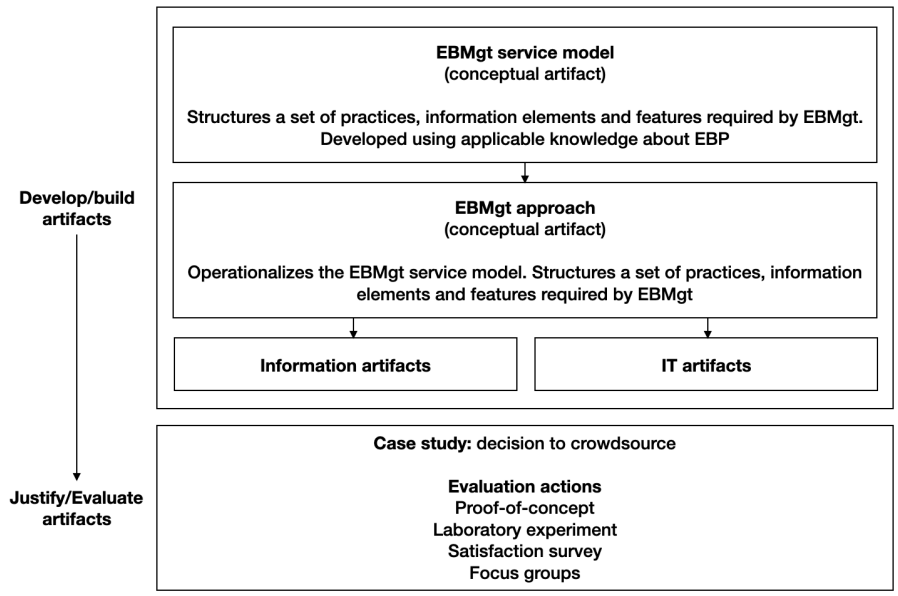

Figure 1. Research activities

As noted by Iivari (2015), meta-design does not have an identifiable client. Instead, it addresses a set of potential would-be clients, which in this case are business decision makers. We also recognize the diverse nature of artifacts in DSR, considering different uses, levels of abstraction, and degrees of designability, where some artifacts contribute to build other artifacts (Goldkuhl, 2013; Iivari, 2017). For that reason, we organize the EBMgt approach as the design of three types of artifacts (Lee *et al.*, 2015) (Figure 1): conceptual, information and IT artifacts. Conceptual artifacts support design activities, defining, representing and articulating the problem, solution and domain. Information artifacts support processing by humans and IT. IT artifacts are tools used to solve problems. In the following section, we present our first (conceptual) artifact.

3. EBMgt Service Model

In the following, we draw from various sources to develop an EBMgt service model. Considering that EBP is much more developed in medicine than management, we often translate knowledge about EBP in medicine to the managerial field.

EBMgt starts with a question, which leads to a review (Figure 2). The review is the process of synthesizing knowledge from the available evidence. Two types of evidence can be considered, depending on their levels of trustworthiness and relevance (Barends, 2015; Kepes *et al.*, 2014). The first type involves experiential knowledge extracted from cases, interventions, developments, examples, and other contributions for which knowledge is yet to be consolidated or is rapidly evolving (Kepes *et al.*, 2014). The second type involves cumulative knowledge, for instance in the form of theory, meta-reviews and controlled cases (Kepes *et al.*, 2014). Cumulative knowledge is considered more trustworthy and relevant than experiential knowledge (Barends, 2015; Kepes *et al.*, 2014). However, experiential knowledge may still be relevant for decision making when cumulative knowledge is not available or lacks contextualization.

The review process also concerns a set of practices (Pearson, 2010). Integration/aggregation is the act of adding up evidence by pooling data from multiple studies, while interpretation is the more qualitative act of generating inductive interpretations from the available evidence.

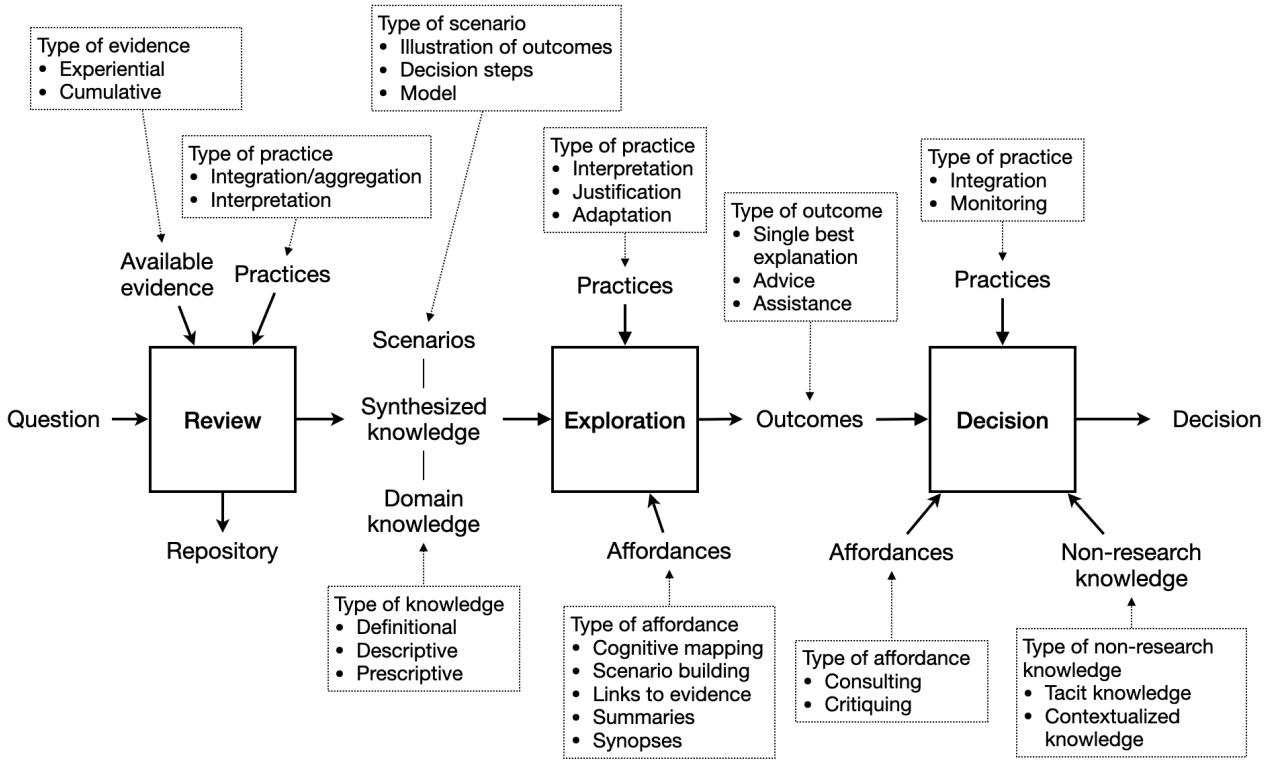

Figure 2. EBMgt service model

The outcome of the review process is synthesized knowledge, which can be divided into two different sets: domain knowledge supports the decision maker in the process of understanding the question domain, while scenarios support understanding and articulating the possible outcomes of a decision. Domain knowledge can be divided into three types (Kepes *et al.*, 2014): definitional knowledge describes the conceptual elements, while descriptive knowledge defines relationships and rules, and prescriptive knowledge expresses methods and procedures of the domain. Even though domain knowledge can provide a plethora of evidentiary elements, it does not directly concern which decisions can be made in terms of outcomes. The latter is the main purpose of scenarios. Three types of scenarios can be considered (Dicks *et al.*, 2014): an illustration of outcomes shows (for example) a decision tree/table with all possible decision nodes and respective outcomes; the decision steps are not focused on the decision per se, but on the process leading to the decision; and a model that allows practitioners to visualize and explore the decision outcomes by playing with variables.

The final aspects we consider in the review is storing the results in a repository. This is a relevant aspect of EBMgt because the community has realized that the approach, in order to succeed, needs to be taken collaboratively (HakemZadeh and Baba, 2016), since sharing the synthesized knowledge with others will encourage the adoption of EBMgt services. This phenomenon can be seen in the Cochrane Collaboration, which was the earliest aggregator in medicine and contributed to the community development of a reusable repository (Djulbegovic and Guyatt, 2017).

After the review comes exploration. Here, the synthesized knowledge is used to analyze the possible outcomes of decisions. This stage is molded by practices and affordances. Practices reflect the intentions of the decision maker and may consider (Jarzabkowski *et al.*, 2012; Kepes *et al.*, 2014): interpretation that seeks to understand the characteristics of the domain; justification that seeks to find rational support for a made decision; and adaptation which concerns the repurposing of knowledge to apply a decision to a particular context. Affordances combine people and technology to enable exploration of the synthesized knowledge. The notion of affordance expresses the idea that exploration is a cognitive process that combines people and technology in the pursuit of certain effects (Pozzi *et al.*, 2014). Several affordances can be identified (Chen and Lee, 2003; Haynes, 2007): cognitive mapping helps understand the domain knowledge by graphically showing its concepts and relationships; scenario building supports forward thinking by manipulating conditions and future states; links to evidence trace pieces of evidence to their original sources;

summaries put evidence together to suggest panoramic views of possible outcomes and synopses; and synopses provide ready-made decision outcomes, usually based on aggregated evidence.

The exploration stage finishes with outcomes. Three different types of outcomes can be considered (Musen *et al.*, 2014): a single best explanation; advice about which outcome is the best to select, based on the reviewed evidence; and assistance, which provides the pieces of evidence necessary to decide, but leaves the selection of the most appropriate outcome to the user.

After exploration, it is time to decide. A decision can combine the synthesized outcomes with non-research knowledge. This combination is considered critical to EBMgt, as it allows practitioners to appraise the evidence according to their context. Non-research knowledge includes practitioners' tacit knowledge (Dawes *et al.*, 2005) and contextualized knowledge (Dicks *et al.*, 2014). Decisions can also be characterized by a set of practices (Kepes *et al.*, 2014): integration involves integrating all available information, including research and non-research knowledge; and monitoring involves checking how the decision is applied in a specific context. Decisions can also be molded by affordances (Musen *et al.*, 2014): Consulting is centered on putting together the pieces of evidence supporting a decision, while critiquing is focused on identifying faults in a selected decision.

Finally, after reviewing, exploring, and deciding, we have a decision. Overall, the EBMgt service model structures a set of practices, information elements, and features (affordances) required for EBMgt. In the next section, we develop an approach to operationalize this model.

4. EBMgt Approach

We regard EBMgt as a process, which articulates a set of activities and information artifacts supported by IT artifacts (Figure 3). Next, we detail the process activities and information artifacts, and then discuss the IT artifacts. We finish with a discussion about users.

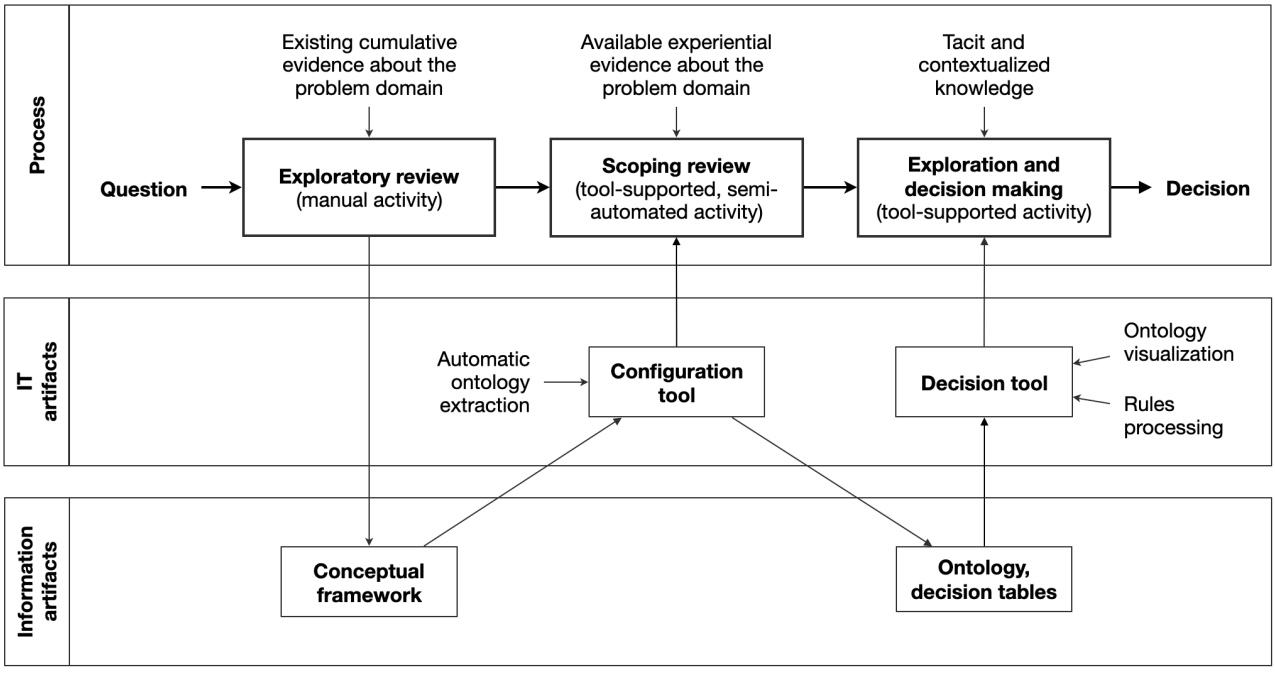

Figure 3. EBMgt approach

4.1. Process activities and information artifacts

Activity 1: Exploratory review. The purpose of the exploratory review is to generate a conceptual framework about the question. Conceptual frameworks are "simplified conceptualizations and representations of problems" (Hevner *et al.*, 2004). We focus on this type of output because it provides a lens about the question, which puts the problem in focus using a certain viewpoint (Niederman and March, 2019). This activity involves searching the literature for cumulative evidence related to the question. Cumulative evidence is usually crystallized in core papers, which tend to be frequently cited. Therefore, an exploratory review does not have to be extensive. The output of this activity sets the stage for the next activity, defining a set of keywords to research the literature in a more comprehensive way than the exploratory review.

Activity 2: Scoping review. Scoping reviews are focused on summarizing the breadth of knowledge on a particular topic using transparent criteria (Paré *et al.*, 2016). We argue that the combination of exploratory and scoping reviews provides an expeditious way to search the literature. The exploratory review provides an initial lens and identifying relevant search keywords, which are used by the scoping review to generate a detailed "map" of the available evidence.

An important consideration to make is what evidence should be searched in the scoping review. We suggest that experiential evidence is particularly important for EBMgt because it helps drawing insights in ways that can be interpreted in different contexts. Since experiential evidence is common in the management field, e.g., case studies and surveys, it seems reasonable to target this specific type of evidence in EBMgt.

We define two outputs from the scoping review, an ontology and a collection of decision tables. Ontology concerns the assumptions and beliefs we hold about the domain (Biesta, 2010). Ontologies are especially relevant in the management field because the field is very diverse. Ontologies offer a way to bring together a variety of concepts and relationships in a way that promotes understanding rather than being systematic (Chandrasekaran *et al.*, 1999). The second output from the scoping review are decision tables. Decision tables aggregate business rules and recommendations contributed by experts. They articulate concepts and relationships using evaluation criteria and decision options (Rockwell *et al.*, 2010).

Activity 3: Exploration and decision making. The outputs from the scoping review feed the last activity, which concerns exploration and decision making. Broadly speaking, the main goal is arriving at a specific decision for a specific problem by integrating the knowledge provided by the ontology and decision tables with tacit and contextualized knowledge provided by the decision maker.

4.2. IT artifacts

The process activities are supported by two IT artifacts, which support the scoping review and exploration and decision making. These IT artifacts are discussed below.

Configuration tool. This tool helps build the ontology and decision tables. The tool has two components. The ontology component, which is shown on the left-hand side of Figure 4, was developed using Protégé[1] and enables users to define concepts, attributes, and relationships in OWL (Web Ontology Language). These elements can be defined automatically, by extracting concepts and relationships from a collection of papers. Automatic extraction uses OntoGen (Fortuna *et al.*, 2005) to obtain the ontology elements from abstracts of selected articles, considering the frequency of occurrences. The configuration tool allows manual adjustments to the ontology after automatic extraction.

The decision tables component, which is shown on the right-hand side of Figure 4, was developed using Camunda[2] and enables users to create and link decision tables to concepts defined in the ontology. Decision tables are visually defined using Camunda and specified in DMN (Decision Model and Notation). Decision tables express recommendations in the form "if [set of conditions] then [set of recommendations]".

The configuration tool generates a set of configuration files that shape the decision tool to operate over the question.

Decision tool. We anticipate that EBMgt will only thrive if EBMgt becomes a repeatable practice, supported by reusable tools. The availability of a decision tool that helps exploring the collected evidence independently of the problem is essential to deliver the EBMgt value proposition.

The functionality of the decision tool is summarized in Figure 5. Knowledge is supplied by the ontology and decision tables. The usage of ontologies and decision tables are well-known to support solid decision support (Haghighi *et al.*, 2013; Miah *et al.*, 2014; Thuan *et al.*, 2018). The rules processing component provides a way to explore the knowledge. Rules are expressed as criteria, alternatives, constraints, and evaluation information. The interaction component offers a graphical user interface, which allows browsing and selecting evidence, and manipulating different parameters and rules (Figure 6).

[1] protege.stanford.edu.
[2] camunda.com.

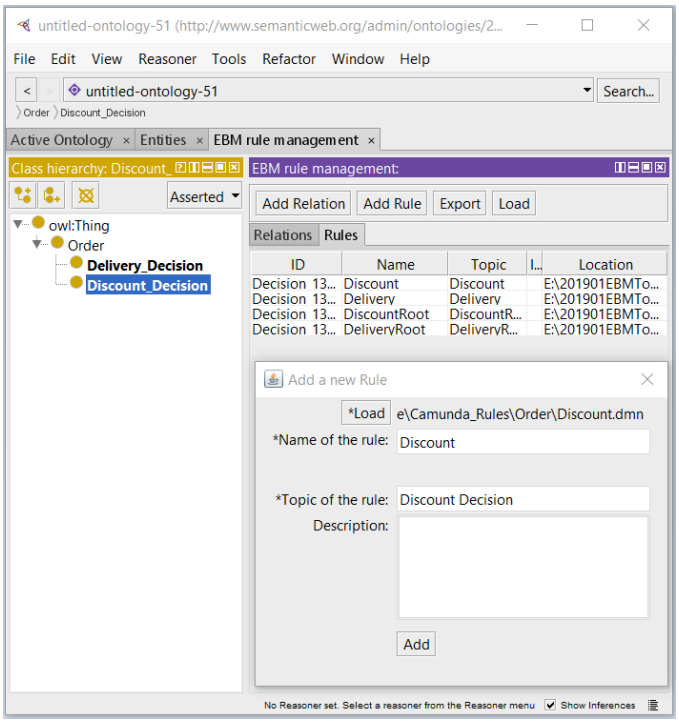

Figure 4. Configuration tool

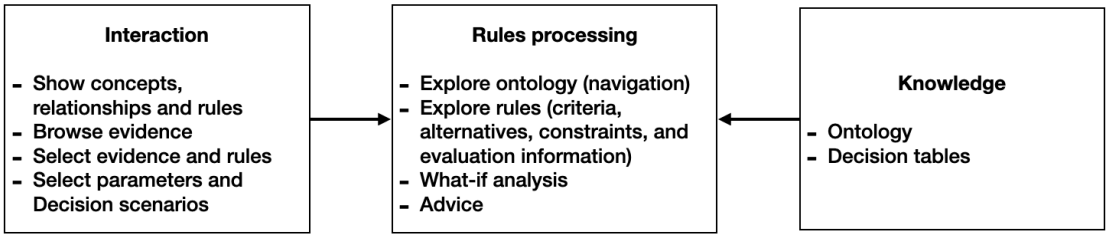

Figure 5. Functionality provided by the decision tool

Supported by the decision tool, users can overview the concepts defined in the ontology, which are presented in a tree structure (Figure 6, left). Users can select specific concepts to see definitions and relationships to other elements. When selecting a concept, the tool shows the related decision tables and highlights a set of parameters that the user may change (Figure 6, right). When a parameter is changed, the tool executes the decision rules specified in the decision tables and updates the outputs. This allows users to perform what-if analysis.

The decision tool uses the same technology of the configuration tool. The two tools are reusable because they do not depend on specific questions or knowledge bases. They provide a general approach for exploring the evidence generated by the scoping review.

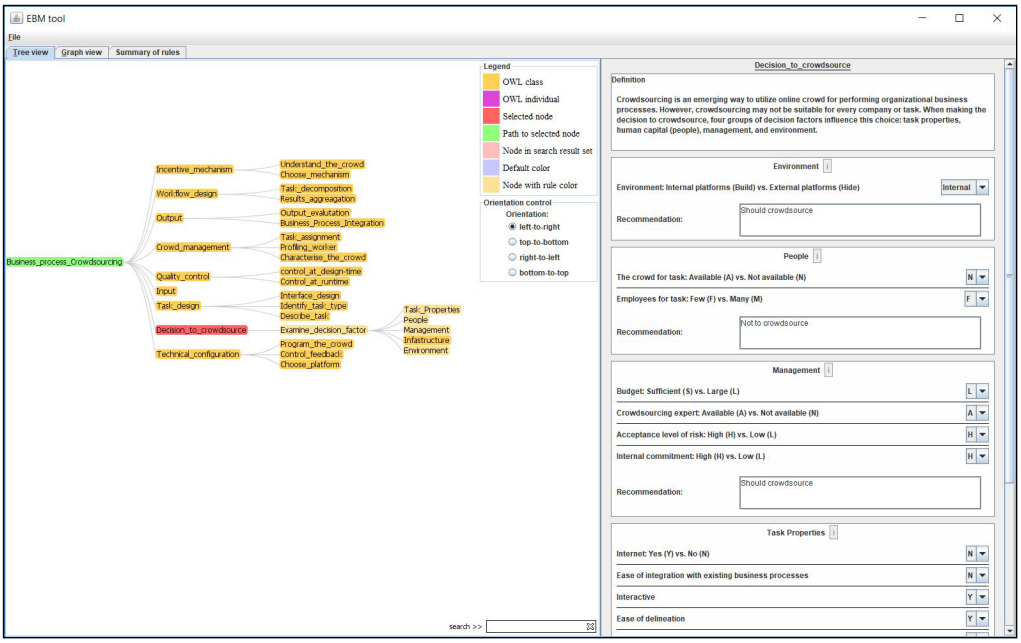

Figure 6. Decision tool

4.3. A discussion about users

We now discuss who is involved in the EBMgt process. The ideal situation would involve a business decision maker to undertake the whole process, from exploratory review to scoping review and decision making. However, we must consider that, for a variety of reasons, some business decision makers may oppose to being involved in the reviews. In fact, reviews take time and have certain requirements and constraints, which may create attrition. We address these issues in two different ways. One is providing a certain degree of automation to the process, in particular the ontology construction and configuration of the decision tool. However, the ontology may still require manual adjustments, and decision tables must be developed by hand. The other way to address the problem is to involve other users in the process, e.g., researchers and business analysts. Researchers may contribute the required information artifacts as research contributions targeted to practitioners. The incentive would be to reduce the research-practice gap.

Business analysts may also be involved in the process, performing the activities required to configure the decision tool, which will then be used by decision makers. This division of responsibilities is not unusual in business environments. The possibility of crowdsourcing the reviews should also not be discarded. Given the level of standardization provided by the information and IT artifacts, the construction of ontologies and decision tables could be done by crowd researchers.

5. Case Study

To justify/evaluate the proposed approach, in this section we describe a case study where it has been applied: making the decision to crowdsource (Thuan *et al.*, 2017, 2018). We consider that the case study method is appropriate for four reasons. First, case studies are the most popular way to justify/evaluate method artifacts (Peffers *et al.*, 2012), which in our case is the proposed EBMgt approach. Second, the case study method is also appropriate to justify and evaluate an approach that is complex, involving an ensemble of artifacts, and different activities and users. As noted by Yin (2013), “for evaluations, the ability to address the complexity and contextual conditions nevertheless establishes case study methods as a viable alternative among the other methodological choices” (p. 322). Third, the decision to crowdsource involves diverse evidentiary data from, e.g., multiple research findings, practical reports, and suggestions, which need a pragmatic approach for synthesizing them. Finally, the case study approach also provides a versatile platform to explore the EBMgt approach in context (Harrison *et al.*, 2017).

The case study involves the decision to crowdsource (Thuan *et al.*, 2016). The case description starts with a short introduction, followed by the three main activities considered by the EBMgt approach.

5.1. Decision to crowdsource

Crowdsourcing allows organizations to utilize an anonymous crowd to accomplish tasks over the Internet (Howe, 2006). Crowdsourcing has been used for a variety of tasks, from simple to complex (Djelassi and Decoopman, 2013). While the uptake of crowdsourcing has been significant, organizations still face strategic decisions regarding whether it is suitable or not for their goals and contexts, and if yes, how to manage business process crowdsourcing (BPC). These are important managerial decisions. A successful adoption of crowdsourcing leverages competitive advantages, while failure to do so wastes organizational resources. The following question can then be formulated: which factors influence, and how do they influence BPC?

This question is challenging not because crowdsourcing studies are lacking. Quite the contrary, many studies exist (Afuah and Tucci, 2012). However, they reflect different, and often conflicting, viewpoints on the subject, which are difficult to integrate. Furthermore, crowdsourcing is mostly regarded in the literature as an ad hoc task while business processes require consistency and integration with business operations (Thuan *et al.*, 2017). The situation prevents managers from making informed decisions by just looking at the literature. In this scenario, the EBMgt method can offer evidence-based support to the decision to crowdsource.

5.2. Supporting the decision to crowdsource

The following describes what was undertaken to answer the question using the EBMgt approach.

Exploratory review. The first step involved an exploratory review of BPC. The review had an exploratory nature because the main goals were to identify the core academic publications related to the question and to construct a conceptual framework that would situate the question using a relevant viewpoint. The exploratory review highlighted the concept has been proposed by La Vecchia and Cisternino (2010) and then characterized in more detail by Pedersen et al. (2013) and Amrollahi (2015). Those were the core papers supporting the conceptual framework shown in Figure 6.

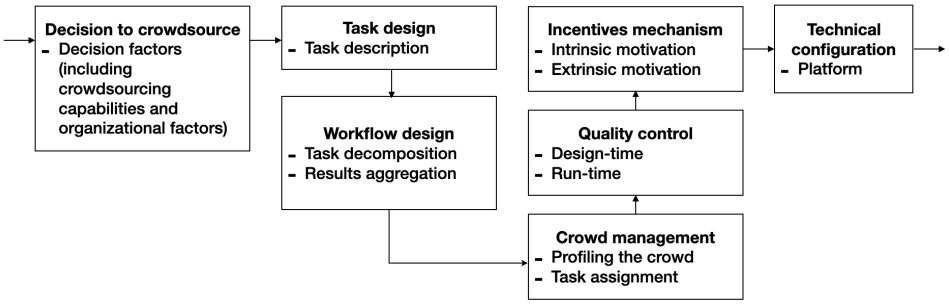

Figure 7. Conceptual framework of BPC

Scoping review. The conceptual framework provided the keywords necessary to conduct a scoping review. The scoping review retrieved 877 papers related to crowdsourcing from eight online bibliographic databases. By applying an exclusion filter, to eliminate unrelated papers, the pool was reduced to 238 papers. The filter required analyzing the paper's titles, keywords and abstracts, and deciding if the papers reported experiential evidence related to crowdsourcing (case studies, tool developments, experiments, surveys, etc.).

The abstracts of the 238 papers were processed using OntoGen, which, based on the frequency of occurrence, generated an ontology. The ontology was manually revised by reviewing the selected articles. Significant consistency was found between core concepts. However, the revision provided more clarity and adequateness to more peripheric concepts. The final ontology identified 39 salient concepts, plus a set of relationships (a fragment in shown in Figure 8).

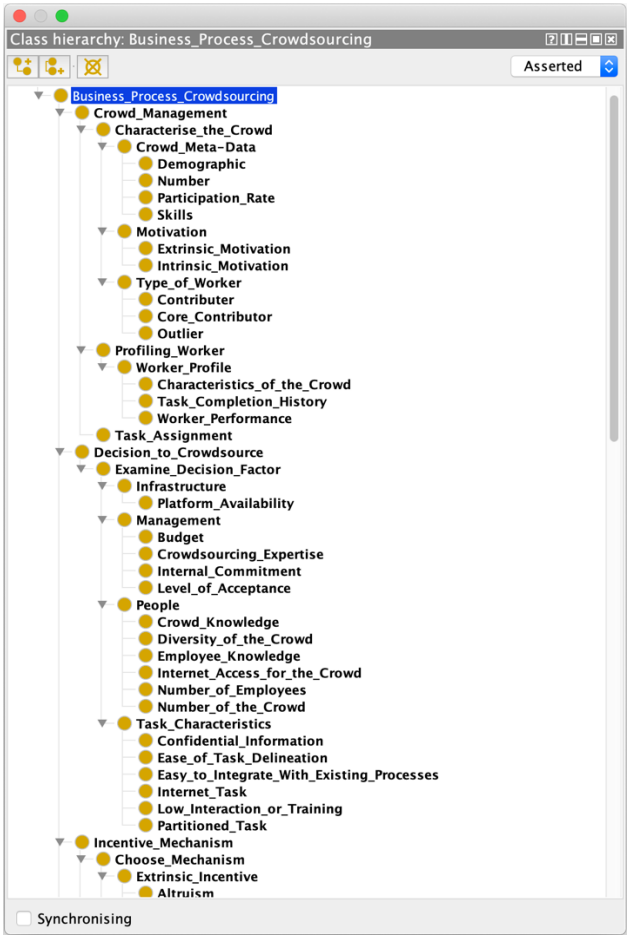

Figure 8. Fragment of the BPC ontology

After creating the ontology, the literature was analyzed again in search of business rules and recommendations related to BPC, which then resulted in a set of decision tables with scenarios and actionable rules supporting the decision to crowdsource. These tables synthesize evidence and practice-based recommendations taken from the reviewed papers. One such table (Table 1) describes different scenarios related to the task (Internet use, ease of integration, etc.), while other tables were developed to address other factors.

Table 1. Fragment of the decision table considering different task scenarios

Task - scenarios											
Internet: No (N) vs. Yes (Y)	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ease of integration with existing business processes		N	Y	Y	Y	Y	Y	Y	Y	Y	Y
Interactive			Y	N	N	N	N	N	N	N	N
Ease of delineation				Y	Y	Y	Y	N	N	N	N
Confidential information				Y	Y	N	N	Y	Y	N	N
Partitionable				Y	N	Y	N	Y	N	Y	N
Actions											
Do not crowdsource	X	X	X								
You should crowdsource						X					
Crowdsource with additional action: clearly define task in the crowdsourcing process								X	X	X	X
Crowdsource with additional action: hide confidential information				X	X			X	X		
Crowdsource with additional action: only crowdsource as a contest					X		X		X		X

We highlight the role of decision tables in the EBMgt approach, as they link the experiential evidence to specific scenarios and actionable decisions. Conversely, these decision tables may also be used to link a decision back to the experiential evidence and knowledge sources supporting that decision.

Exploration and decision making. Supplied with the ontology and decision tables, the decision tool guides decision makers through the essential steps and decisions necessary to define a crowdsourcing process. The tool allows decision makers to select an element from the ontology and then analyze decision scenarios, considering different contexts and decision alternatives. The tool provides advice by combining input data with scenarios defined in decision tables. In Figure 6, we show the decision tool configured to explore the decision to crowdsource.

5.3. Justification/Evaluation

The EBMgt approach was justified/evaluated using different methods. Next, we summarize the various evaluation actions that were accomplished.

Proof of concept. The case study applied the EBMgt approach to the decision to crowdsource, considering review, exploration and decision. It also required the development of support tools and information artifacts. As such, the whole endeavor provides proof of concept (or proof by demonstration): a documented piece of evidence in support of the EBMgt approach, which explains how to solve a problem and provides a course of action (Nunamaker *et al.*, 1990).

Venable et al. (2016) divide DSR evaluations in four categories, considering if they are naturalistic or artificial, or formative or summative. In our case, the case study was done by the researchers and therefore should be regarded as artificial and formative.

Laboratory experiment. The decision tool is critical to the EBMgt approach for various reasons. An important reason is that the decision tool is at the end of the critical path, supporting exploration and decision making. Furthermore, the decision tool utilizes several information artifacts required by the EBMgt approach, including, directly, the ontology and decision tables, and indirectly, the conceptual framework. Finally, considering that future EBMgt services will significantly depend on the availability of such a tool, a proper assessment of the utility of the decision tool can provide a good indicator of the potential of further developments of EBMgt services.

The experiment examined how effectively the tool assisted the decision to crowdsource. The experiment adopted a comparative approach, where two groups of participants were confronted with a set of exercises describing business scenarios and asking the participants to make the decision to crowdsource or not. One group made the decisions with tool support, while another group made the decisions without access to the tool. The experiment was conducted in two experimental sessions regarding two cohorts of students (industry management and information technology). Table 2 shows the number of participants per session. In total, the experiment involved 190 participants randomly divided into a treatment group (91 participants using the tool) and a control group (99 participants not using the tool).

Table 2. Number of participants

Experimental sessions	**Participant background (Student major)**	Control group (not using the tool)	Treatment group (using the tool)
1	Industry Management	49	51
2	Information Technology	50	40
Total participants		99	91

The average decision performance of each group was measured. A performance score was defined based on the individual answers to questions regarding what crowdsourcing strategy should be selected in four different scenarios. The scenarios were based on the study by Afuah and Tucci (2012), which considers several factors affecting the decision to crowdsource. For each scenario, multiple options were given to the participants. The participants were also required to explain their choices.

The performance score considered both the correctness of the selected answer and the explanation provided: 0 was assigned to an incorrect answer; 0.5 to a correct answer with wrong explanation, or vice versa; and 1 to a correct answer with a meaningful explanation. Since the participants had to provide answers for four different scenarios, the scores were obtained on a 0-4 scale where 0 is worse and 4 is best. For

example, a participant that gave two correct and justified answers, plus a correct but unjustified answer, and one wrong answer, would get a score of 2.5. The scores were given by a team of four markers with no relation to the study. The marking team used the study by Afuah and Tucci (2012) to assess the answers and assign the scores.

Table 3 summarizes the results from the experiment. We adopted Mann-Whitney tests to statistically compare the differences between groups because the distributions were not normal. The results indicate that better decisions were made using the decision tool (p-value = 0.03).

Table 3. Results from the experiment

Decision to crowdsource	**p-value**	**Control group** (not using the tool; n= 99)			**Treatment group** (using the tool; n = 91)		
		Mean	**Mean Rank**	**Std.**	**Mean**	**Mean Rank**	**Std.**
Average score (0-4 scale)	0.03	2.40	87.44	0.87	2.67	104.27	0.86

Satisfaction survey. We also analyzed the participants' perceived usefulness of the decision tool. We did this by conducting a survey at the end of the experimental sessions. The survey consisted of four questions rating the tool's usefulness on a 1-5 scale (Table 4). As the control group did not use the tool, before the survey, we asked this group to use the tool to make a crowdsourcing decision for a selected scenario. This way we ensured that all participants had some experience with the tool. Of the 190 participants, 181 completed the survey. The results showed a tendency towards perceived usefulness, that is, all means > 3.9 (out of 5).

Table 4. Perceived tool's usefulness by the participants in the experiments

Perceived usefulness (1-5 scale, 1: useless; 5: very useful)	**Mean**	**Std.**
Using the tool allows me to better answer the questions in the scenarios	3.98	0.63
Using the tool allows me to speed up my answers	4.01	0.80
Using the tool allows me to better understand the questions	3.96	0.77
I find using the tool useful	4.28	0.67

Focus groups. To further evaluate the decision tool, we also organized two focus groups with crowdsourcing experts and practitioners. One group involved four researchers conducting their PhD studies on topics related to crowdsourcing, and the other group involved six crowdsourcing practitioners. These practitioners had more than one-year experience with crowdsourcing projects in the civic sector. In each session, the participants used the decision tool and discussed its perceived usefulness. The insights from the focus groups were structured according to three dimensions: information support, decision support, and tool use. The detailed results of the focus group are presented in (Thuan, 2019) and summarized in Table 5.

Table 5. Summary of focus group results

Dimensions	**Supporting evidence**	**Counterevidence**	**Results**
Information support	The focus groups identified several instances where the decision tool was perceived useful to inform BPC decisions. For instance: "The tool provides more concrete [information]. I have some abstract ideas, it helps the actually specifics"	None	**Positive**
Decision support	After experimenting with the decision tool to make some decisions, some participants changed at least one of their decisions. For instance: "It is definitely promoting a lot of the right things to help make a correct decision"	Some participants suggested the tool did not change their decisions. Some participants suggested adding some decision factors, and weighting them. For instance: "I still rely on my own decision making"	**Mixed**
Tool use	Most participants did not require help; and verbalized the tool was easy to understand	One participant needed help on how to use the tool	**Positive**

Seen together, the various evaluation actions centered on the decision tool suggest that the tool provides value to the decision makers. As the tool is an important component of the EBMgt approach, we

have some positive indicators about the delivery of EBMgt services. The proof of concept provided by the case study also suggests that the EBMgt value proposition can be realized with the EBMgt approach.

5.4. Limitations of the case study

The case study has two main limitations. The first limitation is that the review activities were executed by the research team; only exploration and decision making were done by the participants. Therefore, the viability of having business decision makers doing the reviews is still untested.

The second limitation is that the laboratory experiment relied on business students instead of practitioners. However, we note that using students to evaluate software tools has been generally accepted. Sjøberg et al. (2005) analyzed 113 experiments of evaluating software and noted that "87 percent of the subjects were students" (p. 751). From a knowledge perspective, we understand that students may have limited tacit and contextualized knowledge, which can bias the decision. Addressing this limitation, we complemented the laboratory experiment with two focus groups involving practitioners, who provided further feedback on the decision tool.

6. Discussion

The main goal of our research is to contribute to realize EBMgt services. To our knowledge, EBMgt services have not yet been realized in a concrete manner, and not with concrete evaluation actions. Therefore, this study provides a first-of-a-kind justification and evaluation of the viability of EBMgt services.

A central element of our contribution is the EBMgt approach. Our EBMgt approach promotes a rigorous review process, which involves two steps, first building a conceptual framework, and second using the framework as the basis for a more systematic review. The articulation of the two reviews seems very relevant for realizing EBMgt services. We suggest the first review is particularly appropriate in the management field, as managerial literature embraces a diversity of contributions. Empirical research, case studies, and essays generate many types of evidence, all of which can be difficult to synthesize. The conceptual framework can be sufficiently open and flexible and yet useful to articulate different, if not conflicting concepts, and viewpoints. The conceptual framework identifies what is of interest while providing the necessary openness. Iivari (2017) notes that even though conceptual frameworks do not have "truthlikeness", they nevertheless are useful to identify the essential elements of a territory.

The scoping review uses the conceptual framework as the source of keywords to search the scientific literature more systematically. Our method seeks experiential evidence related to the question. We suggest focusing on this type of knowledge because, once again, the managerial field is diverse in terms of context, theory, methods, and contributions. If we restricted the reviews to cumulative evidence, practitioners could reject the approach for lack of storytelling (Rynes *et al.*, 2018), contextualization (Rousseau and Gunia, 2016) and decision support (Klein *et al.*, 2017).

The EBMgt approach includes a set of information artifacts, which bring a level of regulation over the reviews. We regard this regulation as important, as it supports the vison that an EBMgt service would accumulate knowledge each time someone follows the process to answer a question. This inductive approach is analogous to case research methods, where different case studies involving similar contexts inductively build theory. This of course contributes to expand the usefulness of EBMgt services.

The EBMgt approach also includes a set of IT artifacts. We argue that for EBMgt services to thrive, they must rely as much as possible on tools and automated processing. Therefore, our proposal includes two relevant tools. The configuration tool helps building the ontology and decision tables. The inclusion of automated ontology generation alleviates the burden of synthesizing knowledge and preparing that knowledge for exploration and decision making. The decision tool then helps to explore the synthesized knowledge. The decision tool may be used across different questions by regulating the affordances and practices involved in the exploration of synthesized knowledge. This may be regarded as a drawback but, again, we argue that for EBMgt services to thrive, they must rely as much as possible on regulated practices and reusable tools. As the lack of local contextualization has been identified as a major concern (Rynes and Bartunek, 2017), we address this concern with the decision tool by allowing users to configure the rules to reflect local scenarios.

The DSR paradigm also played an important role in shaping our EBMgt approach. Our meta-design creates and develops several artifacts. Two conceptual artifacts (EBMgt service model and EBMgt approach)

provide a model and a method for realizing EBMgt services. Three information artifacts (conceptual framework, ontology, and decision tables) define the type and structure of information required by EBMgt services. Two IT artifacts (configuration and decision tools) help synthesizing knowledge and making it actionable for exploration and decision making.

We argue that our approach provides a strong response to the many calls for EBMgt (Rousseau, 2012; Rynes and Bartunek, 2017; Wainwright *et al.*, 2018). Specifically, we define and develop an approach for delivering EBMgt services. We also provide a case study to illustrate the viability of the proposed approach and empirically evaluate the decision tool, which is a critical component of the approach.

Our meta-design should also be seen as a contribution to the IS community. In this case, we have developed a set of artifacts supporting EBMgt. This is important for two reasons. First, the developed information and IT artifacts have been tailored to be general enough to apply to a class of problems, rather than just a unique one. Second, our meta-design translates the meta-requirements of EBMgt into a set of prescriptions and artifacts. Perhaps the key to resolving EBMgt is the systematic use of information and IT artifacts, where the ontology artifact, in particular, could be regarded as the "missing link" between the early evidence gathering and the latter decision-making stage.

Our meta-design also highlights certain implementation aspects of EBMgt services, which have not yet been discussed in the related literature. We note that the EBMgt service model defines a set of practices and affordances related to the exploration of evidence and decision making. Such combination of practices and affordances, which have been realized in the EBMgt approach, contribute to characterize the functional requirements of future EBMgt services and systems. As the meta-design was instantiated in a case study, potential service providers may realize the problems, challenges and limitations of the proposed approach, but also the possibilities brought by automating or semi-automating some of the tasks, and potential benefits brought by standardized tools, in particular the configuration and decision tools.

The various evaluation actions accomplished by this study provide some qualitative and quantitative indicators about the viability of the EBMgt approach. We provide proof-of-concept evidence about the process of reviewing available evidence about a problem, exploring synthesized knowledge, and deciding. Our case study highlights the manual aspect of the exploratory review, but also suggests the viability of semi-automating certain aspects of the scoping review, considering in particular automatic ontology extraction. Our case study also highlights that a generic decision tool, which essentially supports decision makers exploring an ontology and decision tables about a topic, can be used to support decision making. Quantitative results suggest that the decision tool can help decision makers, not necessarily making better decisions (even though the laboratory experiment suggests that), but making more informed decisions, as the decision tool helps building scenarios and linking decisions to evidence.

6.1. Limitations of this study

EBMgt leads practitioners to integrate their knowledge and experience with scientific knowledge when making *complex* decisions only. Putting an emphasis on complex decisions is important. The inherent complexity of reviewing and synthesizing scientific knowledge does not make EBMgt amenable to every managerial question; questions must require high degrees of logical analysis, novelty, and quality (Briner *et al.*, 2009).

Another criticism is related to the acceptance of EBMgt by practitioners. The evidence conveyed in scientific literature can be challenged by practitioners. As noted by Rynes et al. (2018), "even when individuals are aware of research findings supported by a vast majority of studies, they often choose not to believe them" (p. 2996). This lack of traction can be hard to overcome. Therefore, EBMgt should only be applied to specific types of questions, which are novel, complex, require logical analysis, and demand high quality.

Rynes and Bartunek (2017) also refer to perceived managerialism bias, which attempts to convert evidence into ideology, as a fundamental problem with EBMgt. Practitioners must make decisions by themselves and in their own contexts, which may conflict with evidence presented as truth in an abstract space. Our research is cognizant of this perceived bias, which is why we developed our meta-design around ontologies and decision tables, as these are open to exploration rather than prescription. However, further research is necessary to understand how practitioners integrate research and non-research knowledge into decision making.

Other authors infer that the EBMgt approach may impose a selective and narrow view of evidence (Morrell and Learmonth, 2015). This criticism seems particularly relevant when we compare EBP in

medicine to EBP in management. As noted by Rynes and Bartunek (2017) and Learmonth and Harding (2006), the management field is more complex than medicine, as it embraces a diversity of agendas, questions, and methods. Therefore, the notion of evidence has different meanings in medicine and management. This is why we consider experiential instead of cumulative evidence. On the other hand, by opening reviews to a diversity of knowledge, we also make them more difficult. It may be particularly difficult to discriminate between what is relevant and not, and in the end accept anything as potentially useful. Defining recommendations for delimiting reviews specifically centered on experiential evidence, in articulation with conceptual frameworks, seems a relevant topic for further research.

Another important criticism is the manual nature of some parts of the process. This criticism seems particularly relevant at a time where practice appears to privilege computational approaches such as big data and analytics (Klein *et al.*, 2017). Even though we already embrace automation in the construction of the ontology, a question that arises is whether conceptual frameworks and decision tables can also be automated or semi-automated.

Finally, one important element that is still missing from this research is the role of online platforms in EBMgt. We recognize that EBMgt has an important community aspect: an online venue where questions and reviews can be shared and discovered, along with decision support. Developing such a platform seems necessary to deliver EBMgt services, since it would decrease the shared costs of EBP. However, such platforms cannot be established before the conceptual infrastructure like the one proposed in this research has been developed. We argue that the prototype of such an infrastructure now exists, and there is a need to develop the platform.

7. Conclusion

Several proposals have been made to bring EBP to the management field (Pfeffer and Sutton, 2006; Rousseau, 2006). However, most propositions (and criticisms) have so far existed at the conceptual level (Rousseau, 2012; Rynes and Bartunek, 2017). Our research brings EBMgt into a more concrete domain. Our value proposition includes an approach for EBMgt service delivery. We characterize EBMgt as a combination of activities: exploratory review, scoping review, and exploration and decision making. The exploratory review addresses a question and acquires cumulative evidence about the question. The scoping review then uses keywords from the exploratory review to acquire experiential evidence about the question. Finally, the experiential evidence is explored and a decision is made. Decisions combine exploration with tacit and contextualized knowledge.

One defining aspect of our approach is that it regulates the decision process using a set of information and IT artifacts. The information artifacts frame the type of evidence that is reviewed and explored, while the IT artifacts define the types of affordances that can be used to explore the evidence and answer the question. We regard IT artifacts as essential to realize EBMgt, as the configuration and decision tools turn EBMgt into a repeatable practice, supported by reusable tool, and bringing a degree of automation to EBMgt.

Considering the complexity and comprehensiveness of the proposed EBMgt method, its justification/evaluation is, truth be told, quite daunting. Fortunately, DSR helps addressing the problem. DSR fosters a variety of evaluations, considering different methods, approaches, and examination of a variety of artifacts, with a focus on exploration and problem solving (Venable *et al.*, 2016). Using this foundation, in this study we justify/evaluate our propositions using a variety of methods. Using the case study method, we provide proof of concept about the proposed EBMgt method. Using a laboratory experiment, satisfaction survey, and focus groups, we provide evidence about the decision tool, which is central to the EBMgt method.

Future research may address some current limitations of the EBMgt approach. In particular, we point out the lack of automation in the generation of conceptual frameworks and decision tables, and lack of a shared repository for the information artifacts generated by the EBMgt approach. Regarding evaluation, even though we provide some evaluation feedback, a more extensive evaluation is still necessary, covering more cases, types of questions, and encompassing the whole process.

References

Afuah, A. and Tucci, C. (2012), “Crowdsourcing as a solution to distant search”, *Academy of Management Review*, Vol. 37 No. 3, pp. 355–375.

Allen, D., Bryant, P. and Vardaman, J. (2010), "Retaining talent: Replacing misconceptions with evidence-based strategies", *The Academy of Management Perspectives*, Vol. 24 No. 2, pp. 48–64.
Amrollahi, A. (2015), "A Process Model for Crowdsourcing: Insights from the Literature on Implementation", presented at the Australasian Conference on Information Systems, available at: https://aisel.aisnet.org/acis2015/4.
Barends, E. (2015), *In Search of Evidence: Empirical Findings and Professional Perspectives on Evidence-Based Management*, PhD Thesis, VU University of Amsterdam, Amsterdam.
Barends, E. and Rousseau, D. (2018), *Evidence-Based Management: How to Use Evidence to Make Better Organizational Decisions*, Kogan Page Publishers.
Bates, D., Kuperman, G., Wang, S., Gandhi, T., Kittler, A., Volk, L., Spurr, C., *et al.* (2003), "Ten commandments for effective clinical decision support: making the practice of evidence-based medicine a reality", *Journal of the American Medical Informatics Association*, Vol. 10 No. 6, pp. 523–530.
Biesta, G. (2010), "Pragmatism and the Philosophical Foundations of Mixed Methods Research", in Tashakkori, A. and Teddlie, C. (Eds.), *SAGE Handbook of Mixed Methods in Social & Behavioral Research*, Sage, Thousand Oaks, available at: https://dx.doi.org/10.4135/9781506335193.n4.
Briner, R., Denyer, D. and Rousseau, D. (2009), "Evidence-based management: concept cleanup time?", *Academy of Management Perspectives*, Vol. 23 No. 4, pp. 19–32.
Briner, R. and Walshe, N. (2013), "Evidence-based management and leadership", *The Wiley-Blackwell Handbook of the Psychology of Leadership, Change, and Organizational Development*, John Wiley & Sons, Oxford, pp. 49–64.
CEBMa. (2017), "CEBMa Guideline for Critically Appraised Topics in Management and Organizations", CEBMa center for Evidence-Based Management.
Chandrasekaran, B., Josephson, J. and Benjamins, V. (1999), "What are ontologies, and why do we need them?", *IEEE Intelligent Systems and Their Applications*, Vol. 14 No. 1, pp. 20–26.
Chen, J. and Lee, S. (2003), "An exploratory cognitive DSS for strategic decision making", *Decision Support Systems*, Vol. 36 No. 2, pp. 147–160.
Daouk-Öyry, L., Sahakian, T. and van de Vijver, F. (2020), "Evidence-Based Management Competency Model for Managers in Hospital Settings", *British Journal of Management*, Vol. 32 No. 4, pp. 1384–1403.
Dawes, M., Summerskill, W., Glasziou, P., Cartabellotta, A., Martin, J., Hopayian, K., Porzsolt, F., *et al.* (2005), "Sicily statement on evidence-based practice", *BMC Medical Education*, Vol. 5 No. 1, p. 1.
Dicks, L., Walsh, J. and Sutherland, W. (2014), "Organising evidence for environmental management decisions: a '4S'hierarchy", *Trends in Ecology & Evolution*, Vol. 29 No. 11, pp. 607–613.
Djelassi, S. and Decoopman, I. (2013), "Customers' participation in product development through crowdsourcing: Issues and implications", *Industrial Marketing Management*, Vol. 42 No. 5, pp. 683–692.
Djulbegovic, B. and Guyatt, G. (2017), "Progress in evidence-based medicine: a quarter century on", *The Lancet*, Vol. 390 No. 390, pp. 415–423.
Fortuna, B., Mladenič, D. and Grobelnik, M. (2005), "Semi-automatic construction of topic ontologies", *Semantics, Web and Mining*, Springer, pp. 121–131.
Goldkuhl, G. (2013), "The IT artefact: An ensemble of the social and the technical? – A rejoinder", *Systems, Signs & Actions*, Vol. 7 No. 1, pp. 90–99.
Haghighi, P., Burstein, F., Zaslavsky, A. and Arbon, P. (2013), "Development and evaluation of ontology for intelligent decision support in medical emergency management for mass gatherings", *Decision Support Systems*, Vol. 54 No. 2, pp. 1192–1204.
HakemZadeh, F. and Baba, V. (2016), "Toward a theory of collaboration for evidence-based management", *Management Decision*, Vol. 54 No. 10, pp. 2587–2616.
Harrison, H., Birks, M., Franklin, R. and Mills, J. (2017), "Case study research: Foundations and methodological orientations", *Forum: Qualitative Social Research*, Vol. 18 No. 1.
Haynes, B. (2007), "Of studies, syntheses, synopses, summaries, and systems: the '5S' evolution of information services for evidence-based healthcare decisions", *Evidence-Based Nursing*, Vol. 10 No. 1, pp. 6–7.
Hevner, A., March, S., Park, J. and Ram, S. (2004), "Design Science in Information Systems Research", *MIS Quarterly*, Vol. 28 No. 1, pp. 75–105.
Howe, J. (2006), "The rise of crowdsourcing", *Wired Magazine*, Vol. 14 No. 6, pp. 1–4.

Iivari, J. (2007), "A Paradigmatic Analysis of Information Systems As a Design Science", *Scandinavian Journal of Information Systems*, Vol. 19 No. 2, p. 5.
Iivari, J. (2015), "Distinguishing and contrasting two strategies for design science research", *European Journal of Information Systems*, Vol. 24 No. 1, pp. 107–115.
Iivari, J. (2017), "Information system artefact or information system application: that is the question", *Information Systems Journal*, Vol. 27 No. 6, pp. 753–774.
Jarzabkowski, P., Lê, J. and Feldman, M. (2012), "Toward a theory of coordinating: Creating coordinating mechanisms in practice", *Organization Science*, Vol. 23 No. 4, pp. 907–927.
Kepes, S., Bennett, A. and McDaniel, M. (2014), "Evidence-based management and the trustworthiness of our cumulative scientific knowledge: Implications for teaching, research, and practice", *Academy of Management Learning & Education*, Vol. 13 No. 3, pp. 446–466.
Klein, G., Shneiderman, B., Hoffman, R. and Ford, K. (2017), "Why Expertise Matters: A Response to the Challenges", *IEEE Intelligent Systems and Their Applications*, Vol. 32 No. 6, pp. 67–73.
La Vecchia, G. and Cisternino, A. (2010), "Collaborative workforce, business process crowdsourcing as an alternative of BPO", *International Conference on Web Engineering*, Springer, pp. 425–430.
Learmonth, M. and Harding, N. (2006), "Evidence-based management: The very idea", *Public Administration*, Vol. 84 No. 2, pp. 245–266.
Lee, A., Thomas, M. and Baskerville, R. (2015), "Going back to basics in design science: from the information technology artifact to the information systems artifact", *Information Systems Journal*, Vol. 25 No. 1, pp. 5–21.
Miah, S., Kerr, D. and Von Hellens, L. (2014), "A collective artefact design of decision support systems: design science research perspective", *Information Technology & People*, Vol. 27 No. 3, pp. 259–279.
Morrell, K. and Learmonth, M. (2015), "Against evidence-based management, for management learning", *Academy of Management Learning & Education*, Vol. 14 No. 4, pp. 520–533.
Musen, M., Middleton, B. and Greenes, R. (2014), "Clinical decision-support systems", *Biomedical Informatics*, Springer, London, pp. 643–674.
Niederman, F. and March, S. (2019), "The 'Theoretical Lens' Concept: We All Know What it Means, but do We All Know the Same Thing?", *Communications of the Association for Information Systems*, Vol. 44 No. 1, p. 1.
Nunamaker, J., Chen, M. and Purdin, T. (1990), "Systems development in information systems research", *Journal of Management Information Systems*, Vol. 7 No. 3, pp. 89–106.
Paré, G., Tate, M., Johnstone, D. and Kitsiou, S. (2016), "Contextualizing the twin concepts of systematicity and transparency in information systems literature reviews", *European Journal of Information Systems*, Vol. 25 No. 6, pp. 493–508.
Pearson, A. (2010), "Evidence-based healthcare and qualitative research", *Journal of Research in Nursing*, Vol. 15 No. 6, pp. 489–493.
Pedersen, J., Kocsis, D., Tripathi, A., Tarrell, A., Weerakoon, A., Tahmasbi, N., Xiong, J., *et al.* (2013), "Conceptual foundations of crowdsourcing: A review of IS research", *2013 46th Hawaii International Conference on System Sciences*, IEEE, pp. 579–588.
Peffers, K., Rothenberger, M., Tuunanen, T. and Vaezi, R. (2012), "Design science research evaluation", *Design Science Research in Information Systems. Advances in Theory and Practice*, Vol. 7286, Springer, Berlin Heidelberg, pp. 398–410.
Pfeffer, J. and Sutton, R. (2006), "Evidence-based management", *Harvard Business Review*, Vol. 84 No. 1, p. 62.
Pozzi, G., Pigni, F. and Vitari, C. (2014), "Affordance theory in the IS discipline: A review and synthesis of the literature", presented at the Twentieth Americas Conference on Information Systems, Savannah, USA, available at: https://halshs.archives-ouvertes.fr/halshs-01923663.
Rockwell, J., Grosse, I., Krishnamurty, S. and Wileden, J. (2010), "A semantic information model for capturing and communicating design decisions", *Journal of Computing and Information Science in Engineering*, Vol. 10 No. 3, p. 031008.
Rousseau, D. (2006), "Is there such a thing as 'evidence-based management'?", *Academy of Management Review*, Vol. 31 No. 2, pp. 256–269.
Rousseau, D. (2012), "Envisioning Evidence-Based Management", *The Oxford Handbook of Evidence-Based Management*, Oxford University Press, available at: 10.1093/oxfordhb/9780199763986.013.0001.

Rousseau, D. and Gunia, B. (2016), "Evidence-based practice: the psychology of EBP implementation", *Annual Review of Psychology*, Vol. 67, pp. 667–692.
Rynes, S. and Bartunek, J. (2017), "Evidence-Based Management: Foundations, Development, Controversies and Future", *Annual Review of Organizational Psychology and Organizational Behavior*, Vol. 4 No. 235–261.
Rynes, S., Colbert, A. and O'Boyle, E. (2018), "When the 'Best Available Evidence' Doesn't Win: How Doubts About Science and Scientists Threaten the Future of Evidence-Based Management", *Journal of Management*, Vol. 44 No. 8, pp. 2995–3010.
Sjøberg, D., Hannay, J., Hansen, O., Kampenes, V., Karahasanovic, A., Liborg, N. and Rekdal, A. (2005), "A survey of controlled experiments in software engineering", *IEEE Transactions on Software Engineering*, Vol. 31 No. 9, pp. 733–753.
Slavin, R. (2002), "Evidence-based education policies: Transforming educational practice and research", *Educational Researcher*, Vol. 31 No. 7, pp. 15–21.
Thuan, N. (2019), *Business Process Crowdsourcing Concept, Ontology and Decision Support*, Springer, Germany.
Thuan, N., Antunes, P. and Johnstone, D. (2016), "Factors Influencing the Decision to Crowdsource: A Systematic Literature Review", *Information Systems Frontiers*, Vol. 18 No. 1, pp. 47–68.
Thuan, N., Antunes, P. and Johnstone, D. (2017), "A Process Model for Establishing Business Process Crowdsourcing", *Australasian Journal of Information Systems*, Vol. 21, pp. 1–21.
Thuan, N., Antunes, P. and Johnstone, D. (2018), "A Decision Tool for Business Process Crowdsourcing: Ontology, Design, and Evaluation", *Group Decision and Negotiation*, Vol. 27 No. 2, pp. 285–312.
Van Aken, J. and Romme, G. (2009), "Reinventing the future: adding design science to the repertoire of organization and management studies", *Organization Management Journal*, Vol. 6 No. 1, pp. 5–12.
Venable, J., Pries-Heje, J. and Baskerville, R. (2016), "FEDS: a framework for evaluation in design science research", *European Journal of Information Systems*, Vol. 25 No. 1, pp. 77–89.
Wainwright, D., Oates, B., Edwards, H. and Childs, S. (2018), "Evidence-based information systems: a new perspective and a road map for research-informed practice", *Journal of the Association for Information Systems*, Vol. 19 No. 11, pp. 1035–1063.
Wright, A., Zammuto, R., Liesch, P., Middleton, S., Hibbert, P., Burke, J. and Brazil, V. (2016), "Evidence-based Management in Practice: Opening up the Decision Process, Decision-maker and Context", *British Journal of Management*, Vol. 27 No. 1, pp. 161–178.
Yin, R. (1994), *Case Study Research: Design and Methods*, SAGE, London.
Yin, R. (2013), "Validity and generalization in future case study evaluations", *Evaluation*, Vol. 19 No. 3, pp. 321–332.
Zeng, X., Zhang, Y., Kwong, J., Zhang, C., Li, S., Sun, F., Niu, Y., *et al.* (2015), "The methodological quality assessment tools for preclinical and clinical studies, systematic review and meta-analysis, and clinical practice guideline: a systematic review", *Journal of Evidence-Based Medicine*, Vol. 8 No. 1, pp. 2–10.