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Corporate Governance: Behavioral Approach and Cognitive Mapping Technique

Nassreddine Garoui¹, Anis Jarbou¹

ABSTRACT

Psychological biases represent new paradigms that complement traditional behavioral finance theory while introducing “behaviorist” aspects to the decision-making process. The aim of this paper is to examine the mental models of actors in Tunisian firms with respect to the behavioral approach to corporate governance. We use a cognitive map to observe these mental diagrams and to visualize ways to conceptualize the behavioral approach. The objective of this study is to understand the concept of “mental models” through the presentation and analysis of the cognitive maps of the actors in Tunisian firms. The paper uses a corporate governance perspective to examine the mental models. Each actor’s systematic exploration grid shows a balance of concepts that expresses their cognitive orientation. Thus, we visualize the concepts (variables) that structure the cognitive universe of the actors, which is projected in terms of influences and dependencies. We can distinguish four major categories of variables through the distribution of the scatter plot variables in the grids, particularly in relation to different quadrants.

KEY WORDS:

corporate governance; behavioral approach; cognitive mapping; mental models; structural analysis

JEL Classification: CO1; C12; C22; C58

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1. Introduction

Psychological biases represent new paradigms that complement traditional behavioral finance theory while introducing “behaviorist” aspects to the decision-making process. Behavioral finance looks at investors’ thought processes to help predict the psychology of decisions. It is based on the application of psychological principles to improve financial decision making. Many studies have examined market

anomalies that are not explained by the traditional theory; these abnormalities have been cited as abnormal movements following a first public offering, a merger, or another fragmentation of capital.

During the 1980s and 1990s, statistical anomalies persisted, suggesting that the existing traditional models were incomplete. Investors did not seem to follow logical reactions to new information, instead showing what appeared to be unfounded confidence.

In recent years, the media have conferred more importance to the valuation of securities, which has caused biases in decisions and deviant behavior among individuals. These anomalies suggest that the principles of rational behavior are not always followed, in-

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dicating the need for new models of human behavior such as those studied in the other social sciences.

2. Literature review

Behavioral approach to corporate governance

According to Thaler (1996), current behaviors differ from traditional economic theories because of three deviations from the standard representations: bounded rationality (bounded rationality), limited willpower (bounded willpower) and limited selfishness (bounded self-interest). These deviations are associated with a number of biases that induce decision-making errors.

Biases associated with bounded rationality

For Jolls (2009), bounded rationality includes both errors of judgment and decisions that are contrary to the standard maximization of expected utility. For example, errors of judgment may be caused by a subconscious bias for or against the members of a group (based on race, class, nationality, sex, beauty, etc.).

Biases associated with the will and limited selfishness

Beyond the means of rationality that led to many developments in the field of law, current behaviors also highlight two other imperfections of human behavior: limited willpower and limited ego. The concept of limited willpower reflects limits to the will of individuals.

The key concepts in the behavioral approach

Overconfidence

One of the foundations in the development of behavioral finance is overconfidence, which is currently one of the most studied phenomena. Among the most cited works is by the pioneers De Bondt and Thaler (1985). This research strand defines overconfidence as the overestimation of the ability of the investor (Ritter (2003)). Generally, overconfidence is present in so-called 'experts' more than in less experienced actors. Overconfidence can have two effects; one is direct, while the other is indirect. Daniel, Hirshleifer and Subrahmanyam (1998) (DHS) demonstrate the direct effect of overconfidence by showing that investors place more emphasis on private information that they receive when making their decisions.

Similarly, DHS also show that overconfidence cannot be the sole determinant of sub-course evaluation and the momentum effect in the short term (between 3 and 12 months). The indirect effect can be summarized by the fact that investors process information and still make biased decisions. This strategy refers to attribution theory or conservatism. Barberis, Shleifer and Vishny (1998) (BSV) show that investors give great weight to information that accords with their beliefs and neglect information that does not. Several disputes have arisen following the spread of behavioral theory. Criticisms have particularly developed from the proponents of the theory of efficiency. These researchers suggest that no theory is as strong as the theory of efficiency. Empirical psychological studies have shown that individuals tend to overestimate their abilities and the precision of their knowledge. For example, in the famous study by Svenson (1981), 93% of in-tomobilists stated that their driving skills were above average, which is known as the better-than-average-effect.

Overconfidence has been observed in many professional fields: doctors, bankers, lawyers, (Yates, 1990), and venture capital investors (Zacharakis & Shepherd, 2001) have all demonstrated overconfidence. Overconfidence differs from optimism, which simply reflects a preference for a positive outlook. Optimism represents an unrealistic overestimation of future events that is not related to one's personal skills, while overconfidence results in an overestimation of one's personal skills.

Formally, in the modeling of these two biases, optimism is seen as a mean error (overestimation) and overconfidence as an underestimate of the variance, but the two terms are often used interchangeably (Fairchild, 2005). Weinstein (1980) emphasizes that the natural tendency of individuals to overestimate the result of a decision is reinforced when the decision maker thinks he can control the outcome. Overconfidence is reflected on a static level by both the overweighting of private information (as opposed to public information) and an overestimation of one's ability to interpret this information, and, on a dynamic level, through an erroneous inference of self-attribution bias. Thus, the effects of mispricing modeled by Daniel et al. (1998) led individuals to attribute good results to their own actions and poor performance to external circumstances. This bias

has important effects in both the inferences arising from overconfidence and the persistence of overconfidence. The self-attribution bias leads to increases in overconfidence during periods marked by positive developments such as the growth of financial markets or positive activities by a company. However, overconfidence also grows stronger in situations marked by uncertainty (private information is naturally given more weight, creating an overstatement of its importance and an overestimation of its accuracy), in the context of difficult tasks involving experts (who are more confident in their abilities than inexperienced individuals), and when a decision regarding returns or the interpretation of information is slow or unclear (Griffin & Tversky, 1992).

Kahneman and Tversky (1979) show that when uncertainty is high, individuals tend to construct scenarios in which they are overly confident about their probability of success (the planning fallacy). The particular jurisdiction may also tend to exacerbate overconfidence (Heath & Tversky, 1991). All of these factors have been observed in the case of decision making by venture capitalists: Zacharakis and Shepherd (2001) show that 96% of their sample of venture capitalists are affected by overconfidence. The connection of this bias with uncertainty is particularly complex because it is the uncertainty that is perceived by the decider, which induces a problem of causality and paradoxical reversal: the uncertainty promotes overconfidence, but the overconfidence bias decreases the perceived uncertainty. Furthermore, this link is dependent on information held only by the decision maker: when the decision maker has private information, overconfidence leads him or her to confer even more weight to this information when the uncertainty is high, which then increases the confidence of the decision maker in his or her ability to assess a situation in the presence of exclusively held information. In experiments where the participants have the same information (and are aware of it), this link disappears or is reversed. The results of Dittrich and di Fenizio (2005) can be interpreted within this framework. The authors' research examines an investment decision where the subjects (MBA and economics students) face the possibility of later changing their choice. Overconfidence is defined as the persistent overvaluation of the subjects' initial decision. A change is made by using excess cash available

after the initial investment (willingness to pay - WTP) or by reselling it (willingness to accept - WTA).

Optimism

Several models have been developed to explain the phenomenon of a bubble, and they all emphasized the importance of investor optimism during the swelling phase of bubble formation. In this regard, Scheinkman and Xiong (2003) built a model in which investors are willing to buy a security at a price above its fundamental value because they anticipate the possibility of resale to investors who are even more optimistic than they are. Note that this model is based on a strong assumption: the absence of short sales, which is present in a model developed by Miller (1977) that shows that only optimistic investors take long positions in sales since the ban found to prevent pessimistic investors to work heavily on the markets. The greater the difference of opinion between optimistic and pessimistic investors, the higher prices will be in the markets.

The prices of securities mainly reflect the views of optimistic investors, and in a bubble, the prices then reach a level that is above their fundamental value. These studies have been used to attempt to explain the development of the Internet bubble, in which it was impossible for investors to sell short the majority of the smaller listed companies.

Cognitive dissonance

Cognitive dissonance, proposed by Festinger in 1957, is defined as "a feeling of psychological discomfort caused by two conflicting cognitions that plunge the individual into a state that motivates him to reduce his uncomfortable feeling" (Festinger, 1957). The theory is related to emotional and motivational cognitive processes.

Some thorough studies have revealed parents' concepts of cognitive dissonance, congruence / incongruence, assimilation / contrast (Sherif & Hovland, 1961) and confirmation / disconfirmation expectations (Anderson, 1973; Oliver, 1980). The theory of cognitive dissonance was developed in the mid-1950s when Festinger postulated that individuals are looking for a cognitive balance that, when broken, produces a state of tension. This situation motivates a subject to restore consistency under the principle of "balance" or

“cognitive consistency”, whereby one seeks to maintain consistency between the elements of his or her personal world (views, actions) (Abelson and Rosenberg, 1958). However, the theory is actually not a theory of consistency, but a theory of avoidance of inconsistency because it has a motivational process of a return to cognitive balance.

Thus, the state of dissonance motivates an individual to its reduction in the same way that hunger drives someone to eat (Brehm, Back & Bogdonoff, 1964; Festinger, 1957). Resistance to change cognitions determines the mode of reduction, and less resistant cognitions are more modifiable than those that are more rooted (Harmon-Jones, 2000).

The basic unit of the theory of cognitive dissonance is cognition. Cognition is defined as anything that can become an object of knowledge for an individual to construct his reality, including knowledge, opinions, values, attitudes, beliefs, and feelings about oneself and one's behavior, another person or group, or even elements of the environment (Festinger, 1957). The relationship between the elements of cognition of an individual in a state of dissonance concerns contradiction, inconsistency and incoherence (Festinger, 1957).

Although the literature on dissonance is often limited to considering only inconsistency between cognitions, more recent research notes that Festinger's theory also concerns a relevance relationship (Harmon-Jones & Harmon-Jones, 2007).

Mimicry

Mimicry is the ability to identify basic human congeners and to imitate them. Many authors can be invoked here: Freud and the concept of identifying, Piaget's genetic psychology and the importance he gave to the concept of imitation, sociologists and “anthropologists” such as Tarde or Girard, for whom social life finds its ultimate explanation in imitation, and cultural psychologists such as Tomasello, who examined precocity and importance of imitative gestures and the role they play in learning.

Mimicry causes the following implications: the relationship begins as undifferentiated, and this lack of differentiation recurs in certain circumstances. Mimicry is the basis of human desire as desire-fusion-unity and cohesion-fusional movements, which are inseparable from the reverse movements of opposi-

tion and exclusion (of cons-imitation seems Tarde, imitation seems negative Girard), by which identities are formed as groups or individuals. Identity formation is based on self-centeredness (egocentrism) or a group (ethnic or socio-centrism) that is often represented by a leader who is very self-centered. Finally, overcoming the opposition is referred to as centrism's de-centering process.

We are indebted to Piaget, who revealed the importance of the de-centering process, both in terms of moral development and cognitive development. De-centration occurs when an individual or group becomes socially capable is able move beyond differences and oppositions to perceive the perspective of others. This implies a type of transition to a “meta” level, from which one can put events into perspective and eventually integrate differences in perspective. Individually, de-centration is responsible for internal discussion based on logical reasoning, according to Piaget. At the interpersonal level, de-centration is necessary to any form of debate and social cooperation.

Mimicry is an imitation behavior that can be found in different areas of the living world. In animals, it is a common instinctual behavior that assumes no conscious activity. Indeed, Henry Bates was the first to use the term mimicry in 1861 to describe the behavior of butterflies in the Amazon. He said that mimicry means, “The ability of some animals to make an appearance consistent with the objects around them.” In human neurobiology, humans are born imitators: many studies on experiments with infants have shown that a newborn is capable of reproducing the gestures of an adult. Thus, for Meltzoff (2005), regarding behavior that requires a conscious effort, mimicry is an innate mechanism that is one of the bases of the mental development of children through the construction of self and the understanding of others. Behaviorally, mimicry is a fundamental mechanism of learning.

Anthropologically, René Girard particularly studied the fundamental mechanisms of human behavior and the development of society. The difference between the concepts of mimicry and imitation concerns intentionality. Mimicry is an adaptive reflex, while imitation operates as a voluntary behavior (Pupion & Leroux, 2006). We nonetheless note that studies describing the phenomena related to imitation in organi-

zational sociology and economics are using the terms incorrectly. According to Gomez (1996), a convention is a system of rules in which the players must make a choice. It is a set of criteria and benchmarks that individuals use to decide how to behave when faced with uncertain situations.

Dependence

Organized collective activity always creates a situation of interdependence between the cognitive players who engage in it. The early works in economics recognized that the collective achievement of a common goal requires the coordination of activities by dividing the work and ensuring synchronization and consistency between the products of the activity, which are either realized by objects or are “intangible” intellectual productions. This cognitive interdependence rests on a structural interdependence that we define as follows: when two actors are contractually bound to achieve a given result, we assume that they are structurally interdependent. This structural interdependence may be created by an informal agreement to work together, an employment contract that associates individuals within a given institution, or as part of a market relationship between individuals or corporations. The structural interdependence that generates the most cognitive dependence or interdependence can be defined as follows: an actor is cognitively dependent on another when the actor can reduce the uncertainty surrounding the conduct of its business without resorting to a third party.

When dependence is mutual, which is the case in most situations of collective action, the actors are cognitively interdependent. In the context of a given work organization, two actors are cognitively interdependent when they cannot do their job without a commitment to their partner or the partner must provide them with important information. This interdependence developed because there may have been some “material” that caused the inability of an actor to perform a goal, such as one having to move a large object or acquire information on a vast topic. The physical inability to achieve a goal on time justified the establishment of a structural interdependence and work organization that provided, in principle, the necessary “resources”; however, at the same time, it generated an interdependent Cognitive between the actors involved

in this organization that required them to develop a significant system of coordination. To reduce or remove dependence, there are currently two main strategies for organizing, which have their counterparts in major socio-political systems.

The first strategy, which corresponds to organizational contexts with a strict hierarchy, is to remove the cognitive interdependence by making certain players strictly dependent on others. The second strategy corresponds to a strict planning context, which removes any dependence between the cognitive actors in advance by scheduling each actor's tasks. In a strictly hierarchical organizational context, we suppress the cognitive interdependence between stakeholders by creating a dependency between some radical cognitive actors vis-à-vis others (hierarchical). Activities that are entirely dependent on the actor can be defined by the hierarchy in a completely erratic manner. For the hierarchical context, the actor is dependent on the resources available to it. Organizational contexts of “pure” strict hierarchy almost never appear in modern organizations, and assuming a hierarchical omniscience is unlikely. In the vast majority of situations, the exercise of hierarchical authority occurs through a subordinate and is in fact largely cognitively interdependent. Another strategy to remove cognitive interdependence is strict planning.

Cognitive impairment can be defined as a change in the psychopathological cognitive activities of an organization (Kempler, 2005). Combining these two concepts leads us to define the concept of cognitive dependency in reference to the status of an elderly person who needs the help of a third party to perform the necessary cognitive activities of daily living. Three dimensions emerge from this definition: 1) elderly, 2) using a third party, and 3) the need to perform the cognitive activities necessary for daily living (ACNVQ). An elderly person is a dimension that refers to gerontology, that is to say that old age is generally defined as exceeding a threshold age of 60 or 65. The need to perform the cognitive activities necessary for daily living (ACNVQ) is a dimension that entails the performance of the cognitive activities that are necessary for everyday life and thus the existence of the elderly. Using the third dimension means that the elderly person cannot accomplish ACNVQ on his or her own and that the aid must be human.

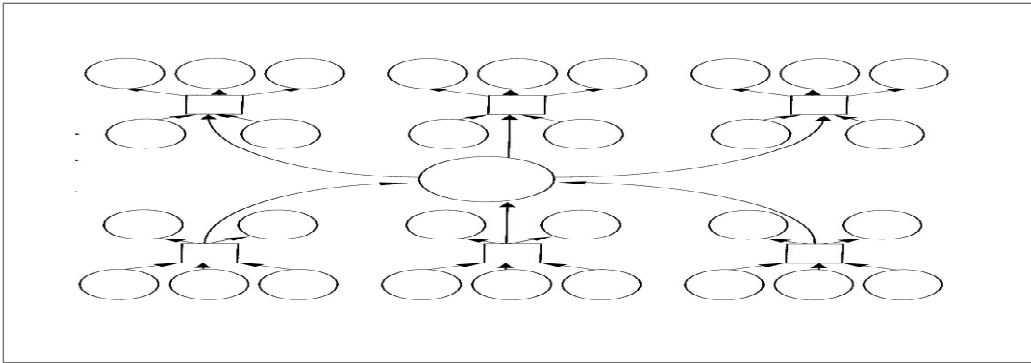


Figure 1. Systematic exploration grid

Table 1. Adjacency matrix

	Concept1	Concept2	Concept n
Concept1	1			
Concept2	L21	1		L2n
.....			1	
Concept n	Ln1	Ln2		1

3. Research Methodology

Methodological tools

I chose to examine the performances of the actors in the company by using a common technique in cognitive approaches, that of cognitive mapping. Cognitive mapping is a graphical modeling technique that has been used in numerous studies in management sciences. The cognitive map is not the only tool for analyzing managerial cognition, but it is the most popular for the presentation of cognitive structures.

Cognitive mapping is a now well-established technique that captures the minds of the players in a problem or situation. A cognitive map allows the researcher to observe certain ideas and beliefs of an individual within a complex area such as corporate governance. A cognitive map is usually defined as the graphical representation of a person's beliefs about a particular field. A map is not a scientific model based on an objective reality, but a representation of a part of the world as seen by an individual.

Description of the empirical investigation

To meet the research objectives noted above, a survey was conducted among players in companies in Tunisia. I chose an exploratory approach using multiple case studies. Through the use of multiple case studies, I aimed to create a better understanding of the phenomenon by studying the phenomenon in its natural setting. The use of case studies is particularly interesting in the case of little-known phenomena. The case studies thus allowed multiple accounts of the specificities and characteristics of corporate governance.

The data were derived from 10 firms. The decision to base my study on a sample of firms from various sectors was based on the assumption that a variety of issues could be addressed. The output is a cognitive map for the actors that reflect their perceptions of the behavioral approach to corporate governance. The method used to create the cognitive maps was the questionnaire.

Presentation of the questionnaire

The questionnaire is divided into two parts: the first identifies the company and the second addresses corporate governance. For the second part, we interviewed actors from each firm on the actor's behavioral approach to corporate governance by providing a list of concepts for each approach with systematic exploration grids and matrices. Systematic exploration of the grid is a technique for collecting materials.

Each player was encouraged to explore his own ideas or cognitive representations in relation to his strategic vision. The subject was asked to identify important factors that he believed would have an impact on the key concept related to an approach to corporate governance.

The cross-matrix is also a technique of data collection and was the basis for the construction of the cognitive map. The matrix was presented in the form of a table with n rows and n columns. The box for index (i, j) indicates the relationship between concept i and concept j .

The actors manipulated the key concepts and assigned pairs of concepts depending on the nature and degree of proximity sensed between the concepts.

Proposal for modeling cognitive maps

When it is difficult to identify the goals, an integrated approach to performance provides a holistic view whereby the performance is analyzed by the processes that lead to the performance. These representation processes represent two problems of implementation: the sharing of the representations of the actors and the identification of the dominant representations in an organization that allows the organization to act upon them. The construction of this representation necessarily requires a model that allows understanding that to act is "an action of intentional design and construction, for composition of symbols, patterns that would make a complex phenomenon intelligible perceived.

In this context, the use of cognitive maps seems relevant because cognitive maps can take into account the complexity and comprehensiveness of the system in which [the behavior] is embedded while maintaining access to the analysis" (Komocar, 1994). The value of the tool is instrumental (Audet, 1994) because it allows the actors to both improve their actions and to make sense of them.

Cognitive mapping is used as a tool for the representation of an idiosyncratic schema (Cossette, 1994), and a pattern is "a cognitive structure that guides the cutting of reality, the interpretation of events, and the actions of individuals." Each pattern is unique to each individual, showing each to have his own behavior.

The construction of the cognitive maps

First, we will present the construction of the concepts and the methodological approach. Then, we will examine how the cards were developed.

Concepts

We addressed this issue by the representations constructed by the players using the method of cognitive maps, which is a method that can be applied to poorly structured situations. An analysis based on cognitive maps can allow an understanding of the process of structuring because the model is built or rebuilt simultaneously with the mental modeling. That is, this construction takes the form of an adapting structure.

The method helps to identify ways to achieve a given goal, the same way it helps to identify the goals justifying the use of such means. Thus, the method facilitates communication and negotiation.

There are two major trends in the construction of the cards: the determination of the concepts can be ex ante or can be determined in subsequent interviews with the respondents for whom the cards are built. Komocar (1994) links the question of determining nodes - or concepts - and links to two paradigms. In the phenomenological paradigm, the universe is largely unknown. The emphasis is on describing the world from the experiences of the people who experience it.

Nodes and links are determined directly by the participants, as advocated Cossette and Audet (1994), not to avoid the subject of representations: the questions should be invitations for the respondent to verbalize his thoughts on what he considers an important subject of research (Cossette, 1994). In addition, the researcher cannot force the subject to consider every possible link because the links must be made spontaneously or in response to open questions, so that the subject constructs his own reality (Cossette & Audet, 1994). In the normative paradigm, the universe is more or less determined. The focus is on operational definitions, and the research plans must be reproduc-

Table 2. Key concepts for behavioral approach

1. Cognitive dissonance (Dis cogn)
2. Dependence (Dep)
3. Optimism (Op)
4. Overconfidence (Over c)
5. Mimicry (Mim)

ible. Observers and different participants should be able to determine the relationship between the variables and nodes.

We selected 5 concepts for the behavioral approach to the actors’ ability to describe the field of governance. We were guided in this task by a literature review and an exploratory study based on a questionnaire made up of systematic exploration grids and cross-matrices. The concepts are presented in the table below.

4. Materials and methods of structural analysis

Analysis of the results was led initially by a preliminary investigation of the perceptions of the players in the Tunisian companies vis-à-vis the stakeholder approach to governance.

This investigation was limited to the analysis of a collective cognitive map for all of the companies, which was prepared based on the systematic exploration grids completed by the actors in each company. From the cognitive maps, we identified and qualified the designs of the actors in the field of corporate governance. The development and analysis of the cognitive maps were performed using the Mic-Mac software. Our initial investigation focused on two elements: the relative importance of the concepts and an analysis of the dynamics of the influence / dependence concepts (or variables) in the cognitive universe of the players in the companies. The relative importance of the concepts was evaluated from the MIC. The Mic-Mac program allowed us to rank the concepts as “balance” and “dependency.”

Overview of structural analysis method

The main objective of structural analysis is to identify the most important variables in determining the

evolution of the system. Inspired by graph theory, structural analysis is based on the description of a system using a matrix linking all of its components. By weighting these relationships, the method highlights the key variables for changes in the system. As a tool, we opted for the software “Micmac” (cross-impact matrices, Multiplication Applied to Classification).

The first step of the MICMAC method is to identify all of the variables characterizing the system under study (both external and internal). The second step involves the linking of the variables in the construction of the matrix based on direct influence and potential. Indeed, this approach is supported by the fact that in a systemic approach, a variable exists only through its network of relationships with other variables.

From this matrix, we identify the key variables. Indeed, we obtain the classifications by the direct sums of the rows and columns. If the total connections line indicates the importance of the influence of one variable on the overall system (direct motor level), the total column shows the degree of dependence of each variable (level of direct dependence). The indirect ranking detects hidden variables through a matrix multiplication program applied to the indirect classifications. “This program allows us to study the distribution of impacts by the paths and feedback loops and therefore to prioritize the variables in order of influence.”

Matrix and processing of the MICMAC method

All of the structural analysis matrices above were established only from direct relationships between the variables. However, it is clear that a variable can also exert an influence on other variables indirectly or through another variable (“path” of order 2) or through several others exercising their influence

Table 3. Matrix of direct influences

	Dis cogn	Dep	Op	Over c	Mim
Dis cogn	0	0	0	0	0
Dep	0	0	0	1	0
Op	0	0	0	0	0
Over c	0	1	2	0	P
Mim	0	0	1	0	1

Note: The influences are rated from 0 to 3 and the ability to report potential influences: 0: No influence 1: Low 2: Average 3: Strong P: Potential

through longer and longer “paths”, and the “paths” can also loop over themselves. The classification of motor skills may be significantly altered, and understanding the mechanisms of the system similarly.

Establishing direct relations matrices for indirect paths of length two, then three ... then N would quickly become intractable.

A relatively simple mathematical processing approach (multiplication of a matrix by itself and elevation of the power matrices N) solves this problem. Benefiting from the spread of personal computers, the MICMAC method (cross-impact matrix-multiplication applied to classification) is a commercial version. As expected, the rankings of the variables by motor / decreasing influence (or dependence) generally change the matrices. However, experience has shown that these rankings become almost stable after three or four students to the power, and the importance of new variables becomes clear in terms of their indirect influences.

Analyzed at the collective level, the map is the collective model of the mental representations of several people on an identified research topic. In some cases, the cards were developed by the collective aggregation of individual cards, and in other cases, the cards were developed directly by building a group card. In the first case, the card is called a collective, and the composite map is constructed by superimposing individual maps (Bougon & Komocar, 1994; Ford & Hegarty, 1984). In the second case, the cards are called strategic, and more individual cards must come together to create a community card. The card then seeks to map the shared perceptions of a group of individuals on a particular area.

PRESENTATION OF VARIABLES

LIST OF VARIABLES

Cognitive dissonance (Dis cogn)
Dependence (Dep)
Optimism (Op)
Overconfidence (Over c)
Mimicry (Mim)

THE INPUT

This step was designed to compile a matrix of direct influence between the variables in a scoring session. The matrix of direct influence (MID) describes the relationship of direct influence between the variables defining the system, and the Matrix Influences (MIDP) represent the potential direct influences and dependencies between the existing and potential variables. The scoring has developed as the input matrix a “matrix of direct influences (MID). The influences are rated from 0 to 3, with the ability to report potential influences.

MATRIX OF DIRECT INFLUENCES (MID)

The matrix of direct influence (MID) describes the relationship of the direct influences between the variables defining the system.

MATRIX OF DIRECT POTENTIAL INFLUENCES (MIDP)

The Matrix of Direct Potential Influences (MIDP) represents the potential direct influences and dependencies between the existing and potential variables.

It complements the MID matrix and also takes into account possible relationships in the future.

Table 4. Matrix of potential direct influences

	Dis cogn	Dep	Op	Over c	Mim
Dis cogn	0	0	0	0	0
Dep	0	0	0	1	0
Op	0	0	0	0	0
Over c	0	1	2	0	P
Mim	0	0	1	0	1

Note: The influences are scored from 0 to 3: 0: No influence 1: Low 2: Average 3: Strong

Table 5. Characteristic of MID

Indicator	Size of matrix	Number of iterations	Number of zero	Number of one	Number of two	Number of three	Number of P	Total	Fill rate
Value	14	2	149	19	14	10	4	47	23,97959%

Table 6. Stability of MID

ITERATION	INFLUENCE	DEPENDENCE
1	104%	105 %
2	98 %	105 %

5. Results of the study

DIRECT INFLUENCES

Characteristic of MID

This table shows the values for 0, 1, 2, 3, 4 for the matrix and displays the filling ratio, which is calculated as the ratio between the number of MID values different from 0 and the total number of elements in the matrix.

Stability of MID

If it is shown that any matrix must converge to stability after a certain number of iterations (usually 4 or 5 for a matrix of size 30), it would be interesting to monitor the stability during successive multiplications.

In the absence of mathematically established criteria, we chose to rely on the number of permutations (bubble sort) necessary to classify each iteration, influence and dependence for all of the variables in the MID matrix.

Sum of rows and columns of MID

This table is used to enter the sums of the rows and columns of the MID matrix.

POTENTIAL DIRECT INFLUENCES

Characteristic of MIDP

This table shows the values for 0, 1, 2, 3, 4 for the MIDP matrix and displays the filling ratio, which is calculated as the ratio between the number of MID values different from 0 and the total number of elements in the matrix.

Stability of MIDP

If it is shown that any matrix must converge to stability after a certain number of iterations (usually 4 or 5 for a matrix of size 30), it would be interesting to monitor the stability during the successive multiplications.

In the absence of mathematically established criteria, we chose to rely on the number of permuta-

Table 7. Sum of rows and columns

N°	VARIABLE	TOTAL OF ROWS	TOTAL OF COLUMNS
1	Cognitive dissonance	6	6
2	Dependence	1	6
3	Optimism	0	5
4	Overconfidence	10	7
5	Mimicry	6	2
	Totals	77	77

Table 8. Characteristic of MIDP

INDICATOR	VALUE
Size of matrix	14
Number of iterations	2
Number of zero	149
Number of one	19
Number of two	14
Number of three	14
Number of P	0
Total	47
Fill rate	23,97959%

Table 9. Stability of MIDP

ITERATION	INFLUENCE	DEPENDENCE
1	102 %	117 %
2	91 %	93 %

Table 10. Sum of rows and columns

N°	VARIABLE	TOTAL OF ROWS	TOTAL OF COLUMNS
1	Cognitive dissonance	6	6
2	Dependence	4	6
3	Optimism	0	5
4	Overconfidence	13	7
5	Mimicry	6	8
	Totals	77	77

Table 11. Matrix of indirect influences

	Dis c	Dep	Op	Over c	Mim
Dis c	24	27	22	25	6
Dep	15	0	0	12	0
Op	0	0	0	0	0
Over c	24	36	30	26	6
Mim	36	17	18	36	6

Table 12. Sum of rows and columns

N°	VARIABLE	TOTAL OF ROWS	TOTAL OF COLUMNS
1	Cognitive dissonance	303	335
2	Dependence	58	183
3	Optimism	0	164
4	Overconfidence	359	322
5	Mimicry	240	27
	Totals	77	101

tions (bubble sort) necessary to classify each iteration, influence and dependence for the set of variables.

Sum of rows and columns of MIDP

This table is used to enter the sums of the rows and columns of the MIDP matrix.

INDIRECT INFLUENCES

Matrix of indirect influences (MII)

The matrix of indirect influences (MII) is the matrix of direct influences (MID) high power by successive iterations. From this matrix, a new classification of variables highlights the most important variables in the system. Indeed, it reveals the hidden variables through a matrix multiplication program applied to the indirect classification.

This program allows us to study the distribution of the impacts by the paths and feedback loops and therefore to prioritize the variables in order of influence, taking into account the number of paths and loops of length 1, 2, ... n from each variable in order of length, taking into account the number of paths and

loops of length 1, 2, ...n arriving on each variable. The ranking is stable in general from an increase in the order 3, 4 or 5.

The values represent the rates of indirect influences.

Sum of rows and columns of MII

This table is used to enter the sums of the rows and columns of the MII matrix.

6. Conclusion and implications of the research

This plan (figure2 annex) visualizes the concepts (variables) structuring the cognitive universe of the actors that can be projected in terms of influences / dependencies. By the distribution of the scatter plot variables in this plan, particularly in relation to different quadrants, we can distinguish four major categories of variables.

The first quadrant includes the most prominent concepts in the dynamics of thought of the actors. For the actors in each organization, the notion of “optimism” is the most dominant in their cognitions, reflecting an inten-

tion based on behavioral logic. Returning to the systematic exploration of grids for each actor, there is a balance of concepts expressing their orientation. For example, for actor1, this concept is expressed through statements such as “under evaluation,” “investment,” and “net present value” that reflect the logical level of investment. Optimistic actors, for whom the market undervalues their firms, reject positive VAN investments to be financed by external resources. This prediction formula draws the same conclusion as theories based on asymmetric information, namely, under-invested firms with cash at their disposal and an insufficient borrowing capacity.

For actor2, this orientation is expressed through statements such as “investment project,” “project cost,” “negative net present value,” and “on valuation,” which reflect a different approach based on return on investment. Optimistic actors overstate their investment projects and can invest in projects they believe will be profitable but whose NPV is negative. Therefore, optimism leads to the same result as that highlighted by the theories based on the agency relationship between managers and shareholders: managers tend to use free cash flow and debt capacity to overinvest.

The second quadrant contains the relay variables that are by definition both very influential and very dependent. In analyzing the plan influences / dependencies, there are players for the concepts or ideas illustrating the concepts of “cognitive dissonance” and “mimicry.” The third quadrant contains the dependent variables. They are both influential and not very dependent and therefore particularly sensitive. This quadrant shows the results that are explained by the variables and motor relay. Thus, there is only one variable, namely, trust. The fourth quadrant contains the variables that are simultaneously autonomous and influential, but only slightly dependent. These variables are relatively excluded from the dynamics of thought of the Tunisian companies. The plan's influences / dependencies show the existence of a single variable, namely, addiction.

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