

An Evaluation of the Added Value of Business Rules Management Principles to Transparency

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Abstract—Business decisions and business logic are important organizational assets. As transparency is becoming an increasingly important aspect for organizations, business decisions and underlying business logic, i.e., their business rules, must be implemented, in information systems, in such a way that transparency is guaranteed as much as possible. Based on previous research, in this study, we aim to identify how current design principles for business rules management add value in terms of transparency. To do so, a recently published transparency framework is decomposed into criteria, which are evaluated against the current business rules management principles. This evaluation revealed that eight out of twenty-two design principles do not add value to transparency, which should be taken into account when the goal of an organization is to increase transparency. Future research should focus on how to implement the design principles that add to transparency.

Index Terms—business rules management, decision management, design principles, transparency

I. INTRODUCTION

An organization's performance depends upon its ability to manage its business decisions and business logic [1], [2]. Currently decisions and underlying business logic are embedded in different information systems. For example: customer relation management systems, enterprise resource management systems and financial systems. These systems only provide a low level of transparency on how the decision is specified and actually executed [3], [4]. Therefore organizations are extracting decision from this type of systems and implementing them in separated information systems like decision support systems and business rules management systems. Thereby increasing the level of transparency.

In addition to the trend that decisions are managed as a separate entity an additional trend influences the management of decisions: the call for transparency with in regulatory frameworks. For example, the new General Data Protection Regulation (GDPR) in the European Union demands transparency with regards to operational decisions that are integrated into the information systems

[5]. Yet, in current literature, the framework to measure transparency in decision-making are predominantly focusing on a tactic and strategic level [6]. For example, [7] in their study propose a framework for transparency existing out of seven elements: integration into broader decision context, clarity, accessibility, openness, accountability, truth and accuracy, logic and rationale. How to formulate design principles or quantitatively measure based on these elements is not presented. Another example is the transparency cube proposed by [8], which has three elements: consequence, information and discussion, with the following related measures: from few to many, little too much and intensive to non-intensive. These are again not very specific and do not allows the formulation of design principles or measurements. In the work of [9] a framework with according measurements is proposed to measure the transparency of decisions and underlying business logic, thereby providing the possibility for organizations to score the level of decision transparency they uphold. Although this provides a means to measure the actual or desired transparency, the framework does not provide principles on how to design more transparent decisions and business logic.

This article extends on this by researching the effect of business rules management principle on transparency. With these premises, the following research question is addressed: "Which business rules management design principles affect the transparency of the design and execution of a decision and business rules management solution?" Answering this question will help organizations to evaluate the actual transparency of their decisions and underlying business logic.

The paper is organized as follows. First, we define transparency, which is the fundament of our research, after which the objects of transparency are presented and the measurements for transparency per area explained. Section three describes the research method and case selection. This is followed by the data collection and analysis in section four. Then, the results of the experiment are presented in section five. This is followed by section six, which discusses the experiment validity and limitations. We conclude and summarize our research in section seven.

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II. BACKGROUND AND RELATED WORK

To be able to determine if design principles have effect on the transparency of decisions and business logic, the exact elements for which transparency is required need to be determined. To do so, the Decision Transparency Framework [9] is utilized. To ground the remainder of this paper and present the elements the design principles affect, the DTF is summarized below. The DTF distinguishes three levels of transparency: 1) the decision level, 2) the decision service level and 3) the source-question-data level. Which are shortly explained hereafter.

Decision-level transparency

From an information/engineering perspective, business logic is an [10], [11]: *“expression that evaluates conditions, by means of a calculation or classification, leading to a conclusion.”* Decomposing this definition results in three different elements, namely: 1) conditions, 2) expression and, 3) conclusion. The condition can be further decomposed into two elements: the condition fact-type and the condition-fact values [11]. For example, the condition fact-type is “weather temperature” while the condition-fact value is “16 degrees Celsius”. The same applies to the conclusion, which also exists out of a conclusion fact-type and conclusion-fact values.

Decision service-level transparency

The previous object of transparency is a single decision, however, decisions are often part of a decision service (also known as business rule architecture). A decision service consists of two or more decisions and a derivation structure. The derivation structure depicts the relationship between the individual decisions. Therefore, the decision service is the sum of all underlying decisions. Thereby the transparency of the decision service is the sum of the transparency of underlying decisions plus the transparency of the derivation structure.

Source-question-data-level transparency

As mentioned earlier in this section the second form of transparency is the transparency between objects. In the DTF framework, this implies the transparency between the decision service & underlying decision(s) and the three other artefacts: 1) the source, 2) decision questions and 3) data.

The source indicates where the knowledge is elicited from to design and specify the decision and underlying business logic [12]. In research, different types of sources from which knowledge can be derived exist, for example, human experts, documentation and/or data. Data indicates the data that is required to evaluate the condition-facts in a decision. In some cases this data needs to be retrieved from third-parties, for example, citizens or other organizations. To realize this, input forms with questions are built or API's can be connected. The connection, either being a question on a form or API is defined as a decision question. To reach optimal transparency, each decision, and therefore the entire decision service, needs to be able to be traced to the specific source(s), data and decision question(s).

The level of transparency of the service, decision service, decision, decision question, data and source

documentation depends on the lifecycle phase in which the object is in. In total 10 phases can be distinguished: the elicitation, design, specification, verification, validation, deployment, pre-execution, pre+ execution, post execution or monitoring.

Decision and Business Rules Management Design Principles

Now more and more DM/BRM solutions are introduced, organizations are searching for guidance to design such solutions. In multiple disciplines, such as industrial engineering, chemical engineering, civil engineering, electrical engineering, and system engineering an important mechanism to guide the design of products and/or information systems are principles [13]. A principle is a simple, direct statement of an organization's belief about how they want to use a specific system [14]. In our context, principles are therefore statements of an organization's basic beliefs about how the organization wants to apply BRM and design BRM solutions.

In literature, many different types of principles are recognized: business process management principles, enterprise architecture principles, information technology principles, software design principles, data principles, software architecture principles, application principles, organization principles, and business principles. Each of these sets of principles are design principles to guide the design of a specific part of the organization and reduce the degree of freedom to create a specific solution. Therefore, these principles cannot be dealt with separately but must be considered as a network [15]. Since BRM is becoming more and more important we propose it should be part of this network. However, research which focuses on principles for BRM is scarce. This article, therefore, extends the understanding of principles with regard to BRM solutions. ‘

The body of knowledge on design principles for decision management and business rules management is thin. To the knowledge of the authors, contributions other than [16] and [17] exist that focus on the formulation of design principles. Therefore, this paper considers the twenty-two design principles presented in [16]. Due to space constraints, this paper does not go into detail regarding these design principles. However, to ground the analysis in this paper, a summary of the principles is provided:

- 1) **Automated decisions where possible, supported decisions if necessary.** Automation of decisions impact transparency. When they are well-defined they increase transparency, when they are not explainable, f.i. because of the application of machine learning, they may decrease transparency.
- 2) **IT does not formulate business rules.** By ensuring that business rules are always defined by someone from the business domain, the risk of implicit decisions hidden in software code is decreased, which has a positive impact on transparency.
- 3) **No big-bang but iteration approaches for business rules projects.** An iterative approach provides for

more flexibility in incorporating changes in business rules during development and implementation.

- 4) **Authorization for decision-making.** This principle ensures that only authorized personnel can make decisions. This positively impacts transparency.
- 5) **Ownership of a decision is defined.** This principle assigns responsibility at the level of decisions. Clarity about who is responsible for what decision improves transparency.
- 6) **Traceable decisions.** This principle prescribes that the design of the BRM solution should make it possible to trace how decisions were taken. This directly links to transparency, as more detailed traceability enables more transparency.
- 7) **Data is recorded according to two-time dimensions.** This principle distinguishes between the validity dimension, when a business rule is valid, and the transaction dimension, the timing of registration. This is relevant in terms of transparency of past decision making.
- 8) **All business rules must refer to a source.** The source is the justification of the business rule. By making the source explicit, transparency is enhanced.
- 9) **P.E.N.S criteria are determined for each business rule set.** By determining criteria for precision, expressiveness, naturalness and simplicity for each business rule set, it becomes possible to fulfill differences in requirements that are borne from variations in situations. This allows for multi-dynamic architecture.
- 10) **Reuse before buying and creating software.** This principle is meant to prevent the same business rules being implemented in disparate software systems, thus ensuring that changes need only be executed in one system instead of many. This enhances flexibility.
- 11) **Best-of-suite approach.** A best-of-suite approach leads to better integrated functions. However, when integration is not transparent it may lead to less flexibility, as it is more difficult to replace specific functions.
- 12) **Gaming only permitted between 09:00 AM and 17:00 PM.** This rule limits the possibilities of experimenting with business rules. Experimentation may reduce transparency because it may be used to manipulate the outcomes of business rule application.
- 13) **Sharing knowledge concerning the execution of laws, regulations, and policies with employees and clients.** Sharing knowledge is related to participating in an ecosystem of collaborating parties.
- 14) **Adhere to context structures.** By organizing business rules and facts into sets of knowledge with maximum internal cohesion and minimal external coherence, it becomes easier to realize changes in the knowledge, thus improving flexibility.
- 15) **Create once and use multiple times.** By recording implementation-independent business rules only once and using this as the only source for the entire enterprise makes it much easier to share the knowledge contained in the business rules with other parties, thus contributing to the openness of the enterprise.
- 16) **Communication with the same standards wherever possible, communication with different standards where desirable.** This principle focusses on having a shared language among BRM stakeholders. To all persons concerned the definition of terms should be clear in the context in which they are used. This has a positive impact on flexibility.
- 17) **Flexible decisions.** This principles states that employees should be able to override decisions during execution. Though this allows for greater flexibility, it may negatively impact transparency when manual interventions are not faithfully recorded.
- 18) **Utilize government-wide standards.** Government-wide standards describe how business rules should be handled and processes performed. Applying such standards increases openness, as it allows for easier use of each other's (implemented) knowledge.
- 19) **Separation of the know and flow.** Business rules (know) have a higher frequency of change than business processes (flow). By separating the two, they can each be changed at their own pace, thus increasing flexibility.
- 20) **Develop business rules from a management perspective rather than an implementation perspective.** Developing business rules from a management perspective better takes into account the post-deployment maintenance of the rules, enhancing flexibility.
- 21) **Transparency concerning decision-making for clients and users.** This principles evidently aims at ensuring transparency of decision-making.
- 22) **Include compliancy in designing products and/or services.** By taking into account compliancy from the start when designing products and services it will be easier to justify the rightfulness of decisions, thereby impacting transparency.

III. RESEARCH METHOD

The goal of this research is to identify whether the current BRM design principles affect transparency. In addition to the goal of the research, also, the maturity of the research field is a factor in determining the appropriate research method and technique. The maturity

of the BRM research field, with regard to non-technological research, is nascent [18], [19]. The focus of research in nascent research fields should lie on identifying new constructs and establishing relationships between identified constructs [20]. Summarized, to accomplish our research goal, a research approach is needed in which a broad range of BRM design principles are explored and combined into one view (the transparency viewpoint). To do so, we combine the knowledge of transparency measurement in a BRM context with existing BRM design principles to identify relationships. This combination, in the form of secondary data, is then qualitatively analyzed according to predefined and grounded transparency criteria, which is elaborated in the next section.

IV. DATA COLLECTION AND ANALYSIS

The data collection consisted of secondary data, which is a form of third-degree data collection. According to [21], when data such as requirements and/or principles are studied, third-degree data collection is a proper fit. The data collected are the principles described in the section two; background and related literature.

The data collection for this study occurred over a period of two months, between February 2019 and March 2019. The data collection is conducted by six researchers representing different levels of expertise on decision management and principles. Two researchers representing the expert group (researcher 1 and 2), two researchers representing the intermediate group (researcher 2 and 3) and two researchers representing the novice group (researcher 5 and 6). Separating the coders increases the inter-reliability in the coding [21] and internal validity of the research [22]. Researcher 1 is a professor with ten years of practical and research experience in the field of DM; Researcher 2 is a lecturer and postdoc researcher with seven years of practical and research experience in the field of DM; Researcher 3 is a PhD-candidate with five years of practical and research experience in the field of DM; Researcher 4 is a Master student with four years of practical and research experience in the field of DM; Researcher 5 and 6 are Bachelor students with two years of research experience in the field of DM. Based on the objects in DTF the following criteria have been formulated:

- **Criterion 1:** The principle adds to the level of transparency of the service, decision service, decision, decision question, data and source documentation.

The second criteria relates to actual transparency of the phases the different objects are in the process or the object in a specific process phase, therefore the following criteria is formulated:

- **Criterion 2:** The principle adds to the level of transparency of the elicitation, design, specification, verification, validation, deployment, pre-execution, pre+ execution, post execution or monitoring.

In addition to individual objects and the processes related to them, also the individuals in the organizations

can have an influence on the transparency, therefore the last criteria is:

- **Criterion 3:** That the principle realizes demystification of the person/role responsible for the decision.

V. RESULTS

In this section, the results of the analysis of the relationship between BRM design principles and transparency are presented. The principles have been categorized to either 1) effect to transparency or 2) no effect to transparency. Table 1 contains the description the overall results of the mapping to the two categories. In the remainder of this section the overall results are presented.

TABLE I. MAPPING OF ADDED VALUE OF THE BRM PRINCIPLES TO TRANSPARENCY

	Effect	No effect
Principle 01		X
Principle 02	X	
Principle 03		X
Principle 04	X	
Principle 05	X	
Principle 06	X	
Principle 07	X	
Principle 08	X	
Principle 09	X	
Principle 10		X
Principle 11		X
Principle 12	X*	
Principle 13	X	
Principle 14		X
Principle 15		X
Principle 16	X	
Principle 17	X*	
Principle 18		X
Principle 19	X	
Principle 20		X
Principle 21	X	
Principle 22	X	

The principles that have a positive effect on the transparency are principles: 2, 4, 5, 6, 7, 8, 13, 19, 21 and 22. With respect to principle two and eight, the decisions and underlying business logic have higher P.E.N.S. value, which is tied to a higher readability for business users [22]. Principle four realizes that for each decision the employee that executed the decision is registered as such. In addition, principle five indicates who is responsible within the organization for the proper execution of the decision. For principle six, when decisions are traceable to the source, the organization can properly explain why and based on what the decision has been made. Principle eight is a further specification of principle six and, therefore, has a direct positive effect on transparency. Regarding principle seven, saving the execution date as well as the validation date of the decision realizes a higher transparency because stakeholders are able to time-travel [16]. Principle thirteen is straightforward since knowledge about the design of the decision-making is shared with stakeholders. With regards to principle 16, which focusses on having a shared language amongst stakeholders that execute or are effected by the decision,

transparency is positively impacted because all stakeholders should be able to use the same language. To all stakeholders concerned, the definition of terms should be clear in the context in which they are used, if for a specific stakeholder this is not clear, the communication can be altered to increase transparency. Principle nineteen has a positive impact on transparency since the decision logic is not embedded in business process diagrams/descriptions which allows for easier reading and transferability amongst stakeholders. Lastly, principle twenty-one states that the execution has to be transparent. Since more regulations, like GDPR state requirements for transparency, this principle automatically has a positive effect.

In total, two principles have an effect but the effect can also be a negative effect. The first principle is principle twelve, which limits the possibilities of experimenting with business rules. This is to prevent experimentation with the business rules such that the most optimal outcomes can be realized. In this respect, the principle actually reduces transparency and therefore should be categorized as “no effect on transparency”. The reason it is classified as “effect on transparency” is because the direct effect of the principle on transparency. However, to produce a positive effect, the principle should be: “*24 hour gaming permitted.*” Furthermore, principle seventeen states that employees should be able to override decisions during execution. This allows for greater flexibility when executing decisions, however, it may negatively impact transparency when manual interventions are not faithfully recorded or employees alter decisions based on personal preferences.

VI. DISCUSSION & FUTURE RESEARCH

Like every research study, several limitations may affect our results. The first limitation is the sampling and sample size. This limitation comprises the sampling of the BRM design principles, which are solely drawn from Dutch governmental institutions. However, the current body of knowledge is very thin on such design principles. We argue that the context of government institutions form a solid fundament for this research and future research since they deal with the implementation of large amounts of business decision and rules derived from laws and regulations. Still, further generalization towards non-governmental organizations is recommended in future research, by validating whether the current set of BRM design principles are relevant in other contexts. Additionally, the generalization of the identification of effects can be increased by involving practitioners as well as other stakeholders that deal with the design and implementation of BRM solutions that have the goal to increase transparency. Lastly, while we argue that the research approach chosen for this research type is appropriate, research focusing on further generalization must apply different research methods, such as quantitative research methods, which also allow us to incorporate larger sample sizes to validate our findings.

VII. CONCLUSIONS

The goal of this study is to identify whether the current BRM design principles affect transparency. To do so the following research question was posed: “*Which BRM design principles affect the transparency of the design and execution of a decision and business rules management solution?*” In order to answer this question, previously identified BRM design principles were selected and scored regarding their effect on transparency, based on five selection criteria. In total, eight principles have no effect on the transparency while the remaining twelve principles have an effect on transparency.

From a **theoretical perspective**, this study provides the knowledge base with knowledge on how principles, in this case BRM design principles, could be evaluated regarding transparency as well as interesting directions for future research to strengthen how BRM solutions could improve transparency.

From a **practical perspective**, this study provides organizations with a set of twelve BRM design principles that are proven to affect transparency at organizations. These twelve BRM design principles should be taken into account by organizations that want to realize better transparency. Furthermore, the results provide (enterprise) architects a framework that can structure thinking about the solution that needs to be designed and implemented.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

KS and MZ both equally contributed while writing this paper. EM conducted several review rounds to ground the quality of the analysis and the paper. All authors approved the final version.

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