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Project managers and decision making: Conditional cognitive switching and rationally stepping up

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ABSTRACT

Decision makers switch between analytical-rational and intuitive-experiential approaches to decision making, a phenomenon termed "cognitive gear switching." Such switching is crucial for decision making in any organization. However, how decision makers switch between the intuitive-experiential and analytical-rational approaches, the interplay between these approaches and contextual factors remains poorly understood. We study this in the context of decisions made in ongoing product-development projects, where we distinguish between the decision-making behavior of project managers and other project members. We show that project managers are more likely to switch decision-making approaches when faced with project uncertainty and, in such cases, to favor the analytical-rational approach. As such, we define project managers as "conditional cognitive switchers" and the strategy used as "rationally stepping up."

1. Introduction

Dual-process theories suggest that decision making can follow one of two distinct processes: an implicit, unconscious process based on "gut feelings," referred to as the intuitive-experiential process; or an explicit, controlled, and conscious process, known as the analytical-rational process. Since the publication of early work on dual processes (Evans, 1984), these theories have contributed to organization and management research (Hodgkinson and Sadler-Smith, 2018) by shedding light on individual and group behavior (Healey et al., 2015), and by offering insights into strategic processes in times of change (Hodgkinson and Healey, 2011). While the fact that individuals switch between the intuitive-experiential approach and the analytical-rational approach is theoretically established, scholars have—with a few notable exceptions (Hall et al., 2015; Kaufmann et al., 2017; Woiceshyn, 2009)—largely ignored questions of how this "cognitive switching" actually materializes. Ignoring such research questions may bear non-trivial consequences as firms and decision makers forego the opportunity to optimally and flexibly adjust their approaches based on the needs and circumstances.

In this paper, we study the interplay between the decision-making approaches in a company simultaneously undertaking numerous new product- and process-development projects. More specifically, we investigate the decision making behavior of project managers versus other project members. Development projects are a special context characterized by less hierarchy and a stronger focus on how the team can combine its skills and resources optimally to solve the project task. This development-project context is particularly suitable for investigating the decision making behavior of project managers versus other project members because it is unknown territory for everyone involved, so all project members must make decisions based on incomplete information, with no priors, when

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facing changing conditions.

We follow Louis and Sutton (1991) in studying “cognitive switching” which they define as switches between decision making approaches made in response to changing conditions. Our research question is the following: Under which circumstances do project managers versus other project members switch between the two decision making approaches and what is the direction of such switching?

We theorize about baseline differences between project managers and other project members in their propensity to switch decision-making approaches (Hodgkinson and Sadler-Smith, 2003; Isenberg, 1986; Sadler-Smith et al., 2000). Furthermore, we posit that cognitive switches are moderated by changing conditions and that the propensity to switch is higher for project managers when project uncertainty is high. Lastly, we theorize the direction of such switching to be from the intuitive-experiential approach to the analytical-rational approach.

To test our theorizing, we use a multi-method research design, where we are primarily deductive and then supplement such an approach with a more inductive approach to understand and deepen the findings. Such an approach has been termed the “test and explore” archetype (Wellman et al., 2023). We focused on a case company active in hydraulic equipment manufacturing in Denmark, where we followed 65 development projects over 6 months (for a similar research design, see Cristofaro, 2017). We capture the two decision-making approaches using various exercises, such as the Cognitive Reflection Test (CRT), at different points in time (Bago et al., 2020; Bronstein et al., 2019; Frederick, 2005; Mosleh et al., 2021; Schneider and Porter, 2020; Toplak et al., 2011).

We find no baseline differences between project managers and other project members in their propensity to switch approaches. However, we find that project managers are more likely to switch in projects with high uncertainty (i.e. projects that are often disrupted because of materials behaving differently than expected, sudden lack of supplies, etc.), and, as such, we label them as “conditional cognitive switchers.” Furthermore, we find that project managers tend to switch from the intuitive-experiential approach to the analytical-rational approach. We refer to this managerial strategy as “rationally stepping up.”

The study contributes to the knowledge created within theories of decision making. More specifically, we add to the knowledge on “cognitive switching” as we unpack, in the context of project work, when and how project members switch their decision making approach. We show that project managers are “rationally stepping up” and applying analytical-rational decision making when needed in cases of higher uncertainty.

2. Theory development: dual processes and cognitive switching

Dual-process theories are prominent in the field of cognition and decision making (Barbey and Sloman, 2007; Epstein et al., 1996; Evans, 1984). They suggest that two decision-making approaches shape human behavior. These two approaches have been conceptualized under a variety of designations, with heuristic, automatic, unconscious, intuitive, and experimental processes (which we denote the “intuitive-experimental approach”) standing in contrast to analytical, controlled, conscious, and rational approaches (which we denote the “analytical-rational approach).[1]

Scholars disagree on the relation between the two processes. Default-interventionists (Evans and Stanovich, 2013; Kahneman and Frederick, 2002) believe that the unconscious, experiential, and associative process is the default and that the conscious, rational, and analytical process is only utilized in certain circumstances, including situations where decision makers are unable to rely on prior experience. In contrast, the proponents of the parallel-competitive view (Barbey and Sloman, 2007; Epstein et al., 1996) suggest that the two processes are independent and parallel, such that they compete for control over human behavior. “Cognitive switching” occurs when the approach differs between two subsequent decisions of a single decision maker (Louis and Sutton, 1991).

The decision-making approach and the capacity to “switch gears” (Louis and Sutton, 1991) have long been identified as crucial for companies. However, exactly how decision makers switch their approaches over time remains under-researched with two notable exceptions. Woiceshyn (2009) studied the strategic decision-making process of 19 CEOs in the oil industry. She found that executives do not substitute intuition for rational analysis, but instead implement and integrate them through “integration by essentials” and spiraling. Hall et al. (2015) studied how the use of intuitive or analytical approaches in succession affects the performance of salesperson-customer relations. Our study builds on these premises, especially on Hall et al.'s (2015) approach, and focuses on multiple decisions and their sequences over time. We also analyze project members' propensity to switch between the two approaches under changing conditions, and we offer a theoretical explanation of the direction of such switches.

2.1. Intuitive-experiential approach

Managerial decision making has frequently been associated with “gut feelings” (Andersen, 2000; Burke and Miller, 1999; Huang and Pearce, 2015) and scholars studied the role of intuition and its relationship with other constructs, such as improvisation (Leybourne, 2009; Leybourne and Sadler-Smith, 2006). Intuition is defined as “affectively charged judgments born of expertise” (Dane and Pratt, 2007). Salas et al. (2010) point to intuition, intuition-based expertise, and expertise along with other important factors, such as individual motivation, as particularly important for experts and their ability to adapt their expertise in novel situations (Salas et al., 2010). Intuition has been linked to performance (Elbanna2013; Kahneman and Klein, 2009; Khatri and Ng, 2000) along with

[1] For a comprehensive review of the nomenclature on these approaches, see Evans and Stanovich (2013); Hodgkinson and Sadler-Smith (2018).

moderating conditions that determine its efficiency,[2] domain-knowledge factors (e.g., expert learning through repetitive practices or implicit learning), and task characteristics. Dane and Pratt (2009) distinguish between problem solving intuition, moral intuition, and creative intuition, and characterize these different types according to the level of incubation, the nature of the association, and the intensity of the effect.

Research has shown intuition to be a frequent starting point and common thread in decisions made by directors and assistant directors in the banking and finance sector (Hensman and Sadler-Smith, 2011). Another study demonstrated that entrepreneurs, who frequently have only limited information, rely on intuition to speed up the decision-making process (Shepherd et al., 2015).

Tversky and Kahneman (1974) link the use of intuition and “mental shortcuts” to systematic biases in managerial judgment (Flyvbjerg, 2022; Hodgkinson et al., 2023). Such biases arise when an individual inappropriately applies intuition. They present twelve types of biases from the default use of intuition (Kahneman, 2011; Kahneman and Frederick, 2002; Kahneman and Tversky, 2000). These biases have been tested in numerous studies applying the CRT, which is designed to measure a person’s tendency to override an intuitive response and engage in further analytical reflection.

The literature on intuitive-experiential approaches in managerial decision making is extensive. One stream focuses on managerial preferences in decision making approaches. Such research has shown that managers more frequently use simple, intuitive thinking, and rely, at least in part, on their experience and knowledge (Isenberg, 1986; Muradog;lu, 2002). Notably, in their study of different phases of strategic decision processes, Mintzberg et al. (1976, p. 285) showed that the analytical approach was rarely used. Authors found the use of this approach in only 18 out of 83 cases of decision making. Interestingly, when examining cognitive styles (Hodgkinson and Sadler-Smith, 2003; Sadler-Smith et al., 2000) in various categories of subjects, scholars have found a positive association between seniority and the reliance on the intuitive decision making approach.

2.2. Project managers’ propensity to switch decision-making approaches

Managers are unique in terms of their roles, the tasks they perform, and the way they accomplish those tasks. Mintzberg (1980, p. 31) provides one of the most compelling summaries of what a manager is and how a manager behaves: “throughout each working day the manager encounters this great variety of activity. Most surprisingly, the significant activity is interspersed with the trivial one in no particular pattern. Hence the manager must be prepared to shift moods quickly and frequently.”

This general characteristic of the role and tasks of managers is also true for project managers who have the overall responsibility for making the project development as smooth as possible. Therefore, project managers must be prepared to deal with all obstacles that might occur and as such be prepared for the shifting of moods. This shifting [of] moods is in line with the “shifting [of] cognitive gears” (Hodgkinson and Clarke, 2007; Louis and Sutton, 1991), and with such constructs as cognitive plasticity and flexibility (Koch et al., 2018; Lövdén et al., 2010; Mercado, 2008; Uddin, 2021).

We build our baseline theorizing on the above-mentioned arguments. As such, project managers act as accountable problem solvers who conduct tasks requiring frequent mood switches. Accordingly, we posit:

H1. Project managers display a higher propensity to switch between the two decision-making approaches than other project members.

2.3. The propensity to switch decision-making approach under uncertainty

In their study of managerial thinking, symbolic interactions, and behaviors, Sashittal and Jassawalla (1998) suggest that managers are unlikely to maintain a single behavioral pattern over time. Uncertainty has been highlighted as an external factor that can trigger a change in the decision-making approach (Chen and Chaiken, 1999; del Campo, Pauser, Steiner, and Vetchera, 2016).

Louis and Sutton (1991) highlight unexpected circumstances as triggers of cognitive switching. A related stream of literature in the fields of neuroscience and psychology studies cognitive flexibility and plasticity (Koch et al., 2018; Lövdén et al., 2010; Mercado, 2008; Slagter et al., 2011) in line with the premise of cognitive switching, related to information processing bottlenecks. In the context of project management, different levels of uncertainty are what characterize development projects that by definition operate in unknown territory. Based on such inherent context characteristics and uncertainty acting as a trigger for cognitive switching, we propose:

H2. Project managers’ higher propensity relative to other project members to switch between the two decision-making approaches is positively moderated by project uncertainty.

In their seminal paper, Louis and Sutton (1991) emphasize the importance of switching from the intuitive approach to the analytical and propose a “circular” model of cognitive switching. This is in line with Paton and Flin’s study (1999), which suggests that switches in either direction are possible. Similarly, Louis and Sutton (1991) theorize that cognitive switching from the intuitive to the analytical approach occurs because of frustration that promotes an attributional search (Wong and Weiner, 1981) and the fact that “unexpected events elicit causal reasoning” (Hastie, 1984, p. 44). This is in line with the “flexibility mindset” (Sassenberg et al., 2022), which posits a reduction in spontaneous processing through the activation of mindsets, such as consideration of alternatives or counterfactual thinking in decision making.

[2] Elbanna et al. (2013) additionally theorized that size of the firm, opportunity-based motivation and decision uncertainty will positively affect the use of intuition and Khatri and Ng (2000) pointed to the environmental instability as a positive moderator of the use of intuition.

Louis and Sutton (1991) name three factors underlying this type of switching: consequent but not overwhelming conditions, a need for a response, and direct involvement of the decision maker. As project managers are directly accountable for their decisions, we believe that at least the need for response and direct involvement (the latter two out of three factors cited above) are salient in their decision making. For other project members, it is possible to escalate problems and doubts to the project manager rather than deciding themselves, while the project manager is expected to solve problems rather than escalate them. In Mintzberg's (2013) terminology, the latter expectation reflects the role of managers as "disturbance handlers." Furthermore, this cause of switching is in line with Chen and Chaiken's (1999) general theoretical argument on the individual's *epistemic motivation*, or willingness to engage in information search and processing. This willingness to systematically process information is contingent upon the (in) sufficiency of information that provides cues (Chen and Chaiken, 1999), as proposed in the literature on motivated heuristic-systematic processing and information sufficiency (Chen et al., 1999).

Scholars studying group behavior have theorized that groups characterized by epistemic motivation will engage in interactions that are information driven (de Dreu et al., 2008; Scholten et al., 2007). Managers may display high levels of epistemic motivation and as such thus engage in information-driven interactions. Similar patterns of switching behavior among non-managers based on epistemic motivation have not been empirically proven, suggesting a possible difference between the two categories that may be particularly salient in the presence of uncertainty. Therefore, we posit:

H3. Project managers' higher propensity relative to other project members to switch between the two decision-making approaches under uncertainty is likely to materialize in switching to the analytical-rational approach.

Our model (see Fig. 1) summarizes the above theorizing and relationships among project managers, other project members, propensity to switch, and other influential factors.

3. Method

3.1. Case company, case selection, and data sources

We gained privileged access to a global hydraulic manufacturer located in Denmark that engaged in R&D, production, marketing, and sales. Employees from different departments worked together with project managers on projects in cross-functional teams throughout various stages of product development.

This setting is ideal for a study of individual decision making for several reasons. First, in the product-development context, all involved move into unknown territory where no routines exist, so decisions must be based on incomplete information. These decisions can rely on intuition or be undertaken more analytically. Second, individuals taking part in many projects at different times and different stages of development are frequently involved in decision making. Cooperation within cross-functional teams on activities like prototyping, validating, and launching production requires all project members to be involved in project decisions. Finally, the respondents in our sample were engaged in a variety of projects, some of which were more uncertain than others. This allowed us to study individual decision making under different contextual circumstances.

3.2. Empirical setting

The projects varied in nature and maturity. However, they were all strategically crucial for the case company, as they enabled the development of new products and product commercialization. As such, they were subject to standard procedures and documentation requirements (e.g., monthly status reports).

We included all project members (i.e., managers and others) in our sample. In a systematic analysis of their tasks, we found the main differences related to project managers' responsibilities for overseeing projects and people management. Other project members were usually involved in more projects, but the number of projects varied per individual and changed monthly. Non-managerial project members were engineers (e.g., technology development or product-development engineers) or specialists. Engineers were the main engine and drivers of the projects, and they spent most of their time on a few projects. Their tasks included testing, validation, maintenance of developed solutions, investigation of issues, and quality improvement. Specialists had higher status than engineers and they contributed with their highly specialized knowledge when that knowledge was critical for the project's progress. They were typically involved in many projects but spent less time on each project.

The projects follow a stage-gate development model, with the early gates including brainstorming, initial ideation, and tests and

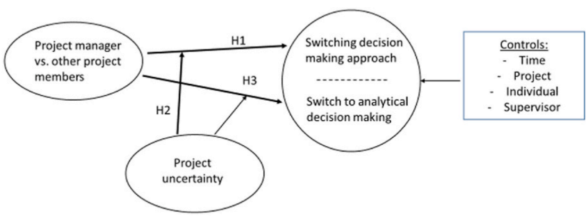

Fig. 1. Model.

validation (gates 1–3). Projects then moved into actual product development (gates 4–6), followed by commercialization (gate 7). In the early stages of the project (gates 1–3), where the focus was more on idea generation, projects typically had fewer members who interacted frequently to develop the project idea. In gates 4–6, when project ideas began to materialize, more project members were involved, and tasks were disaggregated and delegated to more project members. The studied projects are all at different stages in the development process.

3.3. Data

Our primary data originated from four sources. First, we had access to 65 project members, to whom we administered six monthly surveys from December 2018 to May 2019. The main purpose of the surveys was to capture the respondents' decision-making approaches at each point in time. We also used the surveys to gather information on individuals' workload perceptions as well as their intrinsic and extrinsic motivations. We applied a within-subject design in an experimental setting where the same respondents were exposed to different exercises in the six-month time window. Second, we used the focal firm's categorization of certain projects as early-stage technology development projects as a proxy for project uncertainty. Third, we received information from the human resources department about each individual's demographic characteristics, including seniority, gender, age, and supervisor. Fourth, we had access to all project-related time registrations within six months (i.e., each project member's monthly reports on the time spent on each project).

In addition, we interviewed several company experts at different stages of our study. We used those interviews to improve our understanding of the job roles and project processes, but also to deepen the understanding of our findings, in line with the "test and explore" archetype of multi-method research design (Wellman et al., 2023).

3.4. Survey of project members

Our monthly survey was designed to capture the decision-making approach that a respondent was prone to use then. Before the launch of the study, supervisors encouraged the respondents (i.e., project members) to participate in our study. Participants were informed about the project's goal and timeline in November 2018, one month before the administration of the first survey. We sent all surveys, along with a short recap of the goal and timeline, from an external platform to each respondent's personal email address. The external platform and the distribution of the surveys by an academic institution helped to ensure respondents' anonymity. The respondents were assured that the information they provided would remain anonymous.

We administered each survey wave in the last week of each month and kept each wave open for about five days. The surveys were provided in English and Danish. We systematically sent daily, personalized reminders to non-respondents starting the third day after the deadline. The dedicated contact person at the case company participated in this follow-up effort. To avoid biases, we randomized the order of the multiple-choice options and items capturing respondents' workload every month. The goal in this regard was to avoid information sharing among respondents. We also recorded the time each respondent spent completing the survey.

We did not observe any significant differences between early and late respondents in terms of demographics, workload, or the proxy for decision-making approach when we systematically compared these groups using t-tests. Of the 65 initially sampled respondents, 62 completed a survey in at least one wave. We identified the main reasons for non-responses with the help of a company expert. The non-respondents were individuals on extended (parental or sick) leave or on vacation.

Motivation is an important correlate of decision making (Evans and Curtis-Holmes, 2005; Kahneman and Klein, 2009; Salas et al., 2010). To decrease respondents' cognitive load, we only measured motivational items in the first survey, while we included some of the other items (e.g., workload) in all survey waves. Therefore, we could only retain observations from respondents who took part in the first survey wave, which provided us with insights into their motivation. This reduced our sample to 55 respondents. Table 1 presents the distribution of survey responses across all survey waves.

If all respondents had taken part in every survey wave, the sample would have totaled 390 observations (65 × 6). Compared to that maximum sample size, our 263 observations give an overall response rate of 67%. Notably, of the 55 respondents, 23 (41%) took part in all survey waves, and 16 (29%) completed five waves. We discuss the methodological steps we took to address data shrinkage in the Analysis section.

Table 1
Frequency of survey responses.

Number of survey waves answered	Frequency of survey responses	Number of resulting employee-month observations
Six	23	138
Five	16	80
Four	6	24
Three	5	15
Two	1	2
One	4	4
Total	**55**	**263**

3.5. Final data set

We merged the survey responses with the data on demographics and time registration for the 55 sampled individuals. The final panel data set included 263 employee-project-month observations with reported hours and project characteristics. This number is a result of multiplying the number of respondents (55) with the corresponding number of survey waves (see Table 1). In the panel, the number of hours spent on different projects each month, the number of projects, perceived monthly workload and decision-making approaches are all individual-level, time-varying variables.

Of the 263 observations, 259 originated from respondents who took part in at least two survey waves. To consider the propensity to switch decision-making approaches, we required respondents to participate in at least two survey waves. As we needed more than one set of survey responses to be able to estimate change, we had to remove the first occurrence of survey responses for all 51 respondents, resulting in a total of 208 useable observations.

As we retained only respondents who took part in multiple surveys, we might have introduced a selection bias that could affect the test for Hypothesis 1. We therefore undertook an extensive series of t-tests along all demographics and time-varying covariates and found no significant differences between the single-survey and multiple-survey respondents. More specifically, the difference in means for single and multiple participants was 2.19 ($p = 0.65$) for age, 3.73 ($p = 0.37$) for seniority, and 0.25 ($p = 0.25$) for status as a project manager. The levels of intrinsic and extrinsic motivation were 0.48 and 0.30 ($p = 0.46$ and $p = 0.63$), respectively. The difference in the mean for gender was 0.06 ($p = 0.60$). All differences were insignificant across the two groups.

3.6. Variables

3.6.1. Dependent variable—changes in decision making approach

In line with previous research, we implemented the CRT to measure decision-making approaches among project managers and other project members (Kahneman and Frederick, 2002; Frederick, 2005; Toplak et al., 2011). The CRT revolves around several exercises that are constructed in such a way that a typical person who uses his or her intuition or "gut" feelings would respond incorrectly, as the exercises require deeper analyses to be able to arrive at the correct answer (Bazerman and Moore, 2009; Frederick, 2005). This is a study with a within subject design in an experimental lab setting and not a field experiment. This kind of lab experiment does have the well-known challenge of "incentive compatibility" if the experiments do not resonate with real-life decisions. In this case, we have applied exercises that are close to the problems they are facing as engineers in the projects.

We measured decision-making approaches by asking all project members to complete the same exercise in each of the six monthly surveys. Therefore, all respondents were exposed to the same problem, and we could compare the problem-solving outcomes between project managers and other project members over time. We focused on the approach that led each respondent to the ultimate solution in the exercises (i.e., the use of the analytical-rational approach or the intuitive-experiential approach) and captured switches in those approaches from one decision to another. We used three core CRT exercises—"bat and ball," "lily pad," and "widgets"—as well as three other exercises (e.g., the "marbles" and "hospital" problems. All of the questions were either open-ended or multiple choice. The answers to individual exercises were subsequently used as input to build our proxy for switches over time. Table 2 provides a summary of all six exercises.

We took steps to prevent respondents from learning from their previous participation and we tested for learning effects —an issue that we address in the Robustness section. We informed respondents that no tools (e.g., software) were required to answer the questions. In a post hoc analysis, we ruled out the possibility that the respondents had previously been exposed to similar exercises (Haigh, 2016).

Table 3 provides details on the splits of the monthly responses (i.e., frequencies) relying on the intuitive-experiential or analytical-rational approach.

The fact that the practical exercises used in our monthly surveys had varying degrees of difficulty is reflected in the frequencies of answers based on the analytical-rational and intuitive-experiential approaches (ranging from 2% to 150%). We were interested in the variation among respondents exposed to the same exercise (i.e., whether project managers switch more often than other project members), so we focused on the relative rather than the absolute number of (correct) answers. Therefore, the variation in difficulty of the exercises matters less in this case as long as all project members are exposed to the same exercise. Moreover, our model included monthly dummies and we controlled for the business cycle, which minimized the impact of the exercises' varying difficulty. In addition, as discussed in detail below, we ruled out the possibility that a learning effect drove our results.

Based on the responses to the exercises included in the monthly surveys, we first computed an *auxiliary* dummy variable, which

Table 2
Summary of decision-making exercises and source.

Item related to decision making	Source in the literature
Bat and ball puzzle	Kahneman and Frederick (2002); Frederick (2005)
Lily-pad problem	Kahneman and Frederick (2002); Frederick (2005)
Machine/widget problem	Kahneman and Frederick (2002); Frederick (2005)
Hospital problem	Tversky and Kahneman (1974)
Girl/boy baby birth problem	Bazerman and Moore (2009); Kahneman & Tversky, 1972
Marble problem	Bazerman and Moore (2009)

Table 3
Frequencies of answers based on analytical-rational and intuitive-experiential approaches.

Month	Total respondents	Analytical approach	Intuitive approach
December	46	14	32
Project manager	11	4	7
Project member	35	10	25
January	44	4	40
Project manager	11	0	11
Project member	33	4	29
February	47	1	46
Project manager	11	0	11
Project member	36	1	35
March	42	25	17
Project manager	11	7	4
Project member	31	18	13
April	44	7	37
Project manager	10	2	5
Project member	34	5	29
May	40	24	16
Project manager	9	6	3
Project member	31	18	13
TOTAL		75	188

took a value of 1 if a given respondent completed the exercise using an analytical-rational approach and 0 otherwise (Selart et al., 2008). Using this auxiliary variable as a rough proxy of decision-making approaches, we computed the main dependent variable of *change in decision making* as a rolling sum of changes in respondents' decision-making approaches (i.e., a change was recorded if the auxiliary was 0 in the previous month and 1 in the current month or vice versa). We standardized the rolling sum by the number of monthly surveys so that the variable ranged from zero to one.

Our dependent variable indicates that 40% of individual-month observations did not involve a change (i.e., the variable took a value of zero for 86 observations) in the decision-making approach. Notably, our survey only captures the decision making approach applied at a given point in time. However, by repeating this exercise and then comparing the approaches used over time, we can capture the "cognitive switches" (Louis and Sutton, 1991) in decision-making approaches.

3.6.2. Independent variables

Project manager. Our main independent variable focused on job function. We isolated respondents with managerial responsibilities for projects and created a dummy variable that took a value of one for individuals with such responsibility (approximately 24% of our sample; 49 individual-month observations). These observations originated from 13 project managers.

Technology development. Early-stage technology-development projects are inherently uncertain in the sense that the process and outcome are unpredictable, while other project types, like those focused on product improvements, are risky rather than uncertain. The technology-development count variable, which varies monthly, denotes the number of early-stage technology-development projects in which a given individual was involved. Of the projects included in this study, 32% were technology-development projects and an individual was, on average, involved in three such projects monthly. We acknowledge that this is just a rough proxy for uncertainty and therefore we collected additional data on which projects were more uncertain than others. We did that by asking senior managers overseeing projects to assess whether the projects have been exposed to exogenous shocks at a given point in time. We used this proxy as an alternative measure of uncertainty and got qualitatively very similar results.

3.6.3. Controls

We controlled for a variety of characteristics related to the individual, time, project, and supervisor, as all of these characteristics may offer confounding explanations for our findings. For example, if an individual is under significant time pressure in a particular month, he or she may be more likely to rely on the intuitive-experiential approach than in a month with a regular workload. Thus, the time available can affect the decision-making approach (Evans and Curtis-Holmes, 2005) and, ultimately, the propensity to switch between the intuitive-experiential and analytical-rational approaches.

Objective workload (number of reported hours). We computed the number of hours each respondent spent on all projects in the focal month. We then used that number as a proxy for that respondent's workload. As workload is an antecedent of information processing and, thus, the decision-making approach, the omission of this measure may lead to a clear bias. On average, individuals reported 148 h of project work per month, with a standard deviation of 43.

Perceived workload. We followed Perrewé et al. (2005) in computing a monthly measure of perceived workload based on three items ranked on a seven-point scale. We then averaged the three items to compute the perceived workload. The mean was 3.9. Notably, although this variable is positively correlated with *objective workload*, the correlation is not significant, which indicates that the perceived workload associated with projects differs from the actual time spent on projects.

Motivation. The theory links the use of different approaches to the level of motivation (Kahneman and Klein, 2009; Salas et al., 2010). Self-determination theory suggests that individuals may differ in terms of whether their dominant motivation is extrinsic or intrinsic (Gagné and Deci, 2005). We created the variables related to intrinsic and extrinsic motivation to share knowledge by

Table 4
Descriptive statistics and correlations matrix (based on 208 observations).

Table 4. Descriptive statistics and correlations matrix (based on 208 observations)

Variable	Mean	Std. Dev.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) Switch in decision making	.25	.236															
(2) Perceived workload	3.938	1.166	-0.199*														
(3) Extrinsic motivation	3.577	1.324	0.221*	-0.141*													
(4) Intrinsic motivation	5.708	1.327	-0.180*	-0.082	-0.045												
(5) Objective workload	148.3	43.263	0.156*	0.156*	0.025	-0.051											
(6) Male	1.938	.243	0.161*	-0.048	0.075	-0.012	0.012										
(7) Seniority	14.90	8.287	0.205*	0.053	-0.019	-0.013	0.199*	-0.171*									
(8) Age	44.03	9.685	0.016	0.024	-0.075	0.093	0.086	-0.242*	0.527*								
(9) Technology development	3.837	4.129	0.160*	-0.013	-0.091	-0.159*	0.292*	-0.020	0.504*	0.217*							
(10) Project manager	.236	.425	0.051	0.150*	0.008	-0.091	0.015	-0.044	0.128	0.044	-0.107						
(11) FE (objective workload)	138.2	27.022	0.121	0.287*	0.103	0.008	0.504*	0.067	0.237*	0.181*	0.285*	0.043					
(12) FE (perceived workload)	3.971	.904	-0.267*	0.769*	-0.147*	-0.037	0.152*	-0.010	0.057	0.021	-0.031	0.168*	0.345*				
(13) FE (auxiliary dummy)	.713	.175	-0.648*	0.147*	-0.187*	0.250*	-0.172*	-0.144*	-0.255*	-0.062	-0.200*	-0.086	-0.253*	0.184*			
(14) Complex	.918	.275	-0.048	0.004	-0.182*	0.044	0.000	-0.077	-0.097	-0.037	-0.110	-0.124	-0.021	0.028	0.112		
(15) Time spent on the survey	294.4	304.039	-0.108	0.081	-0.044	-0.084	0.051	-0.065	0.100	0.082	-0.015	-0.071	0.021	0.066	0.167*	0.009	
(16) External shock	.19	. 39	0.057	-0.040	0.166*	0.014	0.098	0.134	-0.078	-0.149*	-0.074	-0.177*	0.260*	-0.017	-0.009	0.112	-0.105

* Significant at the 0.05 level

averaging seven items. A comparison of intrinsic and extrinsic motivation shows that the mean is significantly higher for intrinsic motivation than for extrinsic motivation (5.7 versus 3.5), while the standard deviation is similar.

We also controlled for a range of standard demographical characteristics, such as age, seniority, and gender. The average respondent was a 44-year-old male with 14 years of tenure.

The extant literature argues that risk preferences may affect decision-making approaches and outcomes (Frederick, 2005). Although we did not systematically measure the risk preferences of the individuals in our sample, each survey wave included a question on whether the respondents preferred to dedicate their efforts and hours to a complex or a non-complex project in that month. We subsequently computed the variable *complex*.

To rule out the possibility that a time trend (e.g., holidays or the end of the reporting year) or task difficulty drove our results, we introduced month-fixed effects and the employee's supervisor-fixed effects.

3.7. Choice of the modeling framework

After testing for various characteristics of our panel (i.e., unobserved heterogeneity, data shrinkage), we chose a random-effects model as a baseline. Notably, the Hausman test, which evaluates the consistency of estimators under fixed and random effects, was insignificant. This indicates that we cannot reject the null hypothesis that the differences in coefficients in the two models are not systematic (Prob $>$ chi^2 $=$ 0.5802). Accordingly, we used random-effects models in our estimation. However, we acknowledge that

Table 5
Correlated random effects and switches in decision making.

VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Dependent variable	Change in decision making					Direction of change (to intuitive)
Independent variables						
Technology development			0.022*** (0.007)	0.023*** (0.007)	0.021*** (0.007)	0.005 (0.047)
Project manager * technology development (H2 and H3)					0.067** (0.033)	−0.445* (0.244)
Project manager (H1)		0.026 (0.085)		−0.026 (0.087)	−0.610** (0.270)	3.711* (2.231)
Controls						
Perceived workload	0.007 (0.011)	0.007 (0.011)	0.008 (0.011)	0.008 (0.011)	0.008 (0.011)	0.050 (0.234)
Extrinsic motivation	0.007 (0.014)	0.008 (0.015)	0.008 (0.013)	0.007 (0.013)	0.006 (0.012)	−0.015 (0.073)
Intrinsic motivation	−0.010 (0.011)	−0.011 (0.011)	−0.001 (0.009)	−0.000 (0.010)	0.000 (0.010)	0.051 (0.065)
Objective workload	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.001 (0.005)
Male	0.088** (0.045)	0.095** (0.048)	0.021 (0.057)	0.012 (0.062)	0.040 (0.062)	−0.447 (0.446)
Seniority	0.005 (0.003)	0.005 (0.003)	0.004 (0.003)	0.005 (0.003)	0.005 (0.003)	−0.013 (0.013)
Age	−0.002 (0.003)	−0.002 (0.003)	−0.004 (0.003)	−0.004 (0.003)	−0.004 (0.003)	−0.023** (0.011)
Fixed effects objective workload	−0.001 (0.001)	−0.001 (0.001)	−0.001* (0.001)	−0.001* (0.001)	−0.001 (0.001)	−0.001 (0.007)
Fixed effects perceived workload	−0.043 (0.031)	−0.042 (0.030)	−0.044 (0.029)	−0.045 (0.028)	−0.052* (0.028)	0.068 (0.228)
Fixed effects auxiliary dummy: analytical	−0.693*** (0.121)	−0.693*** (0.121)	−0.782*** (0.117)	−0.785*** (0.119)	−0.788*** (0.121)	−0.644 (0.538)
Complex	0.018 (0.030)	0.018 (0.030)	0.023 (0.030)	0.023 (0.030)	0.024 (0.030)	−0.433 (0.492)
Constant	0.804*** (0.228)	0.790*** (0.224)	1.151*** (0.289)	1.180*** (0.296)	1.119*** (0.285)	
Cut 1						−2.534 (1.553)
Cut 2						1.389 (1.538)
Month dummy	Y	Y	Y	Y	Y	Y
Supervisor dummy	Y	Y	Y	Y	Y	Y
Goodness of fit (R2/Pseudo R2)	Within: 0.38 Between: 0.70 Overall: 0.59	Within: 0.38 Between: 0.70 Overall: 0.59	Within: 0.38 Between: 0.73 Overall: 0.61	Within: 0.38 Between: 0.72 Overall: 0.61	Within: 0.38 Between: 0.74 Overall: 0.62	0.243
Observations	208	208	208	208	208	208

Robust standard errors are in parentheses. ***p $<$ 0.01, **p $<$ 0.05, *p $<$ 0.1.

some unobserved individual characteristics (e.g., psychological traits, such as openness or extraversion, or cognitive styles; del Campo et al., 2016; Epstein et al., 1996; Sadler-Smith, 2004; Scott and Bruce, 1995) may influence the propensity to switch between the two approaches. Therefore, we implemented an approach similar to fixed effects known as correlated random effects. We then computed the means of three available time-variant variables: use of analytical thinking (based on the *auxiliary* dummy), perceived workload, and objective workload. We introduced these three "fixed effects" in our correlated random-effects models.

The structure of the panel data includes multiple observations for individual employees, which gives rise to data non-independence. We address this issue by clustering errors at the employee level (Broekel et al., 2014). We modeled our dependent variable with a generalized least squares regression (random effects). All findings remained unchanged when we used a logistic regression model as an alternative.

4. Analysis

Table 4 presents the summary statistics and correlation matrix for all of the variables. Some of the binary correlation coefficients are relatively high, which may indicate some bias in the estimation. Therefore, we ran a formal VIF test to ascertain the extent to which this issue might have adversely affected our results. The average value yielded by the test was 3.31, which is well under the generally accepted threshold of 5 (Marcoulides and Raykov, 2019).

Table 5 presents the results of this analysis.

Models 1–5 have a switch in decision-making approach as the dependent variable. The first model includes only the controls. The second model includes the independent variable *project manager*. The third model includes *technology development* as a proxy for endogenous project uncertainty. The fourth model includes *project manager* and *technology development*, while the fifth model is the full model, which includes the interaction of the *project manager* with *technology-development* projects.

In the first model, the coefficient of *males* is significant and positive, suggesting that men are, on average, more likely to switch between the two decision-making modes. The fixed effects (based on the count of the analytical-rational approach) also display a significant correlation. The coefficient's sign is negative, which implies that individuals who often adopt the analytical mode are less likely to switch between the two. The signs and significance of these controls remain consistent across all models.

The *project manager* variable is insignificant in Models 2 and 4, which indicates that, in general, project managers do not switch between decision-making modes more often than other project members. As the *project manager* variable is insignificant in two of the three models in which it is included, we cannot confirm that project managers switch more often than other project members (i.e., a rejection of H1). *Technology development* is consistently significant and positive across all models, suggesting a correlation between involvement in technology-development projects and the likelihood of switching between the two approaches.

In Model 5, the *project manager* variable gains significance (with a negative coefficient). More notable is its significant interaction with *technology development*, which suggests that project managers are more likely to switch between the two decision-making approaches when they are involved in more uncertain technology-development projects (as proposed in H2). The analysis of the margins yields additional insights. In particular, we find no differences in switching behavior for project managers or other project members when the number of technology-development projects in which they are involved is low (=0) or at the mean (=3). However, project managers' likelihood of switching is more pronounced when involved in more technology-development projects than other project members.

To shed more light on the workings of development projects, we conducted several interviews with senior managers in the case company. The senior managers were not involved in the projects themselves, but the project managers were referring to the senior managers and as such they were overseeing the development of the projects. The senior managers were typically product and process owners who requested a development project.

These interviews corroborate that under normal circumstances, there is little need for the project manager to switch decision making approaches, however, this changes when "hiccups" occur. A senior manager from the case firm explained the role of managers and changes in strategies as follows: *A project manager wears many hats. Not only is a manager a team leader, but he or she is also an organizer, coach, and problem solver — all rolled into one. The role is similar to the coach of a sports team that is creating optimal conditions for the team, protecting the team, being committed to the team, and at the same time changing the strategy and tactics of the team if needed in order to reach the goals.*

Another senior manager expressed the specifics of switching and behavioral changes in this way: *In a project where everything develops according to expectations, the project manager might be relatively invisible. Their role is to remove all hindrances and make it as easy as possible for the project members to move on. This implies that they have to step up if obstacles appear.*

Similar behavior is likely to materialize on uncertain projects such as product development. As put it by a third senior manager: *Most of our development projects have an element of uncertainty to them. However, the uncertainty is higher for our cutting-edge projects, where you have to adapt to constantly changing conditions* e.g. *due to unexpected internal or external events. In these projects, you definitely will have to manage uncertainty instead of trying to manage risk.*

Although we used monthly exercises with varying degrees of difficulty, one could argue that switches may become more likely over time owing to a learning process that leads respondents to switch from the intuitive-experiential approach to the analytical-rational approach. We checked for this possibility using a series of t-tests in which respondents' answers were split into early (January–March) and late (April–June). We then tested whether the means of answers based on the analytical-rational approach were higher in the later period, which would be consistent with the learning explanation. The means of this variable were 0.86 for the early period and 0.55 for the late period, with a highly significant difference of 0.30 ($t = 5.8$ and $p = 0.000$). These results, along with inclusion of the monthly dummy, help alleviate concerns that a learning process may have driven the propensity to switch or the direction of switches over time.

We used a different modeling framework to explore the nature of the switches in decision making. We created a three-level dependent variable, which we termed *direction of change*. This variable took a value of zero if the type of decision making did not change from the previous month (i.e., *auxiliary* had the same value for the current and previous months). It took a value of −1 if there was a switch from intuitive-experiential to analytical-rational thinking (i.e., *auxiliary* had a value of zero in the previous month and a value of one in the current month). It took a value of one if the type of decision making switched from the analytical-rational approach to the intuitive-experiential approach (i.e., *auxiliary* had a value of one in the previous month and zero in the current month). In this extra analysis, which is reported in Model 6 of Table 5, the coefficient of the interaction is negative, which implies that project managers are less likely to switch from the analytical-rational approach to the intuitive-experiential approach. This confirms H3.

We further shed light on the direction of switches with supplementary qualitative evidence. In an interview, a company senior manager outlined the inner workings of projects in this way: *When a shock strikes, a project manager cannot simply work out of intuition. The project's success may be at stake. The manager is expected to take all possible inputs and analyze what went wrong, find possible solutions, and move those solutions up the hierarchy.*

5. Discussion and conclusion

Our study offers three important findings related to the context of development projects.

First, in general, project managers do not differ from other project members in their propensity to switch between the intuitive-experiential and analytical-rational decision-making approaches. The absence of a baseline difference in switching behavior between project managers and other project members is surprising, especially considering the differences in their roles (Busenitz and Barney, 1997; Caspers et al., 2012). This finding indicates that as long as a project is progressing as expected, project managers and other project members do not vary in their switching behavior. This might be explained by the context of this study in development projects where all members of the project group are working on creating new unknown solutions. All project members are basically in the same boat as no one knows the answers and right decisions beforehand. This also implies that hierarchy matters less than in other contexts, while the ability to creatively solve issues matters more. The two types of employees work hand in hand on a daily basis and have similar tasks and objectives, which is a notable difference from the mainstream management context.

Industry characteristics may also explain why we found no baseline differences in switching behavior between project managers and other project members. Past research has yielded contrasting insights into decision-making approaches (Hensman and Sadler-Smith, 2011; Trönnberg and Hemlin, 2014) that can be reconciled by taking industry characteristics into account. The hydraulic pump industry is not characterized by hyper-competition, but by a steady pace of development, where there might be more scope for applying intuition and experience.

Second, our findings show that the difference in the propensity to switch between the intuitive-experiential approach and the analytical-rational approach comes into play for project managers on more uncertain projects. We therefore refer to the project managers as "conditional cognitive switchers," as their greater tendency to engage in switching (relative to other project members) occurs under uncertainty. Again, as indicated by the qualitative interviews, the context helps explain such findings. While faced with a problem, project managers may need to swiftly adjust and switch the "cognitive gears". Project managers step up and undertake their role as problem solvers, when the conditions require it, while they otherwise work side-by-side with other project members.

Finally, we find that project managers tend to switch from the intuitive-experiential approach to the analytical-rational approach, which is why we term this managerial strategy "rationally stepping up." As argued by Louis and Sutton (1991), several factors may contribute to the adoption of a conscious (analytical) approach (e.g., something unfamiliar and unknown, a disruption, a troublesome situation, or a failure). In their study of thinking styles, Epstein et al. (1996) propose that the rational approach allows for effective coping, given that a situation does not allow for irrationality. In our case, such switching is triggered by the nature of a project as a more uncertain technology-development project. The project manager's tendency to engage in analytical information processing increases with the uncertainty of the projects. The "rationally stepping up" strategy can also be linked to extant work on strategizing (Hodgkinson and Clarke, 2007). Although we do not study stable preferences and characteristics, we believe the project managers in our sample may be more cognitively versatile by being more prone to switching between different approaches than other project members. We confirmed this possibility in a post-hoc analysis and interviews.

Our study has important consequences for practitioners. We discuss and propose three main steps that project managers could take to ensure that cognitive switching is present and goes in the right direction and at the desired moment. These are: raising awareness and monitoring of decision making, identifying a need and implementing a cognitive switch, and evaluating and adjusting.

Raising awareness and monitoring of the decision making modes and external factors. The manager should nurture an awareness decision making mode. This goes for project managers and other project members. Such monitoring of cognitive "modes" and the external environment constitutes a stepping stone for any necessary adjustments. To foster such an attitude, firms could implement training programs to raise awareness about cognitive modes and external factors.

Identifying a need for a cognitive switch and implementing switching. Based on continuous monitoring of cognitive modes and external factors, the managers should be able to estimate the need to switch and even trigger such switching. This could be implemented through for instance using brainstorming and creative thinking (if a switch for the intuitive mode is needed) or activation of mindsets, such as consideration of alternatives or counterfactual thinking (if a more analytical approach is in place).

Evaluating and adjusting. The last recommendation for the managers would be to estimate the outcomes of the implemented switches (possibly also in experiment-like set-ups) and adjust the strategies accordingly to individuals, external factors, and other needs.

Our study suffers from several limitations. Although we expect that our findings would hold and extend to similar contexts that involve project work and managers and project members working side-by-side, the results cannot be generalized to other more hierarchical work contexts. To address this limitation, future research could replicate our study in organizational contexts where individuals work more independently, such as service firms and other contexts outside of project work. Here specifically, studying managers and non-managers with more pronounced differences in job descriptions could yield further insights into the switching behavior in other contexts.

While we expect that the context is a significant contingency for our findings, we cannot entirely rule out that cognitive differences in project managers and other project members may drive the results. Although we approximate and aggregate the measure of switches for all participants over time in the post-hoc analysis, we suggest that scholars further study switching behavior in a thorough, longitudinal way after controlling for stable preferences and intelligence with instruments and scales commonly used in studies on decision-making styles (Epstein et al., 1996; Sadler-Smith, 2004; Scott and Bruce, 1995).

In addition, the study's design could be changed to test the robustness of our findings. In particular, future research could provide more qualitative insights into decision making through the use of verbal protocols (Isenberg, 1986), task analysis, or repeated lab or field experiments.

Moreover, we were unable to repeat the same exercise more than once in each time period. Therefore, our proxy for the propensity to switch between the two approaches offers only partial insights into switching behaviors. The fact that we do not find any baseline difference in switching across project managers and other project members may also be due to the coarseness of our proxy. In particular, the lab setting of using the cognitive reflection test to capture the decision making approach introduces some limitations as it might not reflect the real state of decision making for all respondents.

Finally, future studies could use other variables as proxies for uncertainty and, possibly, manipulate them in conjunction with a focal task as we realize that our project-based proxies for uncertainty are coarse as well.

CRediT authorship contribution statement

Agnieszka Nowińska: Conceptualization, Data curation, Formal analysis, Methodology, Software, Validation, Writing – original draft, Writing – review & editing. **Torben Pedersen:** Writing – review & editing.

Data availability

The data that has been used is confidential.

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