# Decision Engineering
# in Case of Intuitive Decisions

*Completed Research*

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## Abstract

As economy thrives on, fast-paced environments decisions have to be made more quickly than ever before. Even though decision-makers face a constantly increasing amount of available information and information systems to support them, it might take too long, especially in highly competitive markets. This is one reason for decision-makers not only to make rational decisions but to trust their intuition in making an intuitive decision. Currently there is no strategic information system at hand to support intuitive decision-making and documentation. Therefore, a prototype was implemented to support decision-makers in managing their decisions under different conditions and learning from the outcomes. Qualitative data from interviews with ten C-level managers and quantitative data from a survey were used to support the design process in order to meet managerial demands in practice.

### Keywords

Strategic Decision-Making, Decision Effectiveness, Decision Support, Intuitive Decision, Design Science, Survey, Prototype.

## Introduction

Decisions have to be made more real-time than ever before (Patton 2003, p. 989). First, decision-makers are confronted with an economical system of immense complexity. Second, highly competitive market situations make it increasingly complicated to face the yet huge amount of information to be considered in decision situations. So the question arises whether the strategy of maximizing decision relevant data is appropriate for all managerial decision situations. Decision-makers trust - under certain conditions - in their intuition instead of making rational decisions. The decision on how to decide depends on various factors, such as risk, importance, repetitiveness or experience. Regardless of the amount and design of such factors, appropriate methods and tools are needed to support decision-makers. Managerial practice needs to be improved by identification, discussion and development of "right-brain skills", such as intuitive thinking and decision making (Lank and Lank 1995, p. 18). Decision Science tools can serve as new conceptual perspectives on the complexity of such decision-making contexts (McKenna and Martin Smith 2005, p. 821). Thus, the aim of this paper is to examine the state-of-the-art on the application and acceptance of intuitive decisions in order to develop a prototype, i.e., an information system used in strategic decisions-making situations, for supporting decision-makers in managing their decisions under different conditions and learning from the outcomes. The paper follows suggestions for design science research studies by Gregor and Hevner (2013, p. 349f). Accordingly, the paper is organized as follows. Relevant literature concerning decision-making in general and the intuitive decision in particular is reviewed and presented. Next, methodology is outlined and followed by artefact description, which initially covers qualitative and quantitative empirical data. Concluding, the evaluation is described and future avenues for research are identified.

## Literature Review

Theory on decision-making seems to be an important topic for the entire scientific community, since it is addressed by many disciplines, including philosophy, psychology, economics, management or information systems. When decisions are made, uncertainty and failure comes with it. For decades, researchers have been dealing with the question of how to make decisions the best way (Dane and Pratt 2007). Although a final answer to this question does not exist, different models and heuristics to subdivide decision modes and to understand judgment of decision-makers have been developed. Even though scientists of diverse disciplines published their research with different views, some basic concepts, models and frameworks remain the same. In general, deciding means choosing between alternatives. We encounter such situations permanently in various settings. These decision situations can be simple or complex. The decision then can be seen as the result of the selection of the certain action alternative that best leads to goal achievement. The economic principle (i.e., rational principle) means choosing the alternative in which input and output are in an optimal relation to each other. Consequently, literature on decision-making is still widely based on the idea of the homo oeconomicus (or economic man), a person with unimaginable resources and capacities, targeting towards maximum utility (Chlupsa 2017, p. 3f). „If you look at economics textbooks, you will learn that homo oeconomicus can think like Albert Einstein, store as much memory as IBM´s Big Blue, and exercise the willpower of Mahatma Gandhi" (Thaler and Sunstein 2009, p. 16). Even more, in business administration rational decisions are idealized (Day 1971, p. 230f). In order to make a 'proper' rational decision, all relevant information for evaluation and calculation must be used (Shapiro and Krishnan 2001, p. 5f). However, this idealized situation can only exist in a small world scenario, therefore this Bayesian decision theory is only genuinely valid in a small worlds (Savage 1951, p. 55f). However, a rational approach to decision-making has a number of disadvantages and contradicts with business life.. Full information is never available and even if it was like that, exact mathematical methods for complex decision situations are still missing. If mathematical models were available, the calculation would still take too long. This leads to the situation that solely probability statements can be made. If it were different, the decision situation, initial and boundary conditions, would have changed long ago (Roth 2017, p. 135). Furthermore individuals in organizations are limited in their ability to meet all the criteria of fully rational choices due to fact that this would depend on perfect knowledge (Tarka 2017, p. 5). This is even more true for fast-moving business environments, such as start-ups and entrepreneurial corporate settings (Vershinina et al. 2017, p. 2).

Lately, more research is done on the field of non-rational, intuitive decisions, sincenon-conscious cognitive processes are involved in complex decision situations (Mavor et al. 2010, p. 824). According to Issack (1978), whose publication can be seen as an initial trigger, it is crucial to foster interest in the study of intuition in management. Furthermore, Kahneman drove research in the field of the intuitive judgement in decision-making (Kahneman 2012; Kahneman and Frederick 2002). Clearly, decision-makers gain specific experience (practice) based on previous decisions. . In decision-making situations, solutions are usually not strictly rational, but intuitively decided based on experiences from comparable situations (Roth 2017; Styhre 2011, p. 123). Intuition covers thoughts and preferences that come to mind quickly and without much reflection (Kahneman 2012, p. 7f). Simon (1987, p. 57f) explains intuition by stressing the example of an infant recognizing a dog and immediately imitating barking. Simon (1987, p. 62) furthermore differentiates between 'irrational' decisions, made under pressure, effected by emotions and leading to nonproductive decision situation and 'nonrational' decisions arising from a decision-maker's expert status. Dane and Pratt (2007, p. 35f) define intuition as affectively charged decisions that arise through fast, unconscious and holistic associations. Agor (1986, p. 5f) describes how managers follow their intuition for strategic decisions and how to improve the ability to apply und trust in intuitive decisions. As the result of this study shows, decision-makers "could adopt a more positive attitude about their own intuitive ability and take an active role in establishing support groups within their organizations in which such skills and techniques could be shared and experimented with" (Agor 1986, p. 17). Peters and Waterman (2004) even state, that the ten best-run companies in America now encourage the use of intuitive skills and nurture its development in their managerial cultures. Okoli and Watt (2018, p. 2) further specify that intuition does not contradict analyses, even though operating in sub-conscious. Intuition can be seen as a kind of analysis included into one's habit over time. Intuition and analysis are concurrent (dual) processes that are differentiated by ease and speed of use (Simon 1987, p. 62).

Analogously, the differentiation between System 1 thinking, which is more intuitive, and System 2 thinking, which is more analytical is widespread (Beresford and Sloper 2008; Hogarth 2003; Kahneman and Frederick 2002). Epstein (1994, p. 710f) names System 1 thinking the 'experiential mode', used by human as well as animals. Intuitive decisions seem to be made automatically, but System 1 thinking also relies on generalization as well as abstraction with prototypes, scripts, metaphors and narratives (Hogarth 2003, p. 5f). System 2 thinking is not just analytical, but also controllable, rule-based, conscious, develops with age, is related to language and is more independent of feelings than System 1 thinking (Beresford and Sloper 2008, p. 7). Although there is a strict difference between the two systems, researchers argue that complex, serious decision-makers use both systems, intuitive as well as analytical (Beresford and Sloper 2008, p. 10f). According to Pfister et al. (2017, p. 15f), System 1 and System 2 thinking cannot exist independently of each other. System 1 can act like a default system in most everyday-situations. When a problem or irregularity appears, decision-makers automatically move to System 2 thinking as an intervention-instance, which can intervene in System 1, but it cannot shut it down. That can lead to conflicts between the two systems. When decision-makers learn to understand patterns of decision situation or do something repeatedly, decisions are made automatically without large cognitive load (Pfister et al. 2017). The combination of rational and intuitive thinking (and deciding) makes a skilled practitioner (Styhre 2011, p. 109). In order to support a decision-maker in appropriately choosing the right decision system for a certain situation it is necessary to focus on its processes (Kalantari 2010, p. 8).

Currently, there is no statistical or mathematical method that enables reliable prediction when and whether a simple heuristic can deliver optimal solutions. The best outcomes are obtained by combining heuristic and rational decision-making procedures (Gigerenzer 2008, p. 20f). Individuals can approximately determine which approaches are best for them by considering different heuristic patterns, analyzing their past experiences and having a good understanding of the structure of their environments (Gigerenzer and Gaissmaier 2011, p. 458). Finucane et al. (2000) show that decisions made within five seconds lead to different results than decisions made with no time limit. Concerning this fact, a correction model is an appropriate method to make decisions within a certain time limit and, if necessary, correct the decisions afterwards (Kahneman and Frederick 2002, p. 7f).

## Methodology

Since the aim of this study is developing a prototype for supporting intuitive decision-making, we follow a design science approach (Hevner et al. 2004; Peffers et al. 2007). The prototype constitutes a research artifact, which is tested against utility in the first place and furthermore against reliability and validity (Hevner et al. 2004). The nature of such artifact is to fulfill business needs, i.e., solve IT challenges evolving in companies. It is based on a theoretical foundation (constructs, models, methods, and instantiations) as well as rigorous research methods. The artifact in this study can be considered as a model as well as process for identifying, visualizing and documenting intuitive decisions. Thus, the prototype supports decision-makers to assess whether intuitive or rational decisions are more promising to fulfill the expected goals. In this study we follow the 7-part guideline (Hevner et al. 2004), including problem relevance, research rigor, design as a search process, design as an artifact, design evaluation, research contributions and communication of research (Hevner 2007; Hevner et al. 2004)(Hevner 2007). Furthermore, we followed an iterative instead of an episodic approach, including results from the literature review, qualitative interviews and a survey to build and re-build the prototype. The artifact then has been exposed to different people in a workshop to test its utility and usability. However, an evaluation in a real-world environment, i.e. in companies, is yet to come.

## Artifact Description

As suggested for design science research (Gregor and Hevner 2013), we present the development of the artifact based on qualitative and quantitative empirical data first, followed by a detailed description of the artifact functionality.

### *Artifact Development Based on Empirical Data*

To gain an impression on the decision-making process in daily business, we conducted semi-structured interviews. This approach allows exploring new insights on motivation for and experience with decision-

making. The interviews were based on a rough interview guideline, covering three topics: (1) current situation of intuitive decisions, (2) relationship between intuitive and rational decisions, as well as (3) known and used heuristics or patterns. The interviews were recorded, transcribed and analyzed based on a content analysis approach. We applied coding techniques as proposed for Grounded Theory approaches, (Strauss and Corbin 1990) namely open coding and axial coding, to develop certain categories. We conducted interviews with ten managers on C-level position from companies operating in central Europe. All interviewees are male and the average interview duration was 75 minutes. Table 1 shows interviewees, their position and the according company.

| ID | Industry | Company Size | Position |
|---|---|---|---|
| I1 | Machinery | 220 000 | Corporate Real Estate Manager |
| I2 | Education | 2 500 | Vice Rector |
| I3 | IT | 140 | CEO |
| I4 | Real Estate | 500 | CEO |
| I5 | IT | 5 800 | Key Account Manager |
| I6 | Finance | 1 300 | CEO |
| I7 | Consulting | 140 | CEO |
| I8 | Consulting | 20 | CEO |
| I9 | Manufacturing | 1 100 | CEO |
| I10 | Culture | 400 | CEO |

**Table 1. Description of Interview Partners**

Based on the interviews we identified factors influencing the choice between intuitive or rational decision-making. In general, factors like experience, mood, recommendations from others and existing data (i.e., indicators) have an influence on this choice. Also costs and time are influencing the choice. Interestingly, certain 'soft' business tasks (i.e., marketing, sales, human resources) seem to be more related to intuitive whereas 'hard fact tasks' (e.g., finance, legal aspects) are directly connected to rational decision-making. However, the latter are still influenced by intuition, since 'feeling fine with decisions' has been named as important. Accordingly, half of the interviewees said that intuition is necessary for managers. Moreover, half of the interviewees reported that they overruled rational decisions based on their intuition. Some intuitive decisions are even justified by rational decisions afterwards. Not surprisingly, almost all interviewees expressed the necessity to make decisions for avoiding costs of late- or non-deciding and even decisions leading to poor results can be used to learn from it. Another interesting finding from the interviews is, that decisions are differentiated by their importance (very important, important, less important) and risk, i.e., possible negative consequences evolving from it. Risks, on the other hand, depend on the risk-proneness of the decision-maker. Not surprisingly, very important and high risky decisions are seen as directly related to rational decision-making, whereas non-risky, less important decisions are related to intuitive decision-making, made based on 'mood' by non-management employees.

Regarding heuristics or patterns, the interviewees were not aware of specific approaches. Although the influence of experience on intuitive decisions has been emphasized, documentation, which would allow relying on existing knowledge and experience, is scarce. The interviewees expressed their need for having documentation of prior decisions to develop a good understanding of 'successful' decision-making. This allows assessment of past decisions and improves the quality of intuitive as well as rational decision-making tremendously. Based on these findings, we developed a first prototype, which is not further described here.

To evaluate these findings and the first prototype and to gain further insights we conducted a survey. The according questionnaire, developed based on literature, resulted in 17 questions, five of them are demographic. The twelve questions related to intuitive decision-making target towards the awareness for making intuitive decisions willfully (Q1: "Have you ever willfully determined between an intuitive and a rational decision?" [Scale: nominal / binary (Yes/No)]), possibility to identify and visualize intuitive decision-making (Q2: "Do you think it is possible identifying intuitive decisions and visualize them for others?" [Scale: nominal / binary (Yes/No)]), frequency of intuitive decisions (Q3: "How often do you make meaningful business decisions intuitively?" [Scale: 4-point scale: "1x a week" / "1x a month", "1 x per

quarter", "Never"]), and preference of intuitive over rational decision (Q4: "Have you ever chosen the intuitive decision although facts would have suggested differently?" [Scale: nominal / binary (Yes/No)]).

Questions 5 to 8 inquire documentation of decisions in general (Q5: "From your point of view, how important is documentation of decisions? Please rank between 1 (not important) to 6 (very important)" [6-point Likert scale]; Q6: "Are decision documented in your company?" [Scale: nominal / binary (Yes/No)]; Q7: "If decisions are documented in your company, are there any templates or guidelines for the documentation?" [Conditional questions; Scale: nominal / binary (Yes/No)]; Q8: "If decisions are not documented in your company, could you please explain why documentation is not done?" [Open question, conditional & optional]). Questions 7 and 8 depend on question 6.

The final questions (9 – 12) focus on the experience with intuitive decisions (Q9: "Consider you have to make a decision which has been made in the past in a specific way (i.e., intuitively or rational), would you decide it the same way?" [Scale: nominal / binary (Yes/No)]), quality (Q10: "Do you think that rational decisions have the same quality compared to intuitive decisions?" [Scale: nominal / binary (Yes/No)]), acceptance (Q11: "Do you accept intuitive decisions which have been made by others?" [Scale: nominal / binary (Yes/No)]), and influence of intuition (Q12: "From your personal point of view, how much does intuition influence your decisions? Please rank between 1 (not very much) to 6 (very much)" [6-point Likert scale]) on decision-making.

Finally, demographic questions included age (Q13; [20 – 30 years / 31 – 45 years / 46 – 60 years / > 60 years]), gender (Q14; [male/female]), position in the company (Q15; open question) experience in a leading position (Q16; [less than 5 years / 5 – 15 years / more than 15 years]), and size of the company based on number of employees (Q17; [1 - 9 employees / 10 – 49 employees / 50 – 249 employees / 250 and more employees]). Due to page limits, we refrain from presenting the demographic questions in more detail. All questions have been presented in the native language of the participants.

Since the study investigates making of meaningful decisions, the target group for the survey are managers on C-level (CIO, CTO, COO, etc.), who are responsible for making meaningful decisions in companies. Based on a selection of companies in central Europe, we invited 200 people from this target group via mail or phone to participate in the survey. 91 questionnaires have been filled in completely, representing a response rate of 45.5 %. Regarding demographics, most of the participants are between 46 and 60 years old (Q13: 54, i.e., 59.34 %), mainly male (Q14: 77, i.e., 84.62 %) and have more than 15 years of experience in a leading position (Q16: 38, i.e. 41.76 %). The open questions regarding their position in the companies (Q15) has been analyzed and categorized, showing that 44 (48.35 %) of the participants see themselves in a management position, additional 11 (12.09 %) directly named a C-level position and 20 (21.98 %) are the head of a department. 9 (9.89 %) of the participants are entrepreneurs, owners of shareholders in the companies and only 6 (6.59 %) stated that they are in a more operational position. The companies they are working in (Q17) represent all sizes, from micro businesses (20, i.e., 21.98 %) to big company (37, i.e., 40.66 %). They are all in a leading position, on different management levels. Details are presented in Table 2.

| | 20 - 30 years | 31 - 45 years | 46 – 60 years | Older than 60 years |
|---|---|---|---|---|
| Q13 (Age) | 2 (2.20 %) | 33 (36.26 %) | 54 (59.34 %) | 2 (2.20 %) |
| | Male | | Female | |
| Q 14 (Gender) | 77 (84.62 %) | | 14 (15.38 %) | |

| | Manager | C-Level | Head of .. | Entrepreneur | Operations | n.a. |
|---|---|---|---|---|---|---|
| Q15 (Position) | 44 (48.55 %) | 11 (12.09 %) | 20 (21.98 %) | 9 (9.89 %) | 6 (6.59 %) | 1 (1.10 %) |

| | Less than 5 years | | 5 – 15 years | | More than 5 years | |
|---|---|---|---|---|---|---|
| Q16 (Experience) | 17 (18.68 %) | | 36 (39.56 %) | | 38 (41.76 %) | |

| | 1 – 9 employees | 10 – 49 employees | 50 – 249 employees | 250 employees and more |
|---|---|---|---|---|
| Q17 (Company Size) | 20 (21.98 %) | 16 (17.58 %) | 18 (19.78 %) | 37 (40.66 %) |

**Table 2. Demographic Results**

The first four questions, investigating awareness for making willfully intuitive decisions (Q1), identification and visualization (Q2), frequency (Q3) of intuitive decisions as well preference of intuitive over rational decision show a rather clear picture. Most of the participants are aware of intuitive decisions they have made (92.31 %), consider identification and visualization of intuitive decisions is possible (84.62 %), make intuitive decisions once a week (34.07 %) or at least a month (41.76 %) and prefer intuitive decisions over rational (76.92 %). The results are also presented in Table 3.

| Question | Y | | N | |
|---|---|---|---|---|
| Q1 (awareness) | 84 (92.31 %) | | 7 (7.69 %) | |
| Q2 (identification and visualization) | 77 (84.62 %) | | 14 (15.38 %) | |
| | Weekly | Monthly | Quarterly | Never |
| Q3 (frequency) | 31 (34.07 %) | 38 (41.76 %) | 14 (15.38 %) | 8 (8.79 %) |
| | Y | | N | |
| Q4 (preference) | 70 (76.92 %) | | 21 (23.08%) | |

**Table 3. Results Questions 1 - 4**

Regarding documentation (Questions 5 – 8), question 5 addressed the importance of documentation of decisions. Interestingly, almost 1/3 (33 participants) rated it as rather unimportant (ratings 1, 2, 3 on a 6-point Likert scale), but only two participants considered it as very unimportant. On the other side of the scale, 31 participants (34.07 %) considered it as close to very important (rating 5 on a 6-point Likert scale), but only 12 (13.19 %) as very important. 71 (78.02 %) participants indicated, that decisions are documented in their company (Q6), but only 50 participants are aware of templates for documentation of decisions (Q7). Reasons for not having templates for documentation of decisions (Q8) include lack of standardization, size of the company ("we are a small company"), time constraints, agile approaches and individual style of decision-makers, to give some examples. Results of questions 5, 6, and 7 are shown in Table 4.

| | Very unimportant | | | Very important | | |
|---|---|---|---|---|---|---|
| Question | 1 | 2 | 3 | 4 | 5 | 6 |
| Q5 (Importance of documentation) | 2 (2.20 %) | 21 (23.08 %) | 10 (10.99 %) | 15 (16.48 %) | 31 (34.07 %) | 12 (13.19 %) |
| | Y | | | N | | |
| Q6 (Documentation done) | 71 (78.02 %) | | | 20 (21.98 %) | | |
| Q7 (Templates available) | 50 (53.95 %) | | | 41 (45.05 %) | | |

**Table 4. Results Questions 5 - 7**

Concerning the questions, which focus on the experience with intuitive decisions (Q9), quality (Q10), acceptance (Q11) and the general influence of intuition on decision-making (Q12), the picture is quite diverse. Regarding question 9, 66 participants (72.53 %) state that they would rely again on intuitive decisions in the same situation. Concerning the quality of rational decisions (Q10), only 38 participants (41.76 %) think the quality is the same compared to intuitive decisions. It is important to keep in mind that we did not ask in which way, i.e., of higher or lower quality. Interestingly, 80 participants (87.91 %) state that they accept intuitive decisions made by others (Q11) and 56 of the participants think that intuition has medium to high influence (rating 3 – 6 on a 6-point Likert scale) on their decision-making (Q12). Details are presented in Table 5.

| Question | Y | | | N | | |
|---|---|---|---|---|---|---|
| Q9 (Experience with intuitive decisions) | 66 (72.53 %) | | | 25 (27.47 %) | | |
| Q10 (Quality) | 38 (41.76 %) | | | 53 (59.24 %) | | |
| Q11 (Acceptance) | 80 (87.91 %) | | | 21 (12.09 %) | | |
| | Not very much | | | Very much | | |
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Q12 (Influence of intuition on decision-making) | 2 (2.20 %) | 9 (9,89 %) | 24 (26.37 %) | 27 (29.67 %) | 23 (25.27 %) | 6 (6.59 %) |

**Table 5. Results Questions 9 – 12**

We further analysed differences in the results based on demographic properties, i.e. age, gender, position, experience in leading position as well as company size (Q13 – Q17). We again describe the results, without testing for significance and independence. Interestingly only company size seems to have an influence. Differences have been found concerning importance of documentation and templates used for this task. Documentation of decisions does not show a clear picture in micro businesses and small companies (equally distributed), but in medium and big companies it is clearly important (Q6). Even more, participants working in medium and big companies state more often that templates are available (Q7).

## *Prototype Description*

As the results of the survey show, most of the participants are aware that rational and intuitive decisions are made consciously, at least occasionally. Worth mentioning seems the fact that almost 85 percent of the respondents are convinced that intuitive decisions can be identified, marked and thereby documented. Decision-makers even make meaningful business decisions based on their intuition. This verifies their trust in it. Only about 25 percent of the respondents always rely on facts. As almost 80 percent state that a documentation of these decisions is important und and 50 percent use structured documentations, it seems obvious that a tool can be helpful. In order to offer the decision-makers a tool to document their decisions and thereby learn from the making of decisions the following prototype was designed. It furthermore provides decision support functionality. Based on the satisfaction with the result of past decisions the prototype recommends a type of decision behavior for a current decision.

We describe the prototype in dual view:a technical and process description. The technical description in addition covers the explanation of the underlying calculation leading to a specific recommendation for a certain decision.

Once the prototype is opened in a browser the decision-maker can add a new decision. The decision is represented by a title and a short description, so that the decision-maker is able to document certain conditions characterizing the decision-making situation. This basic description is necessarily unstructured in order to address the personalized needs. The following questions have to be answered for every new decision:

| Question | Literature (example) |
|---|---|
| How high is the risk? | (Finucane et al. 2000) |
| Do you have to make the decision quickly? | (Kalantari 2010) |
| Is your decision-making led by emotions? | (Kalantari 2010) |
| Has your intuition/instinct helped you before to come to a successful result in similar decision situations? | (Mavor et al. 2010) |
| Is all required information available to reach a decision? | (Shapiro and Krishnan 2001) |
| Is it possible to consider all given information / to take all given information into account? | (Shapiro and Krishnan 2001) |
| Is it possible that the information is biased / tendentious? | (Tarka 2017) |

| Do you expect little added value with additional information? | (Vershinina et al. 2017) |
|---|---|
| Are there any legal restrictions concerning your decision-making? | (Gigerenzer and Gaissmaier 2011) |
| Is a standard option available? | (Styhre 2011) |

**Table 6. Questions and Sources**

When all questions are answered, the decision is calculated instantly and a recommendation for the use of intuition in this certain decision-making situation is shown to the user. In case of questions supporting intuitive decisions, the value for the average calculation is generated by multiplying the rating with the weight of the question. For questions supporting fact based decisions, the value for the average calculation is generated by subtracting the rating from seven and then multiplied with weight of the question. The calculated average, which has a range from one to six as well, is used to determine the recommendation. If the average shows a value between one and smaller three (1.00 to <3.00), the recommendation is 'intuitive decision not recommended'. In case of three to four (3.00 to 4.00), the prototype outputs 'neutral'. Above the value of four (>4.00) the use of intuition is recommended ('intuitive decision recommended').
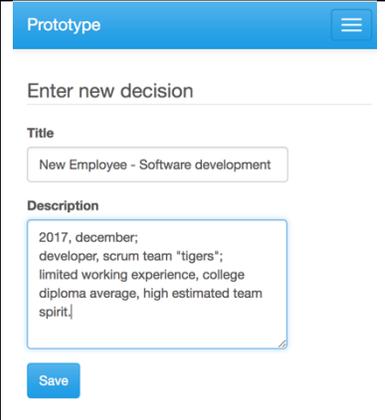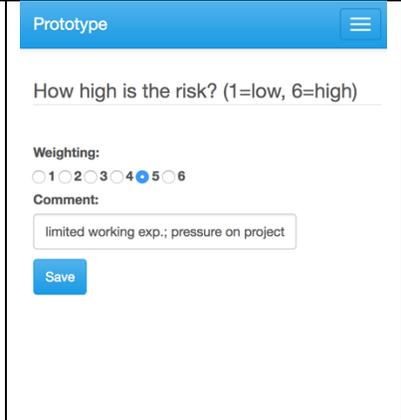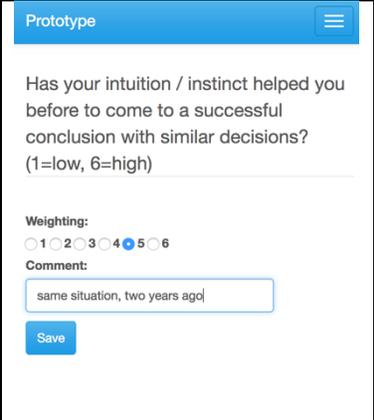
| Figure 1: New Decision | Figure 2: Question on Risk | Figure 3: Question on Experience |
|---|---|---|

The decision-makers can then check whether this recommendation meets the actual influence of their intuition on the decision-making process. Decision-makers can directly compare the results of the evaluation with the estimated influence of intuition. All data entered is saved and documented for later use, for example for looking up past decisions as a reference. Finally, the user can add an assessment of the actual performance of the decision. As the prototype only provides recommendations, the prototype only serves as an additional support for the final decision-making. The decision-makers have to take full responsibility for the consequences of their decisions and should not solely rely on the recommendations of the prototype as justification. The proposed prototype comes with a set of predefined questions, but the users of the prototype can add new questions according to their needs. In this way, the prototype can be improved continuously. Additionally, this feature allows the prototype to be adjusted for more specialized use cases. The prototype is implemented using the ASP.NET framework following a model view controller as design pattern (ASP.NET MVC). Visual Studio 2017 functioned as development environment. The result is a web application using HTML 5 and Bootstrap (3.3.7.) for visual representation. All data generated and used is stored in XML files. In a first evaluation approach, we exposed the prototype to different people with the aim to assess its utility and usability and observed their reaction. The general tenor of this group of people, which participated in a workshop, was positive regarding usability and utility.

## Conclusion and Future Research

As we have discussed in this paper, intuitive decisions play an important role in decision-making in companies. The choice between making a decision based on intuition or solely relying on facts depends on different factors, like experience, mood, but also time and cost pressure. Furthermore, the nature of the decision problem such as risks related to the decision and the importance of the decision influence this choice. The results from empirical data – both, qualitative and quantitative – suggest that documentation to evaluate prior decisions is important. Based on this and the literature, our prototype supports decisions-makers in their choice between intuitive versus rational decisions. Although the problem area has already been identified in literature, to the best of our knowledge the prototype is the first attempt to fill this gap and hence contributes to the knowledge in the field. But even more, the prototype is of value for business, as managers on C-level, forced to make fast decisions to avoid costs of non-deciding, profit from an easy-to-use tool, able to document decisions made and recommend which choice – between intuitive versus rational decision making – should be made.

In order to obtain the principles of design science a structured evaluation of the prototype is forthcoming. A group of decision-makers is going to use the prototype for a certain period of time under the guidance of researchers and supported by developers. Thereby the prototype will be improved incrementally and insights on utility and usability will be derived. Further insights will serve as basis for the improvement of the questions within the artifact, the relation between question and recommendation and the way decision-makers can learn from prior behaviour.

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