Intuition in project management and missing links: Analyzing the predicing effects of environment and the mediating role of reflexivity

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Abstract

The role of an intuitive cognitive style in project planning may be more complex than prior studies have allowed for. Therefore, we used a model of the role of environment in intuition and the relationships between intuition, reflexivity, and project outcomes (measured as project success and speed of completion) in order to examine how environment influences intuition; and whether reflexivity mediates the link between intuition and project outcomes. Our field study incorporates responses from 450 managers representing 410 projects from firms located in the United Arab Emirates. The regression analysis suggests that competition uncertainty and environmental complexity are determinants of intuition; intuition promotes team reflexivity and this in turn enhances project outcomes. These results show that the intuitive approach in planning projects and team reflexivity are complementary foundations for improving different aspects of project performance and, therefore, that models of intuition in project management should incorporate the effects of reflexivity.

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1. Introduction

The past decade has seen an intense interest, conceptually and empirically, among researchers of the role of intuition in managerial practices (e.g., Elbanna et al., 2013; Hensman and Sadler-Smith, 2011). A problem over decision making and project management, which research has hitherto neglected, however, is that the impact of intuition on organizational outcomes such as project performance may be indirect. To date, much of the discourse on intuition within the management literature has highlighted the role of intuitive processes in project/decision outcomes, without offering much enlightenment on the mechanics of the indirect effects of intuition (e.g., Khatri and Ng, 2000).

In contrast to past research, this study did not view intuition as an antecedent of project performance but as a variable of considerable impact on other determinants of project performance. A major aim of this study, therefore, was to improve our understanding of the role of intuition by developing our analysis of intuition so that we are able to identify a mediator of its influence, team reflexivity (or the extent to which project teams reflect upon and modify their functioning). In a project context, reflexivity helps to modify an agreed project plan in order to properly implement it. Hence, reflexivity can be seen as a functional project process in that it interacts with other...
decision approaches such as intuition to enhance project performance. In other words, this paper argues that project performance is affected not by intuition itself but by the way that intuition affects other project processes.

We posit that our new view of the roles of intuition and reflexivity are theoretically viable and can provide empirical evidence to support our hypotheses. However, there have been few, if any, studies that have examined the relationship between intuition and reflexivity in the context of project management. Reflexivity presents teams with clarity, agreement, and a specific challenge about the need for adaptation, making it more likely that targeted outcomes will result. Although research interest in reflexivity is increasing in such fields as health management (Schippers et al., forthcoming), information technology (Misuraca et al., 2013), human resources (Pietersea et al., 2011), other fields such as project management are still lagging behind.

This paper makes another contribution to the literature: a small but growing body of research suggests that team reflexivity may be an important process in enhancing project outcomes (Schippers et al., 2013). However, one organizational outcome dominates the writings of researchers who investigate reflexivity, namely, innovation (e.g., Schippers et al., forthcoming; West, 2002). This being the case, this limitation was remedied by focusing on other important aspects of project performance, namely, project success and speed of completion, which are less researched areas in the literature on project management.

In terms of the study setting, previous studies have found that the particular country of the research setting affects the role of environment (Elbanna et al., 2015). Similarly, Ochieng et al. (2013) argue that different cultural norms and assumptions about the project environment can affect the way project teams communicate and behave. For example, increasing numbers of empirical studies in different countries located in the troubled Middle East, such as Egypt (Elbanna and Child, 2007) and Turkey (Dayan et al., 2012), report a lack of the moderating impact of environment in the planning–outcome linkage. Given that research on environmental variables has shown that perceived environmental uncertainty may operate as an antecedent to the strategy process rather than moderating its influence on organizational outcomes (Boyd and Fulk, 1996), this study contributes to a different analysis of the role of environment in project management by examining environmental features as antecedents of project planning rather than moderators (e.g., Meissner and Wulf, 2014).

In conclusion, the aim of the present study was to examine the impact of environmental characteristics on the level of intuition, the role that intuition plays in reflexivity, and the ways in which these two phenomena relate to project performance. The specific research questions that we addressed were: (1) what are the relationships between environmental features and intuition; (2) what is the relationship between intuition and reflexivity; (3) what is the impact of reflexivity on project performance; (4) what is the role of reflexivity in the relationship between intuition and project performance? These questions are represented diagrammatically in Fig. 1. In view of the new relationships that are examined in this study, its exploratory nature should be taken into consideration.

Answering these questions is significant both for researchers and practitioners because it has the potential to shed light upon the ways in which project teams use intuition and reflexive behaviors. This can contribute to renew the theoretical bases of project management as per recent calls for extending project management research, such as that of Floricel et al. (2014). A contribution of this study lies in its demonstration of the importance of environment for the use of intuition. Moreover, by identifying team reflexivity as a mediator of the relationships between intuition and project outcomes, we both substantiate the theories of project management and point to a mediator variable that offers clear opportunities for project management. This also contributes more generally in explaining some of the surprising results of related research on intuition; it improves our evolving comprehension of its role in management in general and of project management in particular.

2. Theory and hypotheses

As depicted in Fig. 1, the study model investigates the relationship between environmental characteristics (measured as competition uncertainty, macro-economic uncertainty and

![Fig. 1. Research model.](image-url)
environmental complexity) and intuition, and tests for the mediating effect of reflexivity on intuition—outcomes relationships. Before presenting the research hypotheses, the central constructs in the model are discussed, namely, intuition and reflexivity.

2.1. Conceptualization of the central constructs

2.1.1. Intuition

Dane and Pratt (2007: 40) define intuition as “affectively-charged judgments that arise through rapid, non-conscious, and holistic associations”. Elbanna et al. (2013: 150) regard intuition as “a mental process based on a ‘gut feeling’ as opposed to explicit, systematic analysis, which yields an intuitive insight or judgment that is used as a basis for decision making”. At the beginning of this century, researchers embarked on a more scientific type of intuition research based on theoretical and empirical work (Akinci and Sadler-Smith, 2012). Though it is clear now that managers do not focus entirely on rational approaches (Floricel et al., 2014), the softer sides of the human intelligence, and specifically, the role of intuition in managerial actions still provide more questions than answers (Leybourne and Sadler-Smith, 2006).

Moreover, in the context of project management, little theorization and empirical evidence have been available for the antecedents of intuition and the different underlying mechanisms by which intuition affects project outcomes. Sonenshein (2007), for example, argues that the determinants of intuition are not yet well understood. This view assumes that the context in which projects take place has a marked impact on intuition and yet has been little researched. The antecedents of intuition examined in this study are limited to features of the external environment. As argued by Hough and White (2003), any examination of strategic issues that fails to consider environmental factors is likely to provide an incomplete picture. Moreover, the intervention by intuition in other processes is poorly understood by managers and academic researchers alike. Therefore, research investigating the effect of intuition on other project processes such as reflexivity could be helpful in this respect, as noted earlier and discussed in the next section.

2.1.2. Reflexivity

Members of project teams face obstacles as they try to coordinate efforts, strengthen interpersonal relationships, and integrate ideas and hence they need considerable management to identify frustrations and develop and implement solutions (Tjosvold et al., 2004). West (1996: 559) has labeled this group management ‘team reflexivity’ and defined it as “the extent to which team members collectively reflect upon the team’s objectives, strategies and processes as well as their wider organizations and environments, and adapt them accordingly”. As discussed by West (2002), reflexivity has three central elements, namely, reflection, planning, and adaptation, which are shown in Fig. 2. Reflection consists of attention to objects or tasks and the monitoring and evaluation of them. Planning is a potential consequence of the indeterminacy of reflection, since during this indeterminacy, courses of action can be considered, intentions formed, and plans developed. High reflexivity allows detailed planning which considers potential problems, and long- as well as short-range planning. Finally, adaptation refers to actions taken to achieve the desired changes in team objectives, strategies, and processes which are identified by the project team. The reflexivity process is interactive.

Reflexivity emphasizes that reflecting on plans allows them to be adapted and thus is an important foundation for high performance in complex tasks such as important projects (Gurtner et al., 2007). Reflexivity helps those involved to take a step back to evaluate a project’s process, plans, and objectives (Pietersea et al., 2011). Reflexive groups discuss as much as possible how they are doing and whether they are taking the best approach to the task, what causes mistakes to occur, and how they can do better (Pietersea et al., 2011). It has been argued that reflexivity is instrumental in discussing team processes which help team members to better understand their tasks and share a fuller understanding of project strategies and goals; hence, it positively affects group processes (van Ginkel et al., 2009) performance (Gurtner et al., 2007) and innovation (Tjosvold et al., 2004). For example, highly reflective BBC TV teams were performing better than low reflective ones (Carter and West, 1998).

2.2. Research hypotheses

2.2.1. Environment and intuition

Discovering what key factors influence project intuition is important for teams and organizations. Environmental features may be among such key factors since projects are made in the context of an organization’s environment and the process by which decisions are made during the planning of these projects is affected by environmental attributes (Martinsuo et al., 2014; Ochieng et al., 2013). Here, we seek to extend research on the role of the environment in project management by examining the role of two of the most salient factors involved, namely, environmental uncertainty and complexity (McArthur and Nystrom, 1991). The selected features of environmental uncertainty in this study represent two levels of uncertainty, namely, industry level (competition uncertainty) and societal/nation level (macro-economic uncertainty) (Miller, 1993) which can help to better understand the impact of
environmental uncertainty on the use of intuition in project planning.

Environmental features have major implications for all aspects of management (Goll and Rasheed, 1997) including project management (Ochieng et al., 2013). Papadakis et al. (1998), for example, argue that environment may diminish the options available for managers when deciding on strategic issues. The contingency theory in strategic management proposes that the dimensions of project process (e.g. intuition) should vary according to the environmental features (Goll and Rasheed, 1997). In the same vein, Shrivastava and Grant (1985) find that differences in environmental conditions result in variations in the way in which managers process strategic issues.

For example, we can argue that firms which are subject to high levels of environmental uncertainty may not have the time available to engage in rational processes because of the need to respond rapidly to competitors’ actions. Moreover, the use of intuition by project teams may be necessary in situations when environmental uncertainty is related to factors which cannot be known, such as the rates of interest and inflation over the coming years (Daft and Lengel, 1986). Similarly, according to contingency theory, in an unstable environment, incremental processes such as intuition should be adopted (Fredrickson, 1988). Sonenshein (2007) because unstable or high-velocity environments are characterized by information scarcity at the same time as rapid change, which may oblige project teams to act quickly on the amount of information currently available (Papadakis et al., 1998). Sonenshein (2007), for example, argues that conditions of uncertainty will increase the reliance on intuition. Thus, it is expected that perceived environmental uncertainty directly determines the level of intuition in project planning.

Most theorists have identified complexity as one of the important features of the environment (Cannon & St. John, 2007). As argued by Ochieng et al. (2013), complexity is the prime focus in today’s project management literature. Environmental complexity describes the degree of heterogeneity, the dispersion of an organization’s activities and also the number of factors that need to be considered (Child, 1972). It reflects decision makers’ perceptions regarding the factors which should be kept in mind before deciding, and their interconnectedness (Smart and Vertinsky, 1984). Complex environments demand greater information processing and may lead to cognitive simplifications; they restrict the examination of available alternatives and options (Goll and Rasheed, 1997) leading to a higher level of intuitive cognitive style. Mintzberg (1973), for example, suggests that executives in firms facing complex and rapidly changing environments do not engage in an intensive planning process because such environments are impossible to predict and hence it is futile to invest in such intensive processes. Instead, in such environments, a project team prefers incremental approaches such as intuition (Mintzberg, 1973). Similarly, it has been argued that environmental complexity directly influences the amount and nature of information that has to be processed (Papadakis et al., 1998) and may lead to greater use of cognitive simplification processes (Schwenk, 1988).

At the individual level, threat fueled by environmental uncertainty and complexity causes stress and anxiety, which in turn lowers the capacity for information processing (Bantel and Osborn, 2001). Under such demanding pressures, individuals may stick to learned behaviors or experiences and knowledge which use intuitive processes. Formally, these are as follows.

**Hypothesis 1a.** Competition uncertainty relates positively to the use of intuition in planning projects.

**Hypothesis 1b.** Macro-economic uncertainty relates positively to the use of intuition in planning projects.

**Hypothesis 1c.** Environmental complexity relates positively to the use of intuition in planning projects.

### 2.2.2. Intuition and team reflexivity

Reflexivity may vary widely across teams in organizations because it is affected by such contextual variables like team leadership (Pietersea et al., 2011). Developing the confidence and abilities to reflect successfully can be very challenging. Strong relationships that foster a capacity to solve problems would appear to be needed for groups to reflect on their experience and change. This article argues that teams with higher levels of intuition provide an important foundation for reflexivity by fostering the teams’ capacity to reflex. Empirical evidence shows that experienced project managers improvise more than do those with less experience (Leybourne, 2002). Leybourne and Sadler-Smith (2006) argue that reflexivity is associated with the extent to which team members trust their initial feelings, rely upon ‘gut feeling’ and have faith in their initial impressions.

Similarly, the use of intuition may reveal a high level of confidence (Leybourne and Sadler-Smith, 2006) which further enhances the use of reflexivity. For example, if reflexivity is viewed as discussing objectives, strategies, and processes, one would expect it to be related to the extent to which individuals draw upon intuition. Hence, we argue that intuition can help teams engage in productive task reflexivity. In sum, team intuition may enhance members’ confidence and ability to reflect upon their team processes and therefore a link between intuition and a tendency to reflect is proposed by advancing the following hypothesis.

**Hypothesis 2.** The use of intuition in planning projects relates positively to team reflexivity.

### 2.2.3. Task reflexivity and project outcomes

In an era where management was seen as the science of planned and pre-conceived action, based on rationality and systematic forecasting, some tension was been caused by the above view. Similarly, the traditional project paradigm (as in many other areas of management practice) has been one of ‘plan-then execute’, but project management practitioners are aware that in modern, turbulent business environments, the plan often ceases to be effective at precisely the time when one tries to execute it (Tjosvold et al., 2004). One main purpose of this study was, then, to test whether reflexivity would lead to a higher project performance, and if so, how.

Reflexivity is expected to help project teams to know their actual workings and develop new understandings and methods
which respond to the emerging conditions and challenges (Carter and West, 1998). It can help also to reduce the barriers to effective cooperation among team members and is expected then to weaken the forces that impede team performance on a wide range of outcomes (Tjosvold et al., 2003). Reflexive teams will also reflect critically on ideas and choose to implement those which seem more promising (Schippers et al., forthcoming). A variety of studies have demonstrated links between reflexivity and team effectiveness (Carter and West, 1998; West et al., 1999). Tjosvold et al. (2004), for example, indicate that reflexivity can keep project teams focused and efficient and thus may be expected in turn to promote high levels of task accomplishments. Task reflexivity is especially useful in complex environments and challenging tasks such as carrying out important projects. Widmer et al. (2009) suggest that reflexivity in teams can be fostered in order to improve project outcomes. In conclusion, reflexivity in this study is recognized as a means by which project teams contribute to the performance of projects in organizations.

Another reason for the positive effect that reflexivity may have on project performance lies in the observation that teams often plan early on in the working process and therefore the discussion of plans should be repeated after the team has acquired some experience with the project (Hackman and Wageman, 2005). In sum, as discussed above and reported by a recent review, previous research supports the link between team reflexivity and different types of organizational outcomes (Widmer et al., 2009). We, therefore, posit:

**Hypothesis 3.** Team reflexivity relates positively to (a) project success and (b) the speed of project completion.

### 2.2.4. Mediating role of team reflexivity

Examining the direct effects of cognitive styles on decision/project outcomes neglects the mediating role of the actual decision/project processes and, hence, researchers should include measures for actual decision-making and project processes (Shepherd and Rudd, 2014). This means that the impact of a team’s cognitive style (here, the intuitive cognitive style) on project performance may not be direct but mediated by other variables which should be scrutinized in order to fully understand the relationships between intuitive cognitive style and project performance. The examination of such intervention is important, since it helps us to identify and explicate the mechanism or process behind the relationship between intuition and project performance via the inclusion of the proposed mediator, reflexivity.

Research in project management argues that intuition may inhibit, as well as invite, project processes such as improvisation (Leybourne and Sadler-Smith, 2006). Thus, to further develop our conceptual analysis we focused on identifying a relevant mediator (here, reflexivity, as discussed above) of the effects of intuition. The additional benefit of our focus on reflexivity as a mediating factor is that it helps to identify opportunities for managerial intervention which increases the relevance of this research, when applied (Pietersea et al., 2011).

Previous research shows the relevance of reflexivity and its potential added value to study the links between project process and performance. In addition to the argument that team reflexivity is particularly instrumental in affecting project performance, a small but increasing number of studies is examining the mediating role of reflexivity in management practices (e.g., Wong et al., 2007). For example, Gray (2007) argues that reflexivity is seen as one process that mediates the links between actions and outcomes. It can be seen as a transition process (Marks et al., 2001) referring to actions that teams execute after planning and between performance episodes. These have a dual focus, namely, reflecting on and interpreting what has been accomplished and then planning for future actions (LePine et al., 2008). For example, if project teams have difficulties in implementing their projects, rethinking and revising the strategies early adopted, profiting from already acquired experience, can help them remedy these shortcomings in order to foster performance (Gurtner et al., 2007).

Moreover, intuition encourages organizational learning (Hensman and Sadler-Smith, 2011) and therefore enhances the ability of teams to reflect. Another explanation for this view is that intuition manifests itself as tacit knowledge drawn upon unconsciously (Leybourne and Sadler-Smith, 2006) which can help managers to be more reflexive than if they were following the rigid procedures of rational analysis. Hence, we argue that intuition would be likely to lead to higher project performance through its impact on project reflexivity. This probability seems particularly suited in overcoming the issues that we identified as a root cause of the failure of related research to consider the effects of intuition, such as that of Elbanna and Child (2007). In summary, the above arguments suggest that intuition exerts a positive effect on project outcomes if and because it increases project reflexivity. Formally, it is as follows.

**Hypothesis 4.** Team reflexivity mediates the relationship between team intuition and (a) project success and (b) the speed of project completion.

### 3. Methodology

The projects to be investigated were selected according to four criteria: (1) to minimize memory error, the project had to be implemented during the last two years; (2) the respondent had to be fully familiar with the chosen project and closely involved in it; (3) the project had to deal with issues of substantial importance to the firm, to have had a long-term impact and to be able to affect the firm as a whole; and (4) the project outcomes were known at the time when the data were collected.

#### 3.1. Questionnaire design

Our hypotheses were tested using a structured survey method. The first section was devoted to the selection of a recent project and to general information about firms and respondents. The subsequent sections dealt with the study variables. The questionnaire was developed in three stages. First, a draft questionnaire was developed in English, since English is the first language of business community in the United Arab Emirates (UAE) private sector. The draft questionnaire was next reviewed by five
academics. Third, a modified version of it was administered to two professionals to elicit feedback on the intelligibility of the questionnaire and its relevance to the UAE private sector context, leading to some amendments.

3.2. Data sources and date collection

The questionnaire was collected from firms located in the UAE’s three biggest cities, namely, Dubai, Abu Dhabi and Sharjah. The sampling population consisted of 500 private firms employing fewer than 500 employees. Of the targeted sample, 410 firms responded (82% response rate). Multiple respondents from 40 firms were sought, to allow the evaluation of inter-rater reliability (Elbanna, 2009).

The average age of the sampled firms was 16 years; most of them are foreign firms (78%); the remaining firms being either local (15%) or joint venture (7%). The average number of employees in the firms sampled is 120. Most of the employees in the sampled firms were expatriates (93%) and the percentage of Emirati employees was very low (7%). The above results show the importance of expatriate employees in the UAE economy. 42% of the firms belonged to manufacturing industries and 58% belonged to service industries. Because the industries represented in the sample vary, e.g., manufacturing, IT, import and export, general trading, finance, construction and marketing, the projects examined varied widely. The database for our analyses consisted of 410 projects, e.g., introducing a new product, opening a new branch, constructing a new compound, extending a store warehouse, adding new production facilities, launching a new business, installing new production systems, entering a new market, restructurings, and installing new IT systems.

Data were collected in the period from April to September 2013. Respondents were contacted for appointments to collect data and their participation was strictly voluntary. Respondents were provided with examples of important projects as a guide in choosing a project for the study. Data were gathered using a fully standardized questionnaire (five-point Likert scale). 92% of the respondents were male and 8% were female. Respondents were CEOs, general managers, presidents (27%), division or departmental managers (64%), and branch, project, or area managers (7%); the remaining 2% did not give this information. The average age of respondents was 42 years. 4% of them had high school qualifications, 68% had university degrees, and 28% of respondents had graduate degrees, Masters and above.

3.3. Measures

Because projects vary in terms of their size, uniqueness and complexity (Mir and Fimington, 2014), the processes and outcomes of projects within the same firm are expected to differ from one project to another (Müller and Turner, 2007), and therefore this study uses the project as its unit of analysis and assesses all measures at the project level. All the questions in the questionnaire represent scales from papers published in top management journals. Appendix 1 has all the items for the scales used in this study. Each construct was measured using multiple items on a five-point scale, except for team size (number of people) and industry type (a dummy variable to show manufacturing or service). Project success was measured across four dimensions, as follows: achieving project objectives; solving its main problem, stakeholders’ satisfaction, and its impact on firm performance (Lipovetsky et al., 1997; Rodrigues and Hickson, 1995). The speed of project completion was measured by using three-item scales adopted from related research (Dayan and Elbanna, 2011; Lynn et al., 2000). Intuition was measured by using five-item scales, following Scott and Bruce (1995). Conducting a factor analysis led to removing one item from the scale because of poor psychometric properties (the participants in planning this project relied upon their instincts). To measure reflexivity, the four measurement scales of Hoegl and Parboteeah (2006) were used. To measure environmental uncertainty, four-item scales of both competition and macro-economic uncertainties were adopted from Miller (1993).

We controlled for the effect of three variables, namely, team size, industry type and the level of agreement with the project. Team size was used as a control variable because the project management literature revealed that project process and outcomes are influenced by the size of the team (Akgün et al., 2007). Because the relationship between project process and performance may also vary across industries, industry type was added as a control variable to lessen the ambiguity of the results (Dayan and Elbanna, 2011). Finally, the answers of respondents may be affected by the degree to which they agreed with the project during its planning. For example, respondents who did not agree with a project may tend to devalue its outcomes. Hence, a question was added to assess the level of agreement with the examined projects (Elbanna et al., 2013).

3.4. Non-response bias, common method bias, and recalling information bias

The data on 90% of the examined projects in this study were collected from single respondents, which may lead to different types of bias such as incomplete recall and retrospective rationalization. We attempted to reduce this limitation before and after data collection. Before data collection, we (1) assured respondents of complete anonymity and confidentiality; (2) reversed scale anchors in several places; (3) used objective data to measure team size and industry type; (4) organized the survey so that the independent variables were separate from the dependent variables, thus preventing respondents from developing their own theories about possible cause–effect relationships; (5) examined complex relationships (mediation effects) which survey respondents were unable to guess; and (6) examined recent projects only.

After data collection, several tests were used to examine the possibility of bias. First, we analyzed both responses in the 40 firms where we collected data from a second respondent and found that our data enjoy a strong level of inter-rater reliability, where 38 out of the 40 cases with two informants demonstrated significant correlations at the 1 percent level or better and the remaining two cases show significant correlations at the
5 percent level with an average of correlation coefficients in the 40 cases of 0.61 (correlation coefficients range from 0.26 to 0.87). Second, Harman’s single-factor test of common method bias was performed using exploratory factor analysis. The results of the factor analysis show that the first factor explained only 14% of the variance in the data, which is well below the cut-off point of 30%. Hence, a very little common method variance can be shown (Podsakoff et al., 2003). Third, confirmatory factor analysis was applied to Harman’s single-factor model to further assess common method bias (Sanchez and Brock, 1996). The model fit indices of $\chi^2 (65) = 1.234$, NFI = 0.39, IFI = 0.40, CFI = 0.40, RMSEA = 0.21 and SRMR = 0.15 were unacceptable and significantly worse than those of the measurement model. This suggests that a single factor model is not acceptable; thus, any potential common method bias is small (Zhao et al., 2011). Given the above results, we can safely believe that the relationships observed in this study represent substantive rather than artificial effects.

3.5. Internal consistency and validity

The coefficients of both Cronbach $\alpha$ and composite reliability ranged between 0.71 and 0.86, which shows a satisfactory degree of internal consistency for all the study variables. Table 1 shows the correlation among all 10 variables. The relatively low to moderate correlations between similar constructs provided evidence of discriminant validity, with the highest correlation between independent variables being 0.29, between dependent variables being 0.37, and between independent and dependent variables being 0.58 (Hair et al., 2009). As discussed above, conducting factor analysis led to removing one item from the intuition scale. The results of exploratory factor analysis using a principal component with a Varimax rotation and an eigenvalue of one for the remaining items show a pattern of loadings consistent with our theoretical expectations. Each scale demonstrated unidimensionality, with only minimal cross-loading and no item cross-loaded significantly on an alternative scale. Moreover, producing a factor analysis for each set of the items making up one construct confirms the unidimensionality for each construct.

Following the procedures of Hu and Bentler (1999), a subsequent confirmatory factor analysis was conducted using the AMOS 18 software and the Maximum Likelihood parameter estimation method to assess the resulting scales by using the Comparative Fit Index (CFI) and the Tucker–Lewis Index (TLI) as indicators of incremental fit, and the Root Mean Squared Error of Approximation (RMSEA) and the Standardized Root Mean Squared Residual (SRMR) as indicators of absolute fit. The measurement model produced a good fit with CFI of 0.95; TLI of 0.92; RMSEA of 0.07; and a SRMR of 0.04. Other fit indices such as $\chi^2 = 145.37$ with degrees of freedom (df) = 50, $p < .01$, $\chi^2$/df = 2.91 are also acceptable, and all parameter estimates were significant at the 0.001 level (Hair et al., 2009). Moreover, all item measures had standardized factor loadings (SFLs) of more than 0.60 (ranging between 0.61 and 0.95) which well exceeded the recommended threshold of 0.50 (Hair et al., 2009). The above results show that the measurement model is acceptable and indicate acceptable unidimensionality.

4. Analysis and results

Table 1 summarizes the means, standard deviations, and correlations among the research variables at the project level. To test the hypothesized relationships, we performed hierarchical regression analysis and ran six regression models (see Table 2).

The results show no issues of multicollinearity, since the highest correlation among the central variables of the study, as shown in Table 1, is well below 0.80 (i.e., 0.29) and the variance
inflation factor (VIF) analysis is well below 10 (i.e., all VIFs were below 1.30). Hypothesis 1a, Hypothesis 1b and Hypothesis 1c posit that environmental characteristics act as antecedents to the intuitive cognitive style of planning. The findings of Model 1, where we regress intuition on the three control variables and the three environmental features, explain 10% (p < 0.001) of the variance in intuition. In Model 1, both competition uncertainty (β = 0.16, p < 0.01) and environmental complexity (β = 0.19, p < 0.001) positively relate to intuition; while macro-economic uncertainty does not (β = −0.04, N.S.). These results support Hypotheses 1a and 1c only and thus provide partial support for the first hypothesis.

The impact of intuition on team reflexivity was tested in Model 2 where reflexivity was regressed on the six control and environmental variables in addition to the predictor, intuition. The variables incorporated in Model 2 explain 16% (p < 0.001) of the variance in intuition and reflexivity positively relates to reflexivity (β = 0.28, p < 0.001), which fully supports the second hypothesis.

Hypothesis 3 proposes that team reflexivity relates positively to (a) project success and (b) the speed of project completion. The results show that reflexivity is a significant predictor of both project success (β = 0.56, p < 0.001; Model 5) and speed of completion (β = 0.30, p < .001; Model 6) and hence the third condition of a mediating effect is achieved. However, when the mediating variable (reflexivity) is included in the regression analysis, intuition is no longer a significant predictor of project success (β = 0.08, NS; Model 5; full mediation); while its explanatory value of speed of completion is decreased (β = 0.14, p < .01; Model 6) compared to its explanatory value in Model 4 (β = 0.22, p < .001; partial mediation). In conclusion, the above results show both full and partial mediation effects of reflexivity on the relationship between intuition and decision outcomes and hence, the last hypothesis is supported.

4.1. Additional analysis

Do environmental features interact with intuition as joint determinants of project performance? To answer this question, six hierarchical moderated regression models were generated. The procedures of this analysis for each model are in two steps. The first step was to enter the main effects of intuition, reflexivity and the control and moderating factors as one block. This step represents the base model. The second step involved three further models that each entered an interaction term, which were calculated as the product of intuition and a moderating variable. This analysis was conducted twice, one for each project outcome,
namely, project success and speed of completion. Out of the six regression models, there was only one significant relationship where the interaction between macro-economic uncertainty and intuition significantly contributed to the base model of project success ($\Delta R^2 = 0.02, p < .001$). Following Sharma et al. (1981), these results confirm the hypotheses that the three environmental features in this study are antecedents of project intuition, with one exception only. This is that macro-economic uncertainty is a pure moderator of the relationship between intuition and project success (Sharma et al., 1981).

5. Discussion

5.1. Theoretical implications

As organizations get involved in more and more projects and teams are more often used as their basic units to work on these projects, the study of what affects team functioning and performance, as done in this study, is gaining in importance (Pieters et al., 2011). In this spirit, our theoretical framework was developed around an integration of research in decision making styles and project processes in order to explore the role of intuition as a cognitive style of project planning which is affected by environmental characteristics and enhanced by reflexivity. A strength of the current study is the fact that we used field data including a large number of projects (410 projects) and check them for the inter rater reliability of 40 projects. Results driven from the analyses of these projects support the study’s overall model of the antecedents and consequences of intuition and reflexivity. They show that both competition uncertainty and environmental complexity are essential determinants of intuition; intuition is an important predictor of team reflexivity; reflexivity relates positively to project performance (success and speed of completion); the role of reflexivity in the relationship between intuition and project performance is important for team functioning.

Given that few empirical studies can be found on the role of environment in the use of intuition during project planning and that those available in related fields such as decision making seem to have produced contradictory results (Shepherd and Rudd, 2014), our conceptualization of environmental features as determinants of the level of intuition can contribute to future theorization on the role of environment in project planning. An unexpected outcome from this study was the lack of any statistically significant relationship between macro-economic uncertainty and intuition, which shows that environmental features may influence project processes differently and hence provides extra support to our use of environment as a multi-dimensional construct which is necessary before coming to any conclusions (Miller, 1993).

These results suggest that deficits in the way in which environment is conceptualized and used within the decision or project process–performance relationship can contribute to explain the mixed results found in previous research (Forbes, 2007). For example, Meissner and Wulf (2014) suggest that there is a need to rethink the role of environment in the decision process. They proposed conceptualizing environmental features such instability perceived by managers as a predictor of decision process rather than as a moderator of the relationship. Moreover, environmental features have been conceptualized and measured in previous studies on the basis of a multitude of different constructs which may have biased results and makes comparisons between studies difficult (Forbes, 2007). At the same time, the types of environmental features used, such as uncertainty, and their variant impacts have received little attention (Elbanna et al., 2014). Considering these factors, however, may play a crucial role in overcoming the divergent results in the field.

The findings reported in the previous section justify our call for reflexivity as a necessary step towards advancing the understanding of the impact of intuition within projects. The results demonstrate that intuition does indeed play a role in team functioning, i.e., reflexivity, and consequently in project performance. Perhaps intuition, informed by the use of gut feeling, sense and judgment, which are built up over time, encourages reflexivity, which lessens the impact of unrealistic goals, and irrelevant strategies. The fact that intuition was unrelated to project success when reflexivity was incorporated in the research model, tentatively suggests that reflexivity may be a more important influence on project performance than intuition per se. Clearly, future replications and extensions are needed to bolster this conclusion.

Our results also show the necessity to consider the multi-dimensionality of project performance. This can be enhanced further by examining the trade-offs which project teams may need to make between competing outcomes in addition to addressing less examined outcomes such as project propitiousness, project disturbance, project effectiveness, implementation success and learning (e.g., Dean and Sharfman, 1996; Elbanna et al., 2013; Rodrigues and Hickson, 1995).

5.2. Limitations

This study has certain limitations, which pave the way for new lines of research. First, the three key deliverables of a project are time, cost and scope (Leybourne and Sadler-Smith, 2006). The operationalization of project performance, in this study, addresses two out of these three dimensions, namely, time (speed of completion) and scope/what is to be delivered (project success). However, the third, cost has not been examined, a limitation which future research needs to consider. Second, given that intuition and reflexivity may vary across different types of project as well as sector, future research may focus upon a specific sector, e.g., the construction sector (e.g., Ling et al., 2009), or project type, e.g., new product development (e.g., Dayan and Elbanna, 2011), to control for their effects. Third, while an obvious strength of this study is its big sample size, it should be recognized that only experimental studies speak to the causality implied in our research model, and therefore, future research could use field-experimental research designs to establish the relationships examined in this study (Schippers et al., forthcoming).

An important limitation of this study and related ones is the lack of a theoretically compelling and empirically sound scheme for operationalizing environmental complexity (Cannon & St.
John, 2007) and hence researchers should consider specifying a multidimensional measure of environmental complexity which reflects its different sources (see the measure developed by Cannon & St. John, 2007). For example, as stated by Ochieng (2008), project complexity can be examined at three levels, namely, inside the project, outside the project, and in the environment outside the project.

Fifth, while the results show evidence for the impact of team reflexivity, we do not know about the content of this process. That is, we do not know if and how often reflexive sessions took place during the project implementation, what was discussed when the teams reflected, and how these discussions led to better project outcomes (Schippers et al., forthcoming). While such evidence is not a prerequisite for testing our hypotheses, such information would be helpful in further developing the understanding of the role of reflexivity in project management and it may also point to possible contingencies of reflexivity in relation to project outcomes (Schippers et al., forthcoming).

5.3. Future research

Evolving research is needed to explain and contextualize intuition and reflexivity in project management. There is a pressing need for considering other antecedents of intuition such as these of human factors, e.g., personal skills, experience, trust and team empowerment. Moreover, the important role which diversity plays in group functioning (Pieterse et al., 2011) demonstrates the need to examine the impact of different types of diversity on team intuition, for example, demographic and functional diversity. The link between the level of confidence and the use of intuition may be another avenue for future research (e.g., Leybourne and Sadler-Smith, 2006). Similarly, researchers in project management can extend their knowledge of reflexivity by examining other predictors such as trust, psychological safety, a shared vision, diversity and leadership style, as well as other consequences such as innovation (see a review on reflexivity research by Widmer et al., 2009).

It would be valuable if further research empirically explored the impact of other mediating factors in the link between intuition and project performance, not only because it would provide further validation for the current analysis, but also because it would more firmly open the door to an integration of research on intuition and decision/cognitive styles, on the one hand, and research on project processes, on the other. For example, research investigating the effect of intuition on less examined project processes such as improvisation could be helpful in this respect.

Some research has suggested that the moderating roles of contingencies, such as teams’ prior performance and learning, should be considered when examining the reflexivity–performance relationship because reflexivity is an energy-consuming activity (Schippers et al., 2013). This is another important avenue for future research which can help to illuminate the situations under which reflexivity is cost-effective.

This study has attempted to capture environmental influences on project intuition in terms of environmental attributes, uncertainty and complexity. Future research needs to extend the scope of this study so as to incorporate either other environmental features such as hostility or the role of external parties, such as governmental agencies and customers (Dean and Sharifman, 1993). Given related research (Dayan et al., 2012; McArthur and Nystrom, 1991; Sharma et al., 1981), contingency theories should seek to simultaneously examine both key interactions between environmental features and managerial processes and/or cognitive styles and also the direct impact of environment, rather than continuing the past practice of examining one type of relationship only, either a moderating or a direct impact. This is another research implication that concerns the future development of contingency theories.

5.4. Practical implications

In addition to developing theoretical understanding, the support for our hypotheses may have important practical implications for managing projects and improving their outcomes. The findings show that intuition is affected by environmental features, drives project teams to reflect and has an effect on project outcomes which is mediated by the level of reflexivity.

This allows us to claim that intuition and reflexivity themselves require considerable skill and sensitivity from the project team. Reflexivity, however, is not a process that comes naturally to many managers and may have to be learned or facilitated, either in a formal classroom context or through learning processes such as coaching, mentoring and action learning in addition to the use of tools such as reflective metaphors, critical incident analysis, reflective journals and concept mapping (for more details on these tools and processes see, Gray, 2007). Similarly, project teams need to recognize intuition as a legitimate mental function that is particularly useful for some situations (Elbanna et al., 2013) and not something requiring post hoc rationalization or secrecy (Reynolds, 2006).

Moreover, intuition and reflexivity measures can be given to project teams in order to identify barriers to successful project outcomes. Training, in particular for teams rated low on intuition and reflexivity, can be provided to develop members’ intuition and reflexivity capabilities (Okhuysen and Eisenhardt, 2002). This can help to bring such concepts ‘out of the closet’, for once understood they can be more effectively practiced (Leybourne and Sadler-Smith, 2006). Gurtner et al. (2007), for instance, show that general training can encourage teams to reflect on what they have done so far, and how they could improve their strategies in the future, which has clear effects on team performance. This is important, because guided reflection is a method that can be applied fairly easily by many different teams in many different situations and does not require extended task-analysis and specific training procedures. Similarly, intuition can form part of the management training and education curriculum (Elbanna et al., 2013). For example, team members need to recognize how the interaction between intuition and team reflexivity can counteract the negative effects of formal planning in project management and highlight the fact that reflexivity may explain the missing role of intuition in related research on decision/project outcomes (e.g., Elbanna and Child, 2007).
6. Conclusion

Recent research has shown the important role of team intuition in project management (Baldacchino, 2013; Elbanna et al., 2015; Leybourne and Sadler-Smith, 2006). The present study extends and develops this emerging research by using a model of environmental uncertainty and complexity, project managers’ intuitive decision making, the use of reflexivity and project performance in order to examine the impact of environment on the use of intuition, how intuition relates to reflexivity and how intuition and reflexivity are linked to project outcomes. The analysis has shown that both competition uncertainty and environmental complexity are related to the use of intuition, the relation between team intuition and team reflexivity is important for team functioning and that conscious reflection on team functioning is a necessary step towards understanding the impact of intuition within strategic projects. Moreover, reflexivity being especially needed and helpful to detect and improve strategies, implement them and improve project performance.

Our theory and results have important implications for the role of environment in project management. Although prior research has examined implications of environmental conditions for project management and strategy development, little theorizing and empirical research has examined how environment can influence the project or strategy process (Elbanna et al., 2014). Our results indicate that there is a need to rethink the role of environment in the project process by using it as an antecedent of this process which can contribute to explain the mixed results found in previous research (Forbes, 2007; Meissner and Wulf, 2014).

Our use of reflexivity as a means to understand the effects of intuition in project performance can contribute to further develop management theory and open up promising future research opportunities. In particular, such approach can help to renew the theoretical bases of project management in order to focus on what happens in project management, turn away from the problems that stem from the application of methods based on decision-rationality models, and understand the alternative “rationalities” involved in project management (Floricel et al., 2014). For example, intuition represents a distinctive aspect of the processing of information which in turn influences managerial actions such as reflexivity rather than directly affects project outcomes. By showing that the effects of intuition on project performance are contingent upon team reflexivity, our study develops and extends team intuition theorization and we, hence, encourage project teams to reflect on their project plans. Of course, these results are exploratory, and they should be treated with caution until they are replicated.

Finally, we hope this study among others in the future will result in reflexivity becoming more widely accepted as a managerial capability which can assist in different aspects of management such as business planning, project management and strategic decision-making. This movement can also contribute to solving the long-standing dilemma of the functionality of intuitive approaches, and show how they can contribute to organizational outcomes.

Conflict of interest

None.

Appendix 1. Measurement scales.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project success</td>
<td>1. Our firm was successful in achieving the original objectives of this project.</td>
</tr>
<tr>
<td></td>
<td>2. The problem(s) which made this project necessary was (were) solved by its implementation.</td>
</tr>
<tr>
<td></td>
<td>3. Stakeholders were satisfied with the outcomes of this project.</td>
</tr>
<tr>
<td></td>
<td>4. How would you describe the impact of this project on the performance of your firm?</td>
</tr>
<tr>
<td></td>
<td>5. In general, how do you assess this project now?</td>
</tr>
<tr>
<td>Speed of completion</td>
<td>1. This project was completed in less time than what was considered normal and customary for our firm.</td>
</tr>
<tr>
<td></td>
<td>2. This project was completed on or ahead of the original schedule developed at initial project go-ahead.</td>
</tr>
<tr>
<td></td>
<td>3. Top management was pleased with the time it took us to implement this project.</td>
</tr>
<tr>
<td>Intuition</td>
<td>1. Participants in planning this project tended to rely on their intuition.</td>
</tr>
<tr>
<td></td>
<td>2. Participants in planning this project generally made the decisions that felt right to them.</td>
</tr>
<tr>
<td></td>
<td>3. It was more important for participants in planning this project to feel their decisions are right than to have a rational reason for them.</td>
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<tr>
<td></td>
<td>4. Participants in planning this project trusted their inner feelings and reactions.</td>
</tr>
<tr>
<td>Reflexivity</td>
<td>1. The team investigated and observed the context and the progress of the project (e.g., task performance strategies, goals, project requirements, the organizational context, etc.).</td>
</tr>
<tr>
<td></td>
<td>2. The team adjusted its task performance strategies in response to changes in the context and progress of the project.</td>
</tr>
<tr>
<td></td>
<td>3. The team spent an adequate amount of time considering the likely consequences of its task activities (e.g. considerations regarding usefulness of the project, compatibility with other projects, cost, etc.).</td>
</tr>
<tr>
<td></td>
<td>4. Strategies and work approaches chosen were later checked for their appropriateness by the project team.</td>
</tr>
<tr>
<td>Competition uncertainty</td>
<td>1. Easy to predict, (5) difficult to predict.</td>
</tr>
<tr>
<td></td>
<td>1. Changes in competitors’ prices</td>
</tr>
<tr>
<td></td>
<td>2. Changes in competitors’ strategies</td>
</tr>
<tr>
<td></td>
<td>3. Entry of new competitors</td>
</tr>
<tr>
<td></td>
<td>4. Changes in the markets</td>
</tr>
<tr>
<td>Macro-economic uncertainty</td>
<td>1. Easy to predict, (5) difficult to predict.</td>
</tr>
<tr>
<td></td>
<td>1. Inflation rate</td>
</tr>
<tr>
<td></td>
<td>2. Exchange rate with foreign currencies</td>
</tr>
<tr>
<td></td>
<td>3. Interest rate</td>
</tr>
<tr>
<td></td>
<td>4. Economic stability</td>
</tr>
<tr>
<td>Environmental complexity</td>
<td>Complex environment is characterized by rapid change and containing a large number of factors to be considered.</td>
</tr>
<tr>
<td></td>
<td>Considering this definition, how complex was your firm’s environment during this project? (1) very simple, (5) very complex</td>
</tr>
</tbody>
</table>

References


