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Steering committee management. Expertise, diversity, and decision-making structures

Carlos Sáenz-Royo [a,*], Francisco Chiclana [b,c], Enrique Herrera-Viedma [c]

[a] Department of Business Organization and Management, University of Zaragoza, C/Pedro Cerbuna, 12, Zaragoza 50009, Spain
[b] School of Computer Science and Informatics, Institute of Artificial Intelligence, De Montfort University, Leicester, UK
[c] Andalusian Research Institute on Data Science and Computational Intelligence (DaSCI), University of Granada, Granada, Spain

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ABSTRACT

This paper proposes to analyze how the differences in expertise, diversity, and group decision procedures affect the quality of the strategic decision of steering committees. Strategic decisions are difficult to anticipate, and performances of the alternatives are often not observable in their entirety, which prevent researchers from obtaining controlled empirical studies. This paper proposes to analyze the performance of steering committees where managers can err in their decisions using the Intentional Bounded Rationality (IBR). The majority procedure improves the committee's performance concerning authority when the level of diversity and expertise increases. However, in situations of low expertise, the gains over authority narrow. This work provides guidance in terms of trade-offs between the mentality of managers, their expertise, group decision procedures, and diversity, which in the empirical works are contradictory. This study contributes to current theorizations of committee management using the IBR methodology, which is new and allows quantifying the contribution of the distinct characteristics of the committee.

1. Introduction

Managers face high uncertainty regarding strategic decisions where relationships between variables are blurred and cannot be formalized. Extraordinary complexity makes decisions unique and the only known performance are those in the course of action, which prevent the evaluation of the decision-making process. To avoid this problem this work proposes to evaluate the composition and the group decision procedures of the steering committees using the Intentional Bounded Rationality (IBR) proposed in [1]. Hypotheses on the individual behavior of managers condition the strategic decisions of steering committees. A fully accepted hypothesis in management is that individual behavior is rationally intentional but bounded [2]. This means that cognitive boundaries of the brain lead managers to make judgmental mistakes. Aware of these limits, in science systems are designed with the aim of minimizing the consequences of mistakes for organizations [3]. However, the theory on how to design the functioning of steering committees based on the cognitive limitations of managers remains unscanned from a theoretical perspective.

In the area of decision-making there is a deep concern for the mechanisms governing human cognition; however, there is a gap concerning theoretical studies focused on the decisions of the steering committees. Many empirical works have shown how the characteristics (formation, diversity, etc.) of steering committees and their group decision procedures affect the performance of the organization [4–9]. It seems obvious that the theoretical analysis of group decision procedures in steering committees should have a solid basis that can link the individual human behavior of managers with the group decision procedures of steering committees. Sáenz-Royo, Chiclana, and Herrera-Viedma state that the IBR meets three criteria [1]: first, it collects the human way of thinking; second, it collects the possibility that managers may be wrong (make mistakes); third, it is efficient, that is, specific aspects of human behavior that are not necessary to understand the decision-making process have not been modeled. Many authors have shown that the assumption of traditional rationality does not produce satisfactory scientific predictability [10–13]. One of the elements that differentiate this work from existing literature on the topic is that the IBR methodology aims (i) to link the procedures of the choice of a manager with how the human mind proceeds and (ii) to functionally collect the possibility of mistakenly linking it with the complexity of the problem of choice, which allows to create a behavior laboratory to analyze how to manage the individual characteristics of managers (diversity, expertise, way of

* Corresponding author.
E-mail address: csaenz@unizar.es (C. Sáenz-Royo).

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thinking, etc.) and the group decision procedures that best suit the environment facing the steering committee.

Organizational theory has also investigated, both theoretically [14–17] and in real situations [18,19], the relationship between decision structure and group errors. This work is similar to those of Knudsen and Levinthal [14] and Csaszar [19], where the members of a group are individually fallible studying the group's performance probabilistically. The difference is how the "bounded rationality" of managers is expressed, with errors in IBR dependent on personal aspects and difficulty, i.e., not purely random, which allows establishing innovative theoretical relationships between the individual characteristics and the performance of the decision structures of steering committees.

The main innovative aspect of the research presented herein is that it addresses the determinants of the quality of the decisions of the steering committees starting with the IBR methodology. The work is motivated by the relevance of improving the quality of the decisions of the steering committees, and the practical difficulty of properly identifying the reasons for success and failure in the organizations, due to apparently contradictory results [7,20]. To help understand these contradictions, an abstraction is established that allows relating the characteristics of the IBR of individual managers with the final result in the strategic decisions of the steering committees. This decision-making process is rarely observed directly by researchers, and we propose to study it theoretically. Modeling individual manager's decisions using IBR allows classifying the different compositions of the steering committees (level of expertise, thinking focused on beliefs or logical deductions, diversity of committee) to finally evaluate the performance of different group decision procedures (consensus, majority, disagreement management). The results show the importance of the individual mindset of managers and the management of disagreement in group decision procedures [21]. Increasing the expertise of managers improves the performance of all group decision procedures, and only the majority procedure improves the performance of the authority when diversity on the committee increases [22]. Therefore, the majority procedure allows guaranteeing a level of quality with different combinations of expertise and diversity.

The work is structured as follows: Section 2 describes the concept of IBR. Section 3 develops the different mentalities of managers. Section 4 describes the relevant characteristics of decision-making in a steering committee (diversity level and decision structures). Section 5 develops an illustrative theoretical example that allows seeing the trade-off between the characteristics of the steering committee and the quality of the decision. The last section provides the main conclusions of the paper.

2. Intentional bounded rationality (IBR)

Managers are constantly faced with decisions in which there is no clear measure, hiding possible errors in management decisions. The organizations establish group decision procedures that aim to guarantee the quality of their important decisions. Steering committees are one of the most widely used group decision structures. Organizational theory has considered increasing decision participation as an instrument to improve the expected performance of individual decision [14–17] under the hypothesis that while one manager may be wrong, the probability of several managers from different areas being wrong in a decision in which they participate is substantially lower. According to this premise, increasing the number of managers participating and the level of consensus on the decision increases the certainty on the quality of the adopted decision.

When making decisions managers must consider the economic cost of effort and time in deciding how much information they are willing to process (signals to be processed) to improve the outcome of their beliefs or intuitions. In this process, both additional performances and additional costs are uncertain, which causes managers to naturally assume a certain level of error in their decisions. This idea is collected by Sáenz-Royo, Chiclana, and Herrera-Viedma [1] to propose IBR based on the premise that managers are more likely to be correct than to err in their judgments, and to develop a functional form for conditioning the probability of making a mistake with the factors of the human way of thinking [2].

This conceptual framework relates the complexity of the decision, understood as the difference in the latent returns of the alternatives, with the expertise of the managers and their beliefs. In this framework, the more difference there is in latent performance between the alternatives, the more likely it is that the manager makes the right decision; the better prepared intellectually the manager is, the easier it is for him to process information and therefore, the more likely it is that the manager will decide correctly; and finally, the manager's initial beliefs (intuitions) condition his decisions: in the right direction, if the beliefs are correct, but in the opposite direction, if they are incorrect. This methodology is different from other studies that have simply incorporated probabilities into the manager's decisions [15,16,23,24] to evaluate decision support techniques [25]. In this work, the IBR will be used in a pioneering way to evaluate a priori the performance of the steering committee decisions and establish trade-offs between different aspects such as group decision procedures, diversity, or the level of expertise of its members.

The IBR proposes a logistic probability distribution for each individual manager. The individual manager's decision depends on the manager's ability to process information (β), the complexity of the issue (difference between the performance of the alternatives studied $[(V_j - V_i)|\forall j \neq i]$), and the manager's beliefs (p_i^0). Thus, the probability that a manager chooses alternative A_i with performance value V_i, $p_{\beta i}$, is represented as follows:

$$p_{\beta i} = p(A_i) = \frac{p_i^0 e^{\beta \frac{V_i}{\sum_{k=1}^{n} V_k}}}{\sum_{j=1}^{n} p_j^0 e^{\beta \frac{V_j}{\sum_{k=1}^{n} V_k}}} = \frac{1}{1 + \sum_{j \neq i}^{n} \frac{p_j^0}{p_i^0} e^{\frac{\beta (V_j - V_i)}{\sum_{k=1}^{n} V_k}}}. \quad (1)$$

Thus, given latent returns from the alternatives, the IBR defines the probabilistic behavior of a manager. The probability of being right, i.e. choosing the alternative with the best latent performance, depends on the complexity, the expertise (β), and the beliefs (p_i^0) of the manager. On the one hand, when the manager does not know what information to collect on the problem (or she does not how to process the information), then $\beta = 0$, and the probability to choose an alternative is equal to his beliefs (p_i^0). On the other hand, when the manager knows how to process and assimilate all the information on the problem, then $\beta = \infty$, and with infinitesimal differences in the performance, he chooses the best alternative. If the performances to be compared have little (high) differences $[(V_j - V_i)|\forall j \neq i]$, then the complexity is high (low), and the election requires greater (less) precision and require more (fewer) information to make the correct alternative [14,16]. Finally, when the manager's beliefs are correct (erroneous), the prior probability of the best alternative is greater than the rest (less than others), which increases (decreases) the probability of being correct. When there are no beliefs ($p_i^0 = 1/n$) and the manager's decision depends solely on his "logical" ability to process the information, the probability of choosing the alternative with the highest performance is greater than that of choosing any other, which guarantees that group decisions improve individual decisions [26].

3. Mentality of the manager

In IBR the expertise (β) represents the cost of improving the error for each relative performance unit. The higher the value of β, the greater the probability of choosing the correct option since the cost of processing the information will be lower and vice versa. The manager's expertise is not easy to assess and has been a major concern in the context of group or committee decision-making. There have been many attempts by researchers to find a way to qualify expertise, ex-ante when prior information is used, such as experience [27], reputation [28], trust [29]; or

ex-post, using the properties of the expressed judgments, such as their consistency [30,31].

Beliefs are also difficult to quantify; they represent unconscious preferences about alternatives that allow for quick decisions [32]. The beliefs (p_0^i) can change the probability with which each alternative is chosen. Therefore, the manager's affective states can influence the mechanisms to establish the correct alternative [33]. In this work, a simplification is carried out that considers only two possible managerial mentalities, a belief-based mentality ($\beta = 0$) and a logical mentality ($p_i^0 = 1/n$).

The belief-based mindset occurs when the choice probabilities come solely from prior beliefs and no information is processed. In this case, the positions of the managers are immovable, since there is no logical part on which to discuss or learn, decisions can be made in one round (without discussion) and the disagreement must be resolved by establishing authority. The great advantage of this mindset is the speed of decision.

The logical mentality occurs when the probabilities are only of logical origin; there are no previous predilections, it is possible to establish a logical information processing of the problem and the sharing can improve the level of experience of the managers [34]. Some authors argue that discussion and disagreement lead to higher quality solutions [35,36]. For the discussion to improve performance, a high level of freedom of expression and empowerment (logical mindset) is needed in the committee, so that knowledge is shared and not hidden [22,37,38]. Under this mentality, the diversity of approaches is an opportunity to learn to become aware of other perspectives, which can improve the quality of the committee's decisions [35,39,40]. However, improving expertise takes time and creates conflicts [21]. The logical discussion process takes time to gather information and resolve any doubts and objections that the committee members may establish. Maule and Maule [41] emphasize that establishing logical information processing improves performance and helps develop a logical mindset. The conflict increases the quality of decisions, but can generate frustration when the decision structure allows a decision to be made without the consent of all managers, which impacts its implementation [42,43]. These effects are more important in committees whose members have a mentality based on beliefs [44], where prestige depends on the quality of beliefs without the possibility of an explanatory logical discussion [45]. Ultimately, the managers who make up the steering committee have a direct influence on the results, since their mentality leads the way they interact and the results of their group decision procedure.

4. Decisions in the steering committees

Steering committees face strategic decisions of great significance that compromise the organization in the long term and are difficult to reverse [46]; whose uniqueness and novelty require specific studies [47]; and have particular importance in strategic alliances [48]. The level of expertise and diversity of the members of a steering committee together with its mental structure being based on beliefs or logical developments, and its decision procedures can be considered as management variables to help the adaptation of the organization to its environment and modify the level of reliability of its decisions. The research presented in this work should be seen as an attempt to find out how the above influences the performance of a steering committee.

The individual aspects of mentality (expertise and beliefs) have been discussed in the previous section. This section incorporates diversity and group decision procedures to assess the quality of committee decisions through a theoretical illustrative example. Multiple authors [49,50] point out that the cognitive bases of managers are the mental guidelines that underpin their decisions, and consequently affect the results obtained by their companies. In this sense, the possible trade-off in the performance resulting from individual and group aspects in a steering committee is developed [51].

4.1. Diversity

The diversity of managers refers to the difference between their cognitive logical processes which causes the variety of opinions on the alternatives studied to generate disparity in their views. Its origin can be very diverse, age, gender, race, but perhaps one of the most interesting for the study of the behavior of managers is functional diversity. Within an organization functional diversity refers to executives from different departments having different skill requirements, facing disparate difficulties, and probably possessing no coincidental perspectives, attitudes and communication domain [4,39,52]. Beliefs have a strong cultural and social influence, so setting different starting points (age, sex, departments) is easier than generating diversity as independence of opinion [44].

Diversity has been widely studied from an empirical point of view [36,53–56] yielding inconclusive results in terms of their performance. However, we are not aware of any theoretical contributions on diversity to establish a framework to justify the emergence of these contradictions. Diversity can affect both the logical part [56] and beliefs [57]. In the IBR frame, the diversity of alternatives selected is a consequence of processing different signals (Bayesian approach). In this paper a new way of representing diversity is proposed as managers whose decisions are totally independent, that is, they may have the same error probability or not, but the decision of one of the managers does not influence that of the other, their conditioned probabilities are null. The opposite of diversity is homogeneity, i.e., managers who make identical decisions. To understand how strategy is practiced, the analysis needs to focus on how patterns of action are associated with the characteristics of the team [58]. In the homogeneity case, managers not only have the same probabilities of success/error, but their decisions are perfectly correlated, knowing one's decision, and certainty is available in the other's decision. Two homogeneous members of a steering committee may be treated as a single member with twice the votes but do not bring any diversity. A perfectly homogeneous committee will have the same chance of making mistakes as any of its members and the quality of its decision cannot be improved through group decision structures. In this paper the diversity level of the steering committee will be marked by the hypothetical number of fully independent managers.

4.2. Group decision procedures

Decisions are based on the individual decision of managers, who can make mistakes. The group decision procedure of a steering committee determines how individual errors are aggregated into group errors. Sah and Stiglitz [23] demonstrated for the first time the relevance of the group decision procedures, i.e., what kind of demands are set in committees for the group decision to be final. This study is also related to the literature on agreements when individual members have a diversity of opinions, knowledge experience, and/or diversity of mentality [59–61]. These works have shown that both individually and collectively, managers show inconsistencies in the choice of alternatives as a result of internal contradictions.

Diversity allows group decision procedures to be applied as a powerful methodology in complex decision-making, but in turn involves disagreement, conflict, or blockage. The decision procedures set out the requirements for the steering committee to choose from the available alternatives even though its components defend different positions. The procedures studied here are consensus, the simple majority (at least half plus one member in favor), and authority (single member makes the decision). How the problem is addressed is innovative in the sense that it is based on the modeling of the individual decisions of the managers and the subsequent uncovering of the influence of diversity and decision structure on the quality of the committee's decisions and their possible blockage.

Authority has been the most historically used decision-making system. A large part of organizations concentrates on authority and

responsibility by ignoring the potential conflicts that decisions can generate. This implies distortions in the power relations as the manager with authority tends to ignore the judgments of others [62,63]. This organizational structure discourages participation and tends to generate homogeneity among its members, reducing the possible diversity [64] and establishing a great dependence between the expertise of the manager who holds the authority and the results of the organization. Under this structure, decision-making is very quick, and the assimilation process is directed from top to bottom, limiting the participation of other managers in their collaboration in the implementation of decisions.

The complexity of organizations has shown the need to develop the specialization of functions and distribution of authority, which requires a greater degree of coordination and participation [65]. The power of managers is manifested in specialization, in the delegation, and characterizes power as a dynamic interaction in a specific place and time in a more or less coordinated relationship group [66]. This conceptualization challenges the idea of a single power and proposes that the consensus decision structure eliminates the lack of commitment on the part of some managers in the implementation phase. Consensus empowers all members of the steering committee as an essential part, shows the problems of lack of commitment in the discussion phase, and indirectly establishes absolute equality among committee members.

The consensus structure in decision-making has been extensively studied. From the normative point of view, the consensus structure presents the best solution for maximizing well-being [67,68]. From the coordination point of view, it ensures the cooperative behavior of all the managers involved [69]. When it comes to risk, it is the structure that best protects in situations where making mistakes can present irreversible costs for the organization [70]. With three or more alternatives, the consensus is free from the inconsistency of other decision-making structures such as that of the majority [71]. However, this structure has serious drawbacks due to the easy appearance of blockage in the decision phase. This structure presents a high requirement for acceptance that causes omission errors, for the possibility of both not reaching a decision and rejecting projects whose performance is positive.

The majority rule allows reaching a joint decision on many more occasions than consensus, this being a particular case of the first. The majority rule aims to preserve a certain degree of freedom and a priori equality among managers (recognizing the participation of all committee members in a level playing field before the decision) to lose such freedom a posteriori (when the decision is made), for the sake of coordination, reducing the possibility of blockage by disagreement and improving operability. However, any majority system generates two groups of managers: those who impose and those who must accept without believing. In the absence of strategic behavior, the opposition of the managers to the majority decision would be stated through a sincere opinion regarding the potential impairment of the organization's performance.

5. Illustrative theoretical example

This section considers different levels of diversity in the composition of the steering committee, different group decision procedures, and finally, different levels of expertise of managers. These aspects will be evaluated through the probability of choosing the best alternative, as if they were management variables to analyze the quality of the committee decisions, using an illustrative case similar to the proposed in [25].

A steering committee faces a decision in which they have three possible alternatives with following latent relative performances: $V_1 = 0.625$, $V_2 = 0.3125$, $V_3 = 0.0625$, i.e., the performance of alternative A_1 is twice that of alternative A_2 and ten times that of alternative A_3. Also, it is assumed that all members of the steering committee have the same level of expertise. Each of the managers must opt for one of the alternatives and the committee, according to its decision structure, subsequently sets the definitive decision of the organization.

Two levels of expertise are considered to evaluate the problem of group decision procedures and the level of diversity: (i) low expertise to reflect the novelty of the proposals or the complexity of the strategic issue, where the probabilities that a manager chooses each of the three considered alternatives are: $p_1^0 = 0.3831$, $p_2^0 = 0.3277$ and $p_3^0 = 0.2892$ (these probabilities are the result of low-quality beliefs or rationally bounded logical processing by replacing in Eq. (1) the latent relative performance of alternatives with a skill value of $\beta = 0.5$); (ii) high level of expertise to reflect a better knowledge of managers on the subject or their correct beliefs, where the probabilities that a manager chooses each of the three considered alternatives are: $p_1^0 = 0.6343$, $p_2^0 = 0.2484$ and $p_3^0 = 0.1173$ (these probabilities are the result of their correct beliefs or rationally bounded logical processing by replacing in Eq. (1) the latent relative performances of the alternatives with a value of expertise of $\beta = 3$). We consider 7 discrete levels of diversity: level 1, only an independent opinion (matches the authority); level 2, two independent opinions, and so on. Finally, three group decision procedures are considered: the authority, the majority, and the consensus.

To calculate the probabilities of choosing each alternative, the laboratory of IRB determines all combinations of choice of independent managers (diversity level) (see Appendix I for details). For example, in the case of 5 independent opinions (diversity), since the order is important and the choice can be repeated, there are $3^5 = 243$ possible choice combinations. The probability of each choice combination is calculated and then the probabilities of all choice combinations verifying each of the following are added up: (i) choice combinations leading to agreement on alternative A_1 be chosen; (ii) choice combinations leading to agreement on alternative A_2 be chosen; (iii) choice combinations leading to agreement on alternative A_3 be chosen; (iv) choice combinations representing a disagreement or blockage.

Fig. 1 shows the probabilities in the cases of agreement of choosing each alternative for each level of diversity, for a given group decision procedure, and the considered level of expertise of managers. The quality of the decision of the authority group decision procedure corresponds to diversity 1, i.e., only one manager decides. In the agreement cases, increasing diversity in the steering committee means that the consensus procedure ostensibly improves the probability of choosing alternative A_1 in comparison to the authority procedure: for low expertise ($\beta = 0.5$), the probability increases from 0.383 (diversity 1) to 0.678 (diversity 7); for high expertise ($\beta = 3$), the consensus probability of choosing alternative A_1 increases rapidly towards the maximum value of 1 as the diversity increases further. The quality gains of agreement cases of the majority structure relative to the authority structure are more modest: for low expertise ($\beta = 0.5$), there is still a steady increase from 0.38 (diversity 1) to 0.45 (diversity 7); for high expertise ($\beta = 3$), the increase in probability is more significant with values approaching the value 0.9 achieved when diversity is 7.

The choice combinations leading to an agreement within the steering committee have shown that the consensus procedure provides the best quality of decisions. However, there are also many choice combinations leading to disagreement, i.e., choice combinations where the group decision procedure is unable to reach a decision of the committee. As can be seen in Fig. 2, when disagreement is considered, the consensus procedure experiments a noticeable decrease on its probability of choosing any alternative as the diversity increases, due to its high demand for acceptance, especially when the level of expertise is low. This justifies the mentioned empirical results regarding the difficulty of organizations when managing conflict and seeking consensus, where the increase in diversity results in unfavorable performance [72,73]. The theoretical analysis makes it clear that disagreement is directly related to diversity and group decision procedure, and can therefore affect the committee's results [20,74]. However, in the case of the majority procedure, the level of disagreement depends on the number of combinations that can generate ties of votes between alternatives and, unlike the consensus procedure, the trend of the probability of disagreement decreases in most cases as the diversity increases, being this decrement accentuated

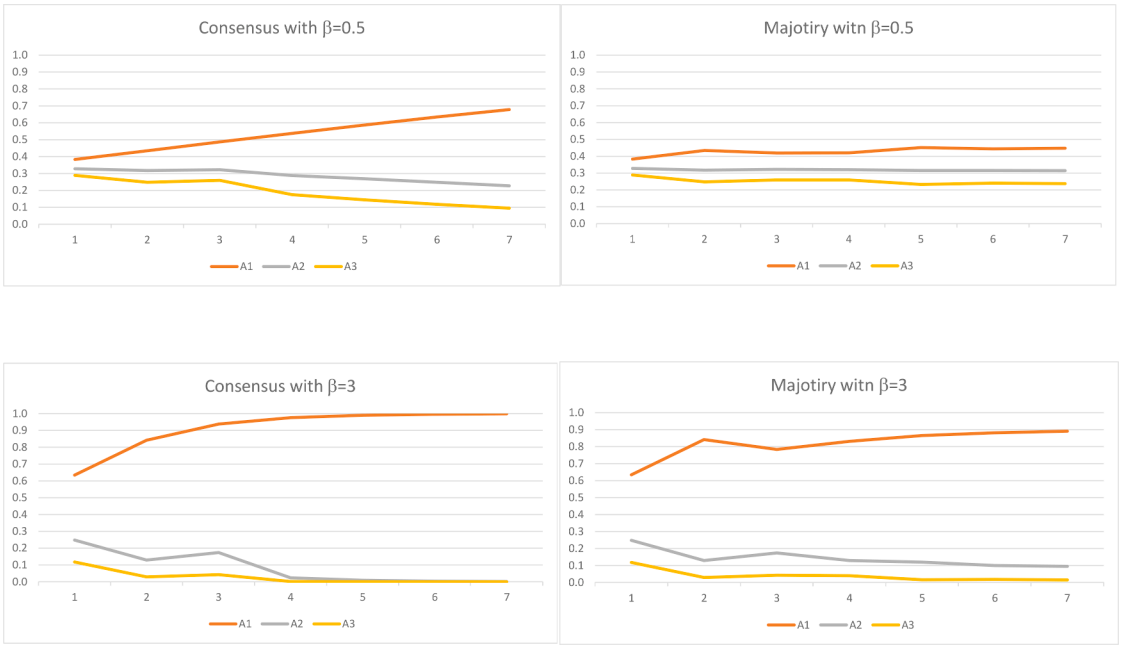

Fig. 1. Agreement decision quality of group decision procedures: Probabilities of agreement on choosing each alternative with low and high expertise.

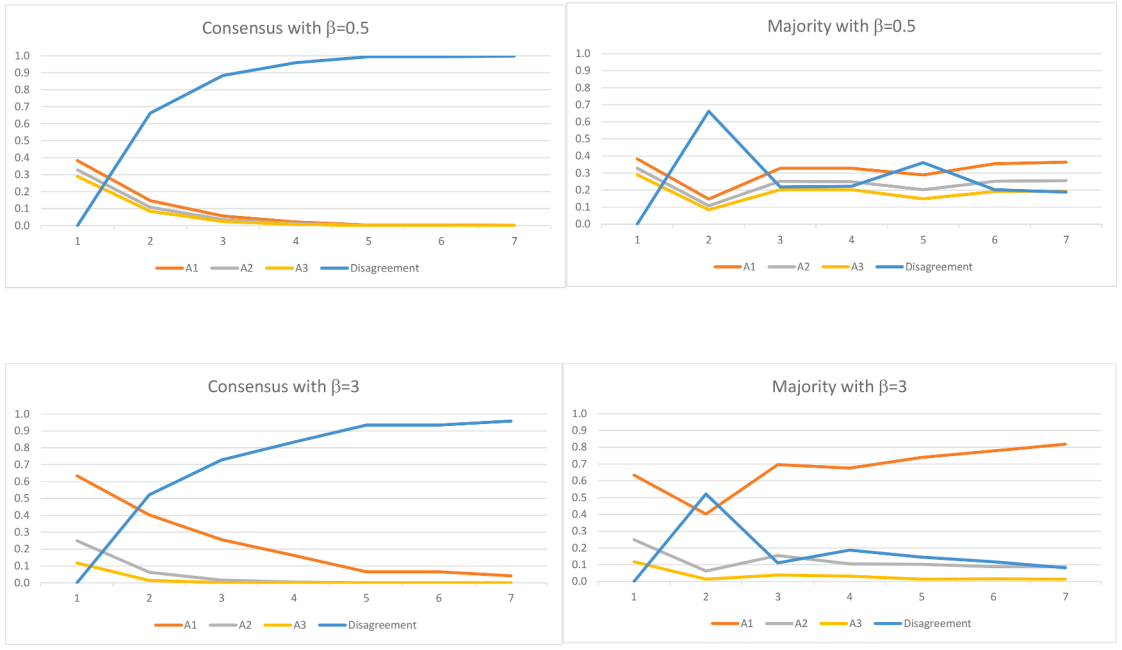

Fig. 2. Disagreement and Probabilities of choosing each alternative on the group decision procedures.

in the case of high expertise, since the probability of choosing the best alternative generally increases (not reaching the value achieved by the authority procedure in case of low expertise at any value of diversity; while being above the level of the authority procedure in case of high expertise for diversity 3 or higher) more than the probabilities of choosing the wrong alternatives (more markedly in case of high expertise). Thus, with high expertise the majority procedure shows great gains per unit of diversity, while the consensus procedure presents better results when diversity is low due to the rapid growth of disagreement.

The great interest in consensus among expert managers by specialized literature (see Pérez et al. [75] for a consensus review) implicitly recognizes issues on the individual judgment of managers regarding the acceptance of the existence of error. The performance of all group decision procedures, at all levels of diversity, is positively affected by the increase in the value of the expertise parameter (β). Some empirical studies approximate expertise through variables such as age, education, and seniority as indicators of the varying degrees of knowledge and skill of committee members, and they always found positive performances when changes of these variables indicate an increase in value of the expertise they approximate [39,76].

The majority procedure can be used to ensure a quality level of the decision when it is not possible to modify the expertise of managers, as the probability of opting for the best alternative in a committee with this group decision procedure increases as the level of diversity rises. The majority procedure is the only one that improves performance by expertise and diversity. To assess the trade-off between expertise and

diversity, the probability of choosing the best alternative is studied, solving the disagreement by equitably distributing its probability among the alternatives tied with the highest number of votes.

Fig. 3 shows how the majority procedure does not present any improvement in quality, in the change from authority to a diversity of 2, because disagreements are distributed equally. There are no small quality gains from increasing diversity when expertise is low. For high expertise (from quality $\beta = 4$), gains per unit of diversity outweigh profits by a unit of expertise. Diversity and expertise show concavity in their quality improvements. The analysis presented allows setting a minimum ex-ante reliability level for the committee, determining the areas of expertise-diversity acceptable. Fig. 3 shows the areas of reliability of choosing alternative A_1 with different colors, so the combinations of expertise and diversity that provide a probability of choosing alternative A_1 between 0.8 and 0.9 are those corresponding to the yellow area.

In conclusion, it can be stated that the majority procedure has better performance when the level of expertise of managers is relatively high as it improves the group decision quality of the committee with more diversity, while at low levels of expertise the gains over authority are very smalls. Choosing between improving the quality of managers or increasing the diversity of the steering committee can be a decisive strategic decision depending on the costs of each one. Thus, if the reliability of the managers is a combinations of expertise and diversity, then the level of diversity the committee requires to have a certain level of reliability can be obtained. Depending on the performance of the decisions to be made and the cost of each expert's judgment, an optimal diversity of management can be obtained for the steering committee. The fact that on many occasions the performances of the alternatives not chosen by the organization are not observable has forced literature to stick to an ex-post analysis of decisions, arguing that the level of diversity and degree of the agreement are indicators of the quality of the committee's decisions ex-post, giving an idea of its reliability. The model presented completes this analysis with the ex-ante results obtained in a laboratory in which managers have IBR.

Some authors have found that committees with high levels of consensus show internal mechanisms for logical development [77]. Knight et al. [72] show how the management of interpersonal conflict and the search for agreements intensely influences the performance of the committee so that the logical mentality of managers is decisive in the phase of discussion of alternatives within the steering committee. Such processes encourage agreements to be broad, as improving member expertise reduces the probability of disagreement of all group decision procedures. The great disadvantage of this type of mentality is that the deterioration of the performance of the alternatives must be assumed due to the passage of time (discussion and decision-making) either as an opportunity cost or as deterioration due to the specificities of the environment. The committee should assess whether the gains in the expertise of the committee components offset the performance losses of the alternatives according to the environment it faces.

6. Conclusions

Before making an election, individual managers decide how much information they will process to improve their choice. This is the main idea of IBR, a methodology focused on the human cognitive process to collect the error in the manager's choice. The probability of a manager choosing an alternative depends on the complexity (difference between the latent returns), his expertise, and his initial beliefs. The functional representation of individual manager proceeding is a "logit function". From this theoretical framework, two possible managerial mentalities have been defined, one based on beliefs and the other based on logic. The belief-based mindset is quick but does not allow for discussion, while the logic-based mindset allows for discussion but takes time. This formalisation of the IBR of managers enables them to study their interaction and behavior in steering committees.

The mentality of the steering committee members compromises their ability to identify and act on profitable opportunities [78], and therefore, the individual decision of the managers affects the characteristics of the steering committee influencing the performance of the organizations.

The division of labor and specialization (diversity) is the natural response to bounded rationality. However, specialization is effective if it moves forward along with mechanisms that facilitate collaboration and exchange in organizations. In this sense, an organization's shared beliefs have been attributed beneficial effects on the coordination and efficiency of organizations [79]. In fact, organizations naturally develop mechanisms (collective rules or references) that aim to guide and converge the attention of their members in certain directions, shaping attitudes and behaviors. Standards become shared expectations about what is considered appropriate behavior or not, which facilitates their control [80] but impairs their ability to improve the quality of their decisions. There are activities in which coordination must take precedence over deliberation (for example, the implementation phase coordination between departments of the organization is essential for success). However, in steering committees, the most important decisions are usually strategic, so quality prevails over decision-time, and therefore, in this case, their group decision procedure must be the majority given their wide path of improvement over authority; higher levels of diversity in their composition and managers with a high level of

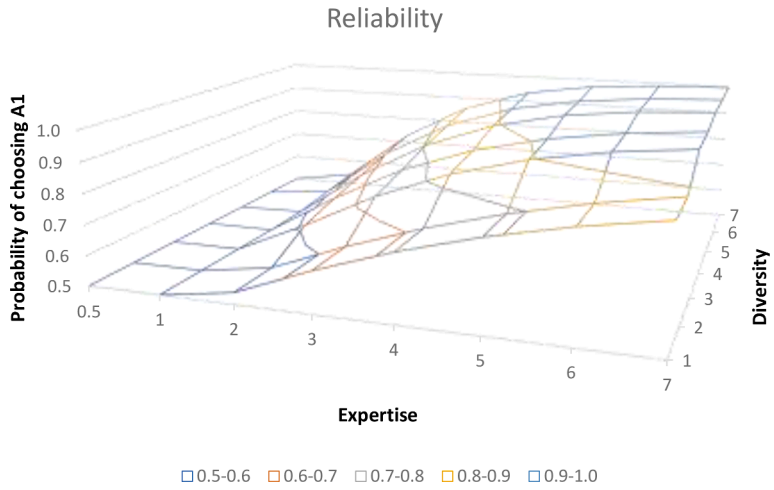

Fig. 3. Probability of choosing alternative A_1 by varying expertise and/or diversity.

expertise and with capacity for deliberation are better.

The success or failure of a strategic decision depends to a large extent on how the alternatives were evaluated and discussed before their approval, and the effectiveness of the implementation stage. The quality of the result in the pre-implementation stage will in turn depend on the information that managers have and can create, as well as on their ability to process the available information. After the choice at the decision stage, the final success or failure of the decision will depend on the actual realization of the states of nature, and the skills to support the implementation stage. The answer to the question of why strategic projects fail requires joint analysis of decision-making and implementation processes, something that can be done at the level of case studies, but not in an extensive and controlled manner. Therefore, this work theoretically analyses how differences in expertise and diversity of managers, and group decision procedures affect the quality of a steering committee's decision. Our work extends the investigation of information aggregation to account for the mechanisms through which deliberation and beliefs are incorporated into the decision process. To date, research has treated the composition of management committees as an exogenous factor that acquires particular characteristics [81–83]. On the contrary, we show that the composition of the steering committee must be considered endogenously to establish the best way to adapt to the environment.

A key contribution of our work is that it provides an ex-ante contingent perspective of the steering committees where the probability of choosing each alternative depends on internal and external constraints. The analysis of the internal aspects focuses on the characteristics of the managers and the different decision procedures that are effective [82]. The research highlights the level of diversity within a group [84], conflict management [85], and the way of thinking and the capacity of managers [15] as key moderators of group decision procedures. Finally, we expand this perspective descriptively to the nature of the external environment [82]. The IBR methodology provides us with a probability distribution of ex-ante errors conditioned to distinct characteristics of the organizations, providing information on the causes of the empirical contradictions found and on the different ways to achieve the same level of reliability required by each environment.

6.1. Internal conditioning factors

Our model shows that the way in which organizations choose their managers and the way in which it is discussed in the steering committees determines the probability of choosing an alternative in the evaluation and selection phase. An advantage of our approach is that it accounts not only for the number of managers included in the committees, as emphasized in previous research [86] but also what characteristics they have. This is a key consideration since it relates decisions to the expertise and way of thinking of those who participate in the decision making.

Our findings provide important results of the following directives. In comparison to the consensus procedure, the majority procedure reduces the possibility of blockage and is especially efficient when managers present high levels of expertise and diversity. The majority procedure generates two groups of managers: those who believe in the decision and impose it, and those who accept without believing. This together with the need to maintain diversity to improve decisions can generate coordination tensions in the implementation phase. This difficult balance seems a promising future line of research. The consensus procedure empowers all managers and facilitates the implementation phase, transferring all tensions to the discussion phase; however, the search for consensus requires a lot of effort and time, and the blockage is difficult to resolve (immobility), with appearance playing a fundamental role in the way of thinking of managers. The authoritarian procedure is the fastest and requires the fewest decision-making resources, although it is the one that generates the most tension in the implementation phase. This decision procedure is especially efficient when the precision of its managers is low, in situations of high uncertainty where the advantage of participation disappears quickly, when blockage is to be, and when agility when innovating is sought after.

Our findings provide important clues to guide design efforts, as discussed above. However, to find the correct ratio of accuracy and/or diversity, an organization must understand the degree of fitness between knowledge within the organization and characteristics of opportunities in the environment. The alternative approach is for an organization to adapt its committee decision strategy to its resources [87,88]. When diversity is cheap but it is difficult to control the precision of the managers, it can be advantageous to establish broad steering committees guided by majority procedures, despite the previous caveats. Electronic platforms facilitate the independence of opinion and reduce discussion times that can be held while working.

6.2. External conditioning factors

The asymmetry between costs comes from the necessary adaptation to the environment, representing an additional relevant factor for the configuration of the management committee [17,89]. The case studied assumed that making a mistake in the alternative only penalizes the loss of a possibility of obtaining a higher performance, and therefore the costs of making a mistake are symmetrical. However, there are many situations in which wrong strategic decisions can lead to larger losses due to irreversible effects on reputation [19,70]. Managing the possibility of blockage in the steering committees can be a way to avoid possible irreversible losses. Reputation loss sometimes involves additional invisible agency costs that justify the asymmetry [90]. This heterogeneity of costs requires an analysis in terms of fallibility, adapting the composition and decision rules of the management committees to the environment they face. Our work also sheds new light on lock management as an important element of some group decision procedures.

There are environments where time has a very high discount rate due to the rapid deterioration of alternative returns, an example of these environments is the military or disaster management in which the steering committee must make decisions in a brief time. Future research could expand the model by studying trade-offs that occur between time, mindset, diversity, and decision structures.

Ultimately, the internal cost structure conditions the way in which the management committee adapts to the environment by choosing the composition and decision mechanisms of the management committees, trying to improve individual limited rationality. Research shows that mechanisms for aggregating individual evaluations in a steering committee are crucial in organizations [91].

CRediT author statement

All the authors have actively contributed to the different aspects of the work.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix I. Calculation of Probabilities (Figs. 1–3)

Step 1: Each manager is numbered. In the case of 5 independent managers, they will be: M1, …, M5.
Step 2: All possible vote of managers are obtained. In the case of three alternatives and five managers, all the possible vote are variations with repetition of 3 elements (three alternatives) taken 5 times 5 (five managers). The number of variants is $3^5 = 243$.

Some of them are (manager, vote):

Possible	vote	1	(PV1):	{(M1,	A1);	(M2,	A1);	(M3,	A1);	(M4,	A1);	(M5, A1)}
Possible	vote	2	(PV2):	{(M1,	A1);	(M2,	A1);	(M3,	A1);	(M4,	A1);	(M5, A2)}
Possible	vote	3	(VP3):	{(M1,	A1);	(M2,	A1);	(M3,	A1);	(M4,	A2);	(M5, A1)}
Possible	vote	4	(VP4):	{(M1,	A1);	(M2,	A1);	(M3,	A2);	(M4,	A1);	(M5, A1)}
…	…	..	…									
Possible	vote	243	(PV243)	{(M1,	A3);	(M2,	A3);	(M3,	A3);	(M4,	A3);	M5, A3)l

Step 3: Calculate the probability of each possible vote.

Probability of PV1 (p(PV1))	$p(PV1) = p_1^0 \cdot p_1^0 \cdot p_1^0 \cdot p_1^0 \cdot p_1^0$
Probability of PV2 (p(PV2))	$p(PV2) = p_1^0 \cdot p_1^0 \cdot p_1^0 \cdot p_1^0 \cdot p_2^0$
Probability of PV3 (p(PV3))	$p(PV3) = p_1^0 \cdot p_1^0 \cdot p_1^0 \cdot p_2^0 \cdot p_1^0$
Probability of PV4 (p(PV4))	$p(PV4) = p_1^0 \cdot p_1^0 \cdot p_2^0 \cdot p_1^0 \cdot p_1^0$
…	
Probability of PV243 (p(PV243))	$p(PV243) = p_3^0 \cdot p_3^0 \cdot p_3^0 \cdot p_3^0 \cdot p_3^0$

Step 4: The consensus cases in favor of each alternative are obtained, the majority cases in favor of each alternative are grouped, and the blocks are grouped. Finally, the probabilities of each of them are obtained. In the case of five managers:

Possible cases of majorities in favor of an alternative:
4 votes for the majority alternative and 1 vote for each of the others.
3 votes for the majority alternative and 2 votes for another alternative.
3 votes for the majority alternative and 1 vote for each of the other alternatives.
Possible cases of blockage:
2 votes for one alternative, 2 votes for another, and 1 vote for a third.
These are the probabilities shown in Fig. 2.

Step 5: The blockage probabilities are eliminated and the probabilities of choosing each alternative are normalized.
These are the probabilities shown in Fig. 1.
Step 6: The previous steps are repeated for different values of expertise ($\beta = 0.5, 1, 2, \ldots, 7$). For each combination of expertise and diversity, the probability of choosing alternative A1 among the situations.

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