FUTURE SRJ
FUTURE STUDIES RESEARCH JOURNAL: TRENDS AND STRATEGIES

PROFUTURO: FUTURE STUDIES PROGRAM
Scientific editor: James Terence Coulter Wright
Avaliação: Doublé Blind Review by SEER/OJS
Revisão: Grammatical, normative and of layout

ORGANIZING SCENARIO VARIABLES BY APPLYING THE INTERPRETATIVE STRUCTURAL MODELING (ISM)

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ABSTRACT

The scenario building method is a thought mode - taken to effect in an optimized, strategic manner - based on trends and uncertain events, concerning a large variety of potential results that may impact the future of an organization. In this study, the objective is to contribute towards a possible improvement in Godet and Schoemaker´s scenario preparation methods, by employing the Interpretative Structural Modeling (ISM) as a tool for the analysis of variables. Given this is an exploratory theme, bibliographical research with tool definition and analysis, examples extraction from literature and a comparison exercise of referred methods, were undertaken. It was verified that ISM may substitute or complement the original tools for the analysis of variables of scenarios per Godet and Schoemaker's methods, given the fact that it enables an in-depth analysis of relations between variables in a shorter period of time, facilitating both structuring and construction of possible scenarios.

Key-words: Strategy. Future studies. Interpretative Structural Modeling.

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ORGANIZANDO VARIÁVEIS DE CENÁRIOS COM A APLICAÇÃO DA TÉCNICA DE ANÁLISE E ESTRUTURAÇÃO DE MODELOS (AEM)

RESUMO

O método de construção de cenários é uma maneira de pensar - de forma otimizada, estratégica, baseada em tendências e eventos incertos - sobre uma grande variedade de potenciais resultados que podem impactar o futuro de uma organização. Neste estudo, objetiva-se contribuir para uma possível melhora nos métodos de elaboração de cenários de Godet e Schoemaker por meio da utilização do método de Análise e Estruturação de Modelos (AEM) como ferramenta para a análise de variáveis. Por se tratar de um tema exploratório, realizou-se uma pesquisa bibliográfica com definição e análise das ferramentas, exemplos extraídos da literatura, e um exercício de comparação dos referidos métodos. Constatou-se que a AEM pode substituir ou complementar as ferramentas originais de análise de variáveis de cenários dos métodos de Godet e Schoemaker, haja vista que permite uma profunda análise das relações entre as variáveis em menor espaço de tempo, facilitando a estruturação e construção de possíveis cenários.

Palavras-chave: Estratégia. Estudos do futuro. Método de Análise e Estruturação de Modelos.

1 INTRODUCTION

The study of scenarios is a means of dealing with situations that might occur in the future as of a limited, yet structured, list of optional events. This methodology qualifies the company in the analysis of the environment´s behavior and development along time, and also, in how to prepare itself, upfront, for one that is becoming true some.

Unlike extrapolation models that merely indicate betting on future outcomes often ground on past events, scenario methodologies give rise to an array of options, based on current trends and the volume of uncertain events the corporation shall have to deal with. Scenario methodology becomes an interesting alternative since it doesn´t look upon the situation in a tendentious manner, assuming that all shall remain unchanged over the coming years. This option might be taken into account at a study of scenarios, but the methodology suggests that one ought to ponder alternatives that might bring about major changes in the environment, such as: economic, political alterations and in the competitive front, in view of new entrant, suppliers and/or customer arrivals.

Although nomenclature, emphasis and scenario preparation sequence may vary from author to author, in general, the methodology flows along the following path: definition of objectives; identification, analysis and description of variable relations; variable status completion and consistency check; individual scenario main theme definition, based on major identified variations; and narrative construction for at least two scenarios: one to serve as reference and the other as contrast. In this study, emphasis is placed on the analysis between variables with views to verifying the application of the Interpretative Structural Modeling (ISM) method in the ordering of scenario variables.

The ISM method is characterized by organizing complex problems as of the analysis and interpretation of it´s components, ordered into a list of elements. The method enables the verification of influence and relationship between elements in a paired mode, contributing in such a manner that all aspects might be perceived and the analysis of the entire issue, better ground. Thus, the inclusion of the ISM method in the variables analysis stage of the scenario preparation method is herein discussed.

With views to comparing variable structuring methodologies, two scenario methods, duly acknowledged by the existing literature, are taken into consideration in this study: Paul Schoemaker´s and that of Michael Godet. These were chosen given that they study the structuring and relation between variables as of matrices. Whilst Godet resorts to mathematical methods and software to analyse the relationship between variables, Schoemaker seeks to correlate uncertainties as of a matrix of qualitative content, to be completed by the group that is engaged in scenario ideation.

In this study, the objective is to contribute towards a possible improvement in Godet´s and Schoemaker´s scenario preparation methods by means of utilizing the Interpretative Structural Modeling (ISM) technique as a tool for the analysis of variables.

Hereinafter, the research methodology, conceptual definitions and applications for scenarios, Godet´s and Schoemaker´s methods, the ISM methodology and it´s use in the organizing and analysis of variables, are presented.

2 RESEARCH METHODS AND TECHNIQUES

Considering this is an exploratory theme, a bibliographical research was undertaken with the analysis of tools, and examples were extracted from both literature and scenario methodologies, which might be perfected by this new approach. According to Gil (1988), one might affirm that the exploratory research´s main objective is to improve ideas or unveil intuitions. According to the author, in most cases, this kind of research requires the: identification of literature, interviews and the analysis of examples that promote comprehension. Further per Gil (1988), bibliographical research is composed of material that has already been compiled, mostly books and articles.

Although almost all studies call for this kind of approach, research has been developed exclusively as of bibliographical sources (Gil, 1988). Bibliographical research may be defined as exploratory studies that seek an improved perception and more data concerning the issue at hand. For Marconi and Lakatos (2007), bibliographical research is not mere repetition of what has already been said or written about a given subject since the new approach

concerning the theme may lead to innovative conclusions. Further to the bibliographical research of concepts listed at the end of this article, a sample comparison of methods applied at a classroom and another, extracted from the literature, is presented.

3 SCENARIOS: DEFINITIONS AND CRITICAL ASPECTS

It´s Schoemaker´s (1995) understanding, that planning per scenarios is a structured (disciplined) method for the ideation of possible futures. The author emphasizes that amongst the various methodologies to ponder the future, planning per scenarios is unique, given the capability of capturing a vast assortment of possibilities, with a high level of detailing. The scenario may be constructed as of the identification of tendencies and uncertainties to assist management in the decision making process.

Wright and Spers (2006) complement this definition by affirming that the study of scenarios enables the mapping of distinct pathways, considering what individuals believe to know about the future including events perceived as being uncertain within a specific timeframe. As far as the authors are concerned, scenario preparation is not an exercise of prediction but rather an effort to make plausible and consistent descriptions of possible future situations. Although it´s a partial and imperfect representation of what is to come, this tool must embrace the main aspects of the problem to currently support the decision making process that will ensure future objectives.

For Turner (2008) the use of scenarios ensures that the organization thinks in a systematic and strategic manner concerning the variety of potential results without the influence of it´s own biases, opinions and prior judgement. For this author, planning per scenarios supports the organization in pondering and rehearsing possible futures and avoids accommodation or fear of changing a currently favourable situation.

Given the absence of prediction and precision capabilities of other models, scenarios allow for the conjecturing of possible future situations so that the corporation may adapt to emerging phenomena, adjusting itself to events as one of those identified materializes, without calling for exceedingly detailed and costly preparations (Mc Master, 1997).

According to Schoemaker (1995), the planning of scenarios simplifies the massive flow of data into a limited number of possible states since each tells the story of how varied elements interact under given conditions. The organization of the possibilities in the form of a narrative facilitates understanding and allows for the gathering of a large volume of data to ground the scenario. In sum, scenario planning seeks to richly capture a series of possibilities, stimulating decision makers to consider changes that other methods do not comprise.

Scenarios may be utilized for individual decision making or for the anticipation of change however it´s main application is in corporate strategic planning and in the building of a common vision. They may also be employed as a communication tool within the organization.

Schoemaker (1995) emphasizes that the scenario methodology may be employed at any situation of uncertainty since it may be utilized to previously identify alert signals, evaluate the soundness of corporate core competencies, generate improved strategic options and evaluate each option´s risk/benefit. According to the author, the use of scenarios is adequate under the following conditions:

- ✓ high uncertainty in relation to the capacity of studying the future;
- ✓ many surprises occurred in the past;
- ✓ new opportunities were not perceived or generated;
- ✓ low quality of strategic thinking;
- ✓ the corporation requires a common language without losing diversity;
- ✓ there are numerous diverging opinions.

According to Turner (2008), the scenario planning process is creative, collaborative and challenges perceptions in relation to the future. Ideally it must involve multiple corporate collaborators and external agents with varied experiences and points of view.

Ribeiro (1997) affirms that at least two scenarios ought to be constructed so as to reduce uncertainty. These must be:

- ✓ plausible, arise in a logical manner, in a chain of causes and effects of past and present;

- ✓ internally consistent whereby events within each scenario are to be built along correct lines of rationale;
- ✓ relevant to the user´s concerns, allowing for the generation of comprehensible and innovative ideas, providing adequate means for the testing of future plans, strategies or corporate orientation;
- ✓ new and original vision of themes and selected questions on the corporation´s agenda;
- ✓ transparent, facilitating the capturing of it´s logic.

According to Schoemaker (1995), as of the 70´s, companies - such as Royal Dutch Shell, which present a steadily improved performance in oil prospection in relation to it´s competitors – employs the scenario method as part of their process to generate and analyse strategic options.

In suit, the scenario preparation method proposed by Godet and the scenario preparation method proposed by Schoemaker, are described.

3.1 THE SCENARIO PREPARATION METHOD PROPOSED BY MICHEL GODET

Godet´s method, described by Ribeiro (1997), is based on the identification of scenario priority issues, which include the identification and projection of key variables and of players as determined by the same, that is, by the *stakeholders* involved with the system for which the scenarios were prepared.

According to Ribeiro (1997), the interaction and relations of power between players and variables result in the system dynamics towards the possible futures. The description of the system scenarios under study is based on the most probable evolution of key variables and in the behavioral hypothesis of the players. Ribeiro (1997) decomposes Godet´s scenario method into the three blocks henceforth described:

- ✓ Construction of the historical and analytical base: it´s the representation of the system´s current status and includes the identification of key variables and of the group of players.

- ✓ Exploration of the field of possible evolutions: building block that results from the reduction and study of uncertainties. Following Godet´s method, a morphological analysis is undertaken by decomposing the system into combinations, as from essential item study or estimates concerning the probability of occurrence of different combinations.
- ✓ Scenario preparation: description of possible variable and player final states and of one path that might lead from the current status to that desired.

3.1.1 Construction of the historical and analytical base

Prior to the start of the scenario work itself, Godet suggests that time be set aside for the pondering of the issue at hand. Ribeiro (1997) calls this dynamics "Ateliers of outlooks", whereby project participants come together at a workshop to ponder, criticize and emulate the scenario approaches to be applied.

Within the first block of Godet´s method, the objective is to generate an image of the current system status and perform a preliminary diagnosis of factors related to it´s dynamics. According to Ribeiro (1997), such an image ought to be: detailed and qualitatively and quantitatively in-depth explored; comprise economy, technology, ecology and other issues; and also be self-explanatory before all system evolution mechanisms. This block divides itself into four stages: system delimitation, structural analysis, current and retrospective analysis and analysis of the group of players and their relation with key variables.

- ✓ System delimitation: pertains to the description and framing of the system at study within the general context, that is, before the political, economical, technological, etc., environment. At this stage, an as complete as possible list is complied of the variables to be taken into consideration (quantitative or not), so as to frame a more ample perspective of the system. As from this list, variables are classified according to their standing, namely internal (these characterize the phenomena at study) or external (characterize the environment within which the phenomena is comprised).

- ✓ Structural analysis: classifies variables according to their role within the system and determines key variables. Structural analysis comes to effect once the relations between variables is established; first, analyzing the relationship between internal and external variables; second, measuring the relationship between them in terms of levels of intensity; all performed by means of matrices. As a result, one expects to classify each variable in terms of motricity (influence that a given variable has over the remainder) and dependency (incoming influence this variable is subject to, as originated by the others). Given this classification a motricity/dependency map with five types of variables, is constructed:

  1st driving variables: highly influential and minimally dependent, amongst which external variables are to be found;

  2nd relay variables: simultaneously highly influential and dependant. Amongst these, according to Godet, key variables are to be found;

  3rd result variables: minimally influential and highly dependant, their evolution resides in the behavior of preceding variables, most often of internal nature;

  4th minimally dependant and minimally influential variables: according to Godet, these are the "heavy trends" or factors of relatively autonomous development. They do not determine the future and may be excluded; and

  5th moderately driving variables: these are considered as taskforce variables since, in principle, it´s not easy to determine their role within the system.

  According to Godet, pondering the direct relationship between variables is not enough given that this conceals indirect relationships that might change the position of a given variable in the motricity/dependency map. The application of the MICMAC method allows for the pinpointing of variable classification considering direct, indirect and potential relations. MICMAC is a specific software that

treats variables, prepared by Godet, that potentializes (usually to the fourth or fifth) the structural analysis matrix seeking hierarchy stabilization between variables. The end result of completing the matrix into a map of direct influence/dependency contributes towards the identification, in graphical format, of driving and key variables at times of scenario structuring. Displayed on a structural analysis matrix and examined as of a motricity/dependency perspective, these variables allow for the construction of a graph that presents the structure of relationships between major variables or group of variables, emphasizing it´s strength by resorting to colour or size of the arrow that brings them together. Along this study, an example of this approach is presented.

- ✓ Current and retrospective analysis: studies the current system and it´s historical evolution, identifying: determinant players for system evolution, invariants (elements that are supposedly permanent within the horizon under analysis), heavy trends (movements that impact a variable for a long period of time) and facts that carry the future (less perceivable elements at present but that might become heavy trends in the future).

- ✓ Analyses of the group of players and their relationship with key variables and possible relation with the system´s evolution as a whole: builds a picture of players and identifies issues and strategic objectives as to their pertinence. Each player´s positioning before strategic objectives is analyzed by means of a matrix with views to pinpointing convergences and divergences between each pair of players. Thus one may multiply the matrix to visualize, in a clearer manner, direct and indirect player influences so as to give rise to an influence/dependency plan and the determining of four groups of players, classified along the same line of thought as that employed for variables: dominant players, relay players, autonomous players and dominated players. As of this classification and refinements, one may analyse eventual alliances and conflicts between players, in as much as strategic issues and objectives are concerned.

3.1.2 Exploration of the field of possible evolutions

This item prepares the elements that shall constitute the base for the preparation of scenarios as of the previous block´s findings, working with the system evolution mechanisms. After defining the variables and key issues, one ought to work with uncertainties and probabilities regarding the future state of previously defined items. This block comprises two stages: morphological analysis and definition of combination probabilities.

- ✓ Morphological analysis: selection of the most important variables and future hypothesis that might give rise to a large number of potential scenarios. Morphological analysis groups key variables and key stakeholder issues so as to define possible states that might reflect on the future. Subsequently, a list of combinations of these future states is prepared, analyzing the set of restrictions and incompatibilities that render the combining of certain future states, impossible. Thereafter, a combination matrix including the identification of most contrasting combinations (and that deserve further analytical detailing) is built since these shall face another selection stage that involves the allocation of probabilities.
- ✓ Combination allocation of probabilities: prepared as of the cross impact method that requires seeking expert advice as to the use of the MIC Prob-expert software, proprietary to Godet. During the initial analysis, with the supporting software, experts evaluate each combination´s probability of occurrence. Those of greater average probable outcome are considered core hypothesis. Upon second analysis, experts evaluate if these central hypothesis´s probabilities shall or not be conditioned to other events. Subsequently, the expert´s probability average is calculated for each set of combinations to determine the most probable and thereafter, build the scenario networks.

3.1.3 Preparation of scenarios

The final block of Godet´s methodology comprises two stages: perfecting of scenario "final images" and construction of a sequential narrative.

- ✓ Improving the "final images" of the scenarios that were chosen during the allocation of probabilities: this refers to the development of the reference scenario that corresponds to the set of combinations presenting the greater probability of occurrence and to the building of at least one contrasting scenario that comprises those of lowest probability, differing from the reference scenario. In this task, invariant elements are to be included as is also the case concerning the effects of past trends.
- ✓ Construction of a sequenced narrative: for every given scenario, the path should be described in a logical manner, as of the current situation, right until that of the "final images", as setforth in the previous step, emphasizing ruptures and changes that will appear in each scenario.

Next, Schoemaker´s scenario preparation method is described.

3.2 THE SCENARIO PREPARATION METHOD PROPOSED BY PAUL SCHOEMAKER

Schoemaker´s methodology is not supported by software or mathematical models as per that of Godet. Schoemaker (1995) presents his method by surrounding major scenario possibilities into ten stages, in a simple and didactical manner, as henceforth described:

1st Scope definition: the environment that will be analysed (products, markets, geographical area, technologies, etc.) and the reference of time are determined (which also depends on the field of interest, competitor intents, product life cycles, etc) for subsequent tailoring per segment. In Schoemaker´s examples, there are scenarios for an advertising agency with a seven year horizon and for a crude oil company, with a 50 year outlook.

2º Identify major stakeholders: who are the most interested parties in the job concerning scenarios? Who shall be impacted by it? Who might influence it? According to the author, the major stakeholders

might be identified as of these queries. Current roles, interests, positions of power, how and why these aspects have changed along time all ought to be identified.

3rd Pinpointing of basic trends: which political, economic, technological, legal, industrial amongst other tendencies, might impact items identified in the scope? A brief explanation of each trend is prepared informing how and for what reason it might tend to influence the organization. It´s worth noting that trends must be consistent with the proposed timeframe. Items that generate disagreement in relation to the impact or influence they might have on the organization ought to be treated as uncertainties, not as a trend.

4th Identify key uncertainties: which events of uncertain outcome will significantly impact issues that pose core corporate concerns? Political, economic, environmental, legal, technological and other factors ought to be taken into consideration. Prime possibilities for each uncertainty are to be listed (existing technology or not, consumers acknowledging the price or quality value, etc.). The relationships between these uncertainties such as, for instance, inflation and unemployment levels, must also be identified. The author emphasizes that only plausible combinations must be considered. At this stage, Schoemaker (1995) resorts to a correlation matrix that analyses the interrelationship between uncertain variables. Each uncertainty is compared to the others and on the matrix the correlation between uncertainties is positive, negative, uncertain or inexistent. Figure 1 presents the author´s example. Attention is drawn to the fact that the matrix is only half complete given that the correlation between variables is identified irrespective of the direction/order of uncertainties. According to the author, there are other more sophisticated manners of evaluating conditional probabilities, but this matrix model is a simple and practical way of evaluating the consistency of a scenario.

Part B Correlation Matrix

	U_1	U_2	U_3	U_4	U_5	U_6	U_7
U_1	X	+	?	0	+	+	0
U_2	X	X	+	+	+	+	+
U_3	X	X	X	0	?	+	0
U_4	X	X	X	X	+	+	–
U_5	X	X	X	X	X	+	?
U_6	X	X	X	X	X	X	+

X = These entries were already estimated via their mirror image above the diagonal.

Figure 1: Correlation matrix

Source: Schoemaker (1995).

5th Build scenario initial themes: these are built as of the analysis of trends and uncertainties. There are different approaches to define themes such as, for instance, a simple analysis of positive and negative elements (that might shadow opportunities or innovations if treated under negative connotations); combinations of variables that once grouped, may display themes or initial themes may arise from the crossing of major uncertainties raised in the previous item, where the author mentions techniques that demonstrate how some uncertainties are clearly more relevant than others.

6th Verify consistency and feasibility: there must be internal consistency and fluidity between combinations of variables. According to Schoemaker (1995), the verification of internal consistency may be taken to effect as of trends, outcome combinations and as of stakeholder reaction. First: are trends are compatible with the chosen timeframe? Second: scenarios combine uncertainty results that cannot be placed together (inflation zero and unemployment zero)? Third: those that express greatest interest are placed in positions that they´d disapprove and might alter (OPEP will not withstand the low price of crude oil)?

7º Develop learning scenarios: it must be emphasized that the objective in a study of this nature is to identify themes that are strategically relevant and organize them around possible results and trends. Some appear in all scenarios and what varies is merely the impact that each shall have on planning, and consequently, the level of attention that will be granted to it. As of such themes, a title is given to each scenario and considering scenarios are stories, one must capture the essence of each scenario from the title, so that it is easily remembered.

8th Identify research needs: at this stage, one identifies which studies require in-depth investigation to enable the understanding of given uncertainties and trends. The learning scenarios, built as of the previous step, support the identification of points that must be further analyzed.

9th Develop quantitative models: after completing the additional research, one must examine scenario consistency once more to identify which interactions might be effected by models, so as to quantify the consequences of diverse scenarios. Models for the monitoring of prices, inflation, GNP, tax and others may be developed.

10th Involve scenarios in the decision making process: use scenarios to test corporate strategies and generate new ideas. If learning scenarios or quantitative models disclose information that was not by then detected, the previous steps must be revised. It is also important that the study be revised whenever the proposed scenarios do not promote creativity, do not bring novelty to the company or do not demonstrate how to evaluate each strategy´s risk options. To ensure the validation of the final versions of the scenarios, the author suggests a group of criteria, such as: relevance, internal consistency, description of varied different futures (and not variations of the same theme) and preparation of the company for the upcoming future.

Finally, Schoemaker (1995) indicates that scenarios must cover an ample assortment of possibilities, emphasizing opportunities within and outside the organization whilst at the same time focuses on the interconnection and internal logic of each future. Henceforth, the ISM method is presented with views to evaluating it as a tool for the structuring of scenario variables.

3.3 THE INTERPRETATIVE STRUCTURAL MODELING (ISM)

The ISM methodology was developed as a tool to increase teamwork efficiency when analyzing complex issues. By means of this technique, the group defines a structured hierarchy with due computer support, preparing a structural model of the issue at hand.

According to Warfield (1976, apud Wright, 1989), the ISM technique is acknowledged for it´s application at times of objectives structuring, priority definition and of policies and directives ordering. This technique enables the structuring of a large amount of non-quantitative information, contributing with the analysis and decision making process regarding policies and guidelines where, usually, quantitative models do not capture many of the critical conditioners that the situation discloses (Wright, 1989).

The ISM tool extracts from the studied context, a set of issue components or elements using the computer to order, store and design logical inferences concerning the problem at hand. According to Wright (1989), the resulting model is represented by a directional graph, obtained via the application of basic topology notions, to which the group´s human judgment and the capacity of computers in processing a large amount of data to make logical inferences, is added.

The set of information required to define a structure of this nature may be represented by a binary matrix and a mathematical operation (successive Boolean potentializations), that enable transforming it to the extent of displaying all inferences and hierarchical levels contained in the original information (Warfield, 1976, apud Wright, 1989). With these procedures of logical inference, the method is able to identify relations as of replies and fill in the matrix without the group having to look into all issue items.

According to Wright (1995), a new approach to the ISM method, based on logical inference procedures, opens the path for the adoption of hues between the yes, the no and the maybe, ensuring ample application of the technique in the field of business administration. This new approach to the structuring issue resorts to a procedure of heuristic search to define the sequence of questions for the collection of information.

Wright (1995) further states that the work team's job once using ISM consists in defining the context of the problem and extracting a precise set of pertinent elements. Subsequently, the group analyses the existence of a transitive relation between pairs of elements, replying to questions placed by the computer that performs the possible logical inferences and, as of these, produces a structural model. The clear definition of problem components and their relations are extremely valuable to improve the group´s understanding of the issue, systemize member rationale and facilitate communication.

It´s worth emphasizing that the group is not required to be knowledgeable in the mathematical procedures that are employed, given the fact that that they solely analyze the relationship between pairs of elements of the issue at stake. The computer, on the other hand, performs logical inferences exclusively based on the information supplied by the group, minimizing the number of questions required to determine the structural model.

According to Wright (1995), the method´s resulting structural model facilitates communication, visualization, model interpretation and structure rationale mechanisms. During the process, participants clearly perceive that results derive exclusively from the information they supplied without any interference from the computer, in terms of content.

The above presented concepts corroborate with the idea that the method enables the structuring of any type of complex issue as of a list of elements related to the problem, which in turn leads to the inference that ISM might successfully substitute the structuring stages of scenario variables laid forth by Schoemaker and Godet. This matter is next discussed.

3.3.1 Application of ISM in scenario methodologies

Within the scenario preparation methodology, the ISM technique is particularly useful during the structuring of variables stage, whereby the interaction and relationship between them calls for analysis. The tool may,

according to the group of analysts, characterize, in a more practical manner, the relationship between each variable given that the methodology allows for the completion of the matrix in an intelligent manner, without directing all queries to the user. This occurs because the software automatically fills in the positions on the matrix from which logical inferences may be extracted from replies that have already been collected. This benefit accelerates the completion of the matrix and reduces the respondent group´s level of effort, thus maintaining their focus on the queries that truly require analysis and replies.

Furthermore, the method simplifies the task, organizing the completion of the analysis of variables via a hidden matrix. Instead of filling in a square matrix that will be sized according to the volume of scenarios, the user responds to questions that investigate the interaction between two variables, without having to visualize and fill in a matrix - a task performed automatically by the software. This mode of presenting and analyzing the relationship between variables also facilitates the application of this exercise in a group format, given that the ISM drives analysis variable per variable, focusing the group discussion on the two variables at stake. Another benefit that arises resides in the fact that during ISM structuring, variables are displayed in a graphical format, clearly presenting cause and effect relationship or hierarchy between variables, emphasizing which variables are causational (drivers), intermediate or resultant.

It´s quite evident that MICMAC´s variable analysis generates motricity/dependency maps and useful and interesting graphs that, despite not identifying the driving and resulting variables, do depict the strength of relationships between them and allow for the comparison of differences between each relationship. However, the fact that the ISM method provides similar results within a single structure ensures friendly application. The belief resides in the fact that it ought to be simpler to complete the matrix in the form of questions using the ISM as opposed to filling in a numerical matrix, item by item, utilizing mathematics-based software, such as Godet´s MICMAC.

Yet another point of comparison between the ISM and Godet´s and Schoemaker´s methods, is that a matrix may not be intelligible to all that work with the structuring of variables, especially if there are a large number of items. In this case, ISM´s format of questions and answers continues to be advantageous since it hides the filling in of the matrix performed automatically by the computer.

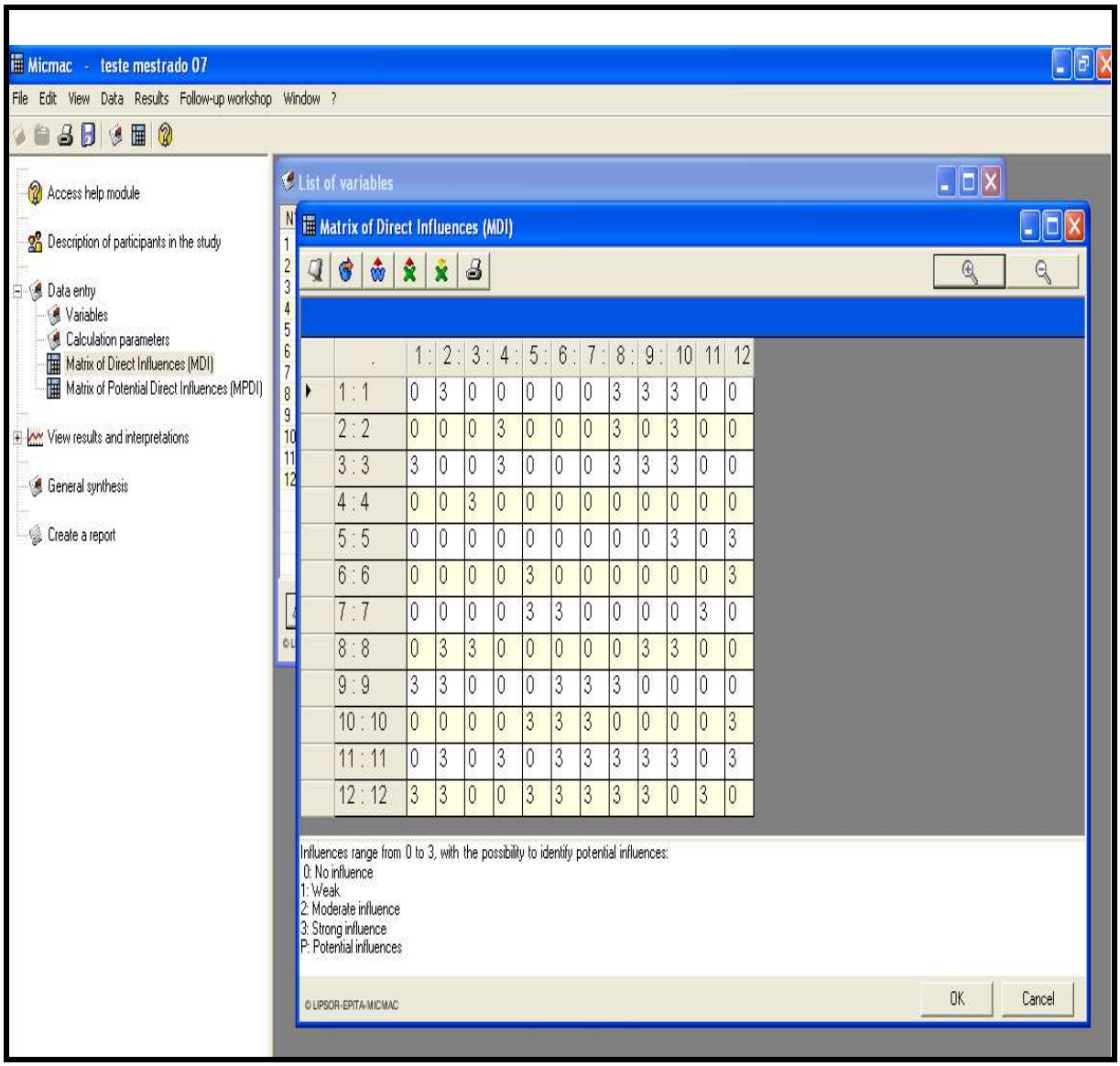
To clarify the points herein discussed, subsequently, the results of a comparison exercise between previously described methods and a practical example of the application of ISM in the structuring of scenario variables, is presented.

4 EXAMPLE: COMPARISON BETWEEN SCENARIO STRUCTURING METHODOLOGIES

The 2007 second semester class group attending the Technological Evaluation and Forecasting discipline offered by the University of São Paulo´s post graduate course in Administration, under the supervision of Prof. Dr. James Wright, studied numerous scenario preparation methods. Students were granted the opportunity to simulate the construction of scenarios, utilizing and comparing methodologies. The purpose of the simulation exercised on site was to build scenarios to discuss the future of higher education, foreseeing support to the University of São Paulo´s Faculty of Economics and Administration Department´s (FEA/USP) strategic planning, until 2015.

In this simulation that focused on the structuring of variables - which is the subject matter of this study- the students themselves, under the Professor´s guidance, promoted a discussion to define the scope and raise the scenario´s variables. With the twelve duly defined variables, hands-on experience was acquired given the opportunity to verify the differences between the structuring of scenario variables by applying Godet´s MICMAC and Wright´s ISM methods. It´s worth noting that Schoemaker´s technique was not taken into consideration for the purpose of this example because it´s application, though relatively simple, compares variable per variable within a correlation matrix without the use of specific software.

As can be seen from Figure 2, entries into the MICMAC software are performed by means of a matrix that enables the comparison between all variables, considering that each is identified by a number. On this matrix, weights according to the strength of the relationship between variables are allocated.



.	1 :	2 :	3 :	4 :	5 :	6 :	7 :	8 :	9 :	10	11	12
1 : 1	0	3	0	0	0	0	0	3	3	3	0	0
2 : 2	0	0	0	3	0	0	0	3	0	3	0	0
3 : 3	3	0	0	3	0	0	0	3	3	3	0	0
4 : 4	0	0	3	0	0	0	0	0	0	0	0	0
5 : 5	0	0	0	0	0	0	0	0	0	3	0	3
6 : 6	0	0	0	0	3	0	0	0	0	0	0	3
7 : 7	0	0	0	0	3	3	0	0	0	0	3	0
8 : 8	0	3	3	0	0	0	0	0	3	3	0	0
9 : 9	3	3	0	0	0	3	3	3	0	0	0	0
10 : 10	0	0	0	0	3	3	3	0	0	0	0	3
11 : 11	0	3	0	3	0	3	3	3	3	3	0	3
12 : 12	3	3	0	0	3	3	3	3	3	0	3	0

Figure 2: screen captured from Godet´s MICMAC software.

Source: Prepared by the author based on the MICMAC software.

Once relationships are identified and pondered, the arrangement of variables on the MICMAC´s influence/dependency map becomes apparent. The direct influence map presents the design constructed with the values that were placed on the matrix, whilst the map of indirect influence/dependency shows, in a clearer manner, the position of variables after successive interactions, as a result of the use of software. Without applying the interactions of the software, some variables remained in a position that induced doubt in relation to its characteristics. After the interactions, all variables are clearly displayed in regions of the map, enabling classification, as depicted in Figure 3.

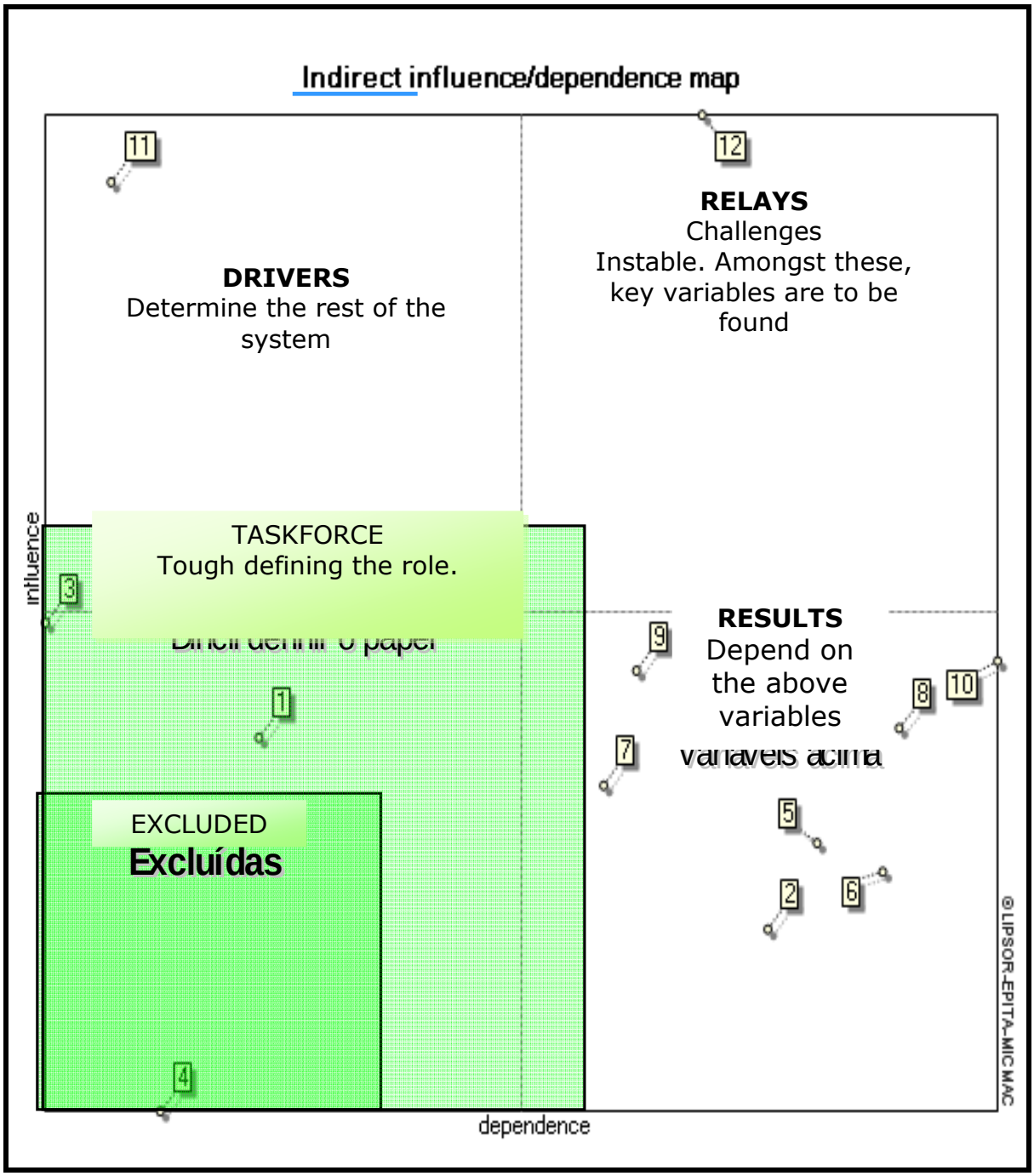


Figure 3: Indirect influence and dependence map

Source: Prepared by the author, adapted as of Godet´s MICMAC software

Figure 4 depicts the same variables displayed in an influence graph where, as labelled, the strongest relations between variables become apparent. It´s to be noted that the twelve variables are not pictured in the graph since if all that present weakest relations were to be included in this example, the graph would become polluted, one of this system´s disadvantages.

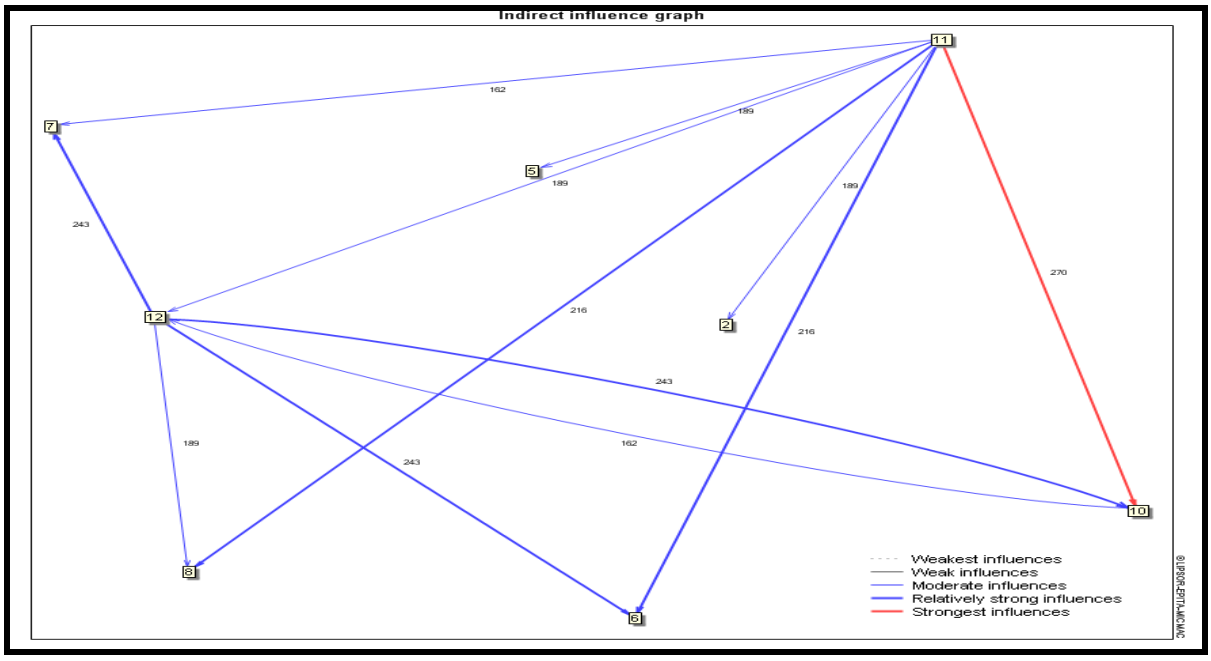


Figure 4: Indirect influence graph

Source: Prepared by the author, adapted as of Godet´s MICMAC software.

On the other hand, under ISM´s treatment, input occurs as of question and answer mechanisms. The matrix is completed in a hidden manner by the computer whilst participants are answering to questions posed by the software as presented in Figure 5.

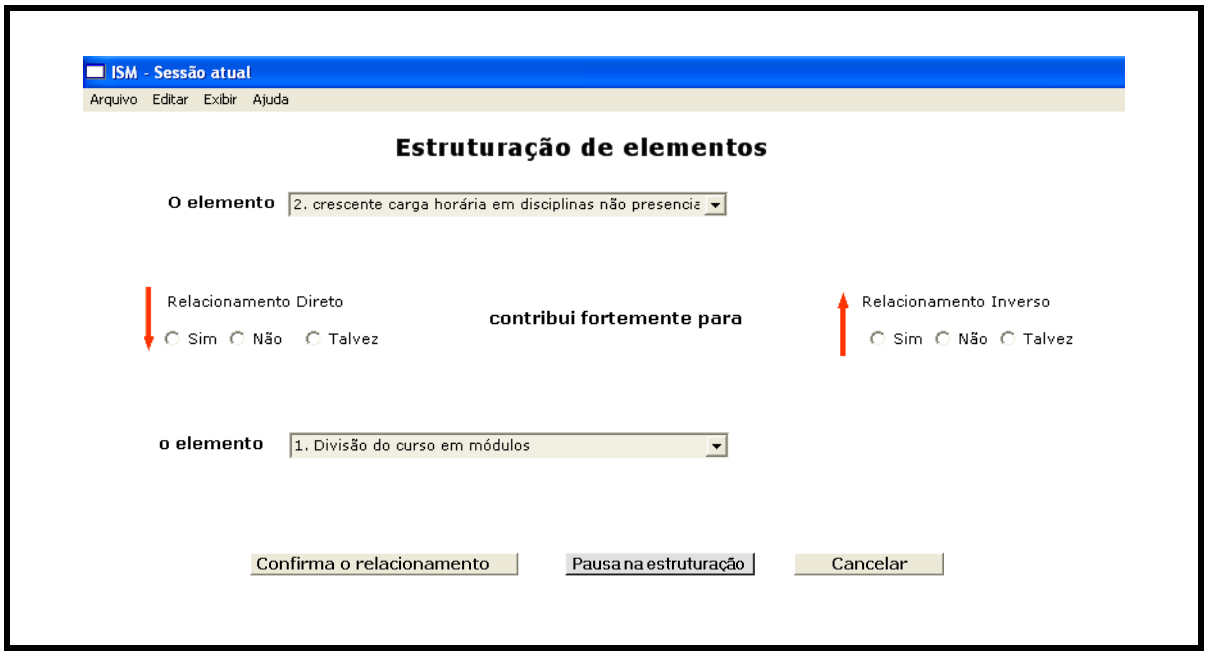


Figure 5: Element structuring

Source: Prepared by the author, adapted as of Wright´s ISM software

The software´s output enables the construction of a map, as represented by Figure 6. If, on one hand, the quantification of the strongest or weakest relations is not emphasized, on the other, all variables are presented in an intuitive manner so that base intermediate and resulting variables (or drivers, according to Godet´s nomenclature) may be identified.

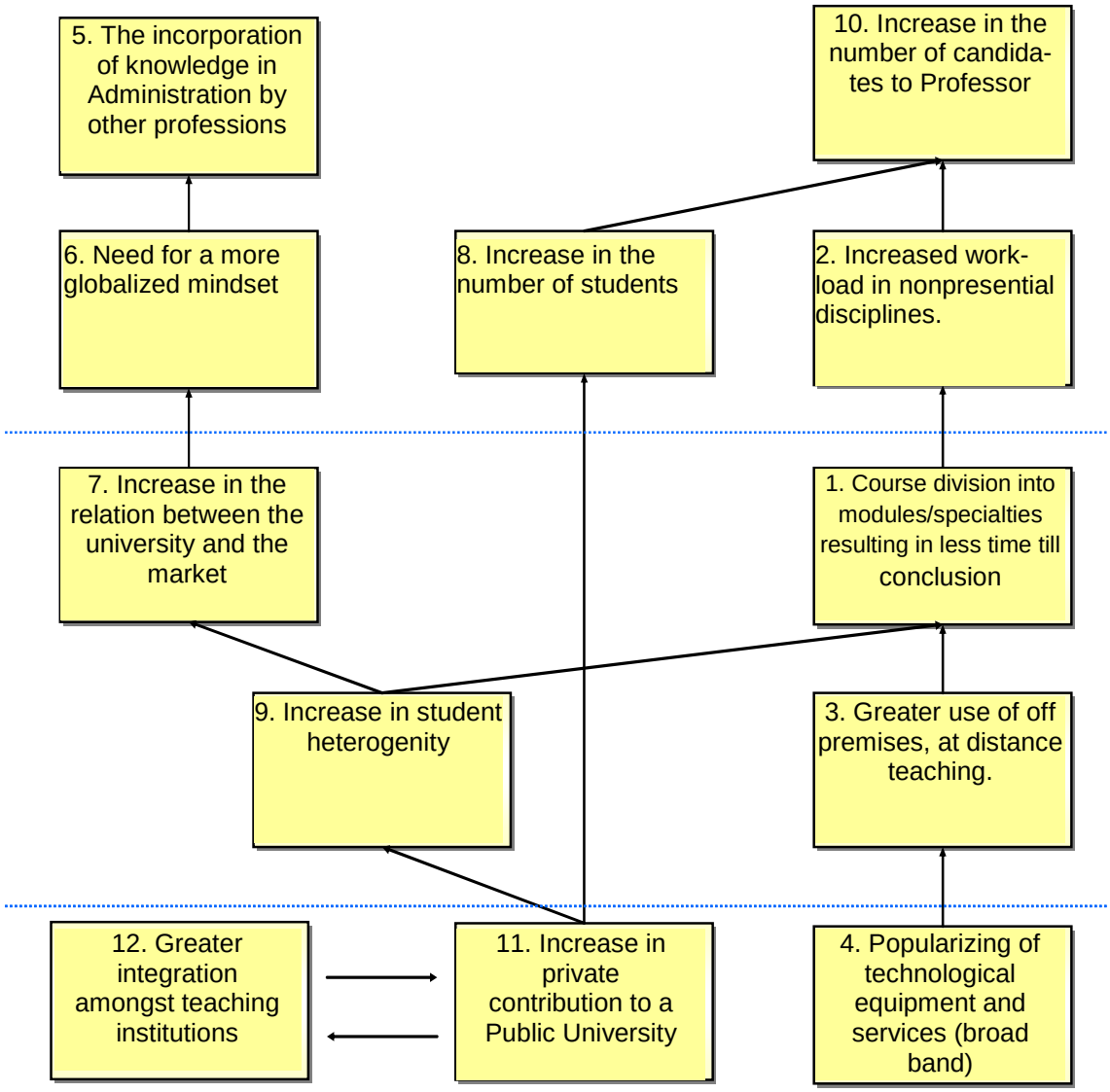


Figure 6: Scenario variables map

Source: Prepared by the author, adapted from Wright´s ISM software

By presenting this example the expectation is that an improved picture of differences between methods will have been provided. Next, together with the final considerations, a sample case of the application of the ISM as scenario variable builder is supplied.

5 FINAL CONSIDERATIONS

In a world of increasing uncertainties, the scenario method is an optimized thought mode concerning a large variety of potential variable results that may impact the future of an organization. This methodology is sufficiently flexible to be used in partnerships with other strategic tools so as to provide a perspective of the future that supplies greater support to the taking of decision´s today.

In this study, amongst the various scenario building stages and methods, the organization and analysis of variables was emphasized, envisioning a contribution to a possible improvement in Godet´s and Schoemaker´s techniques given the use of the ISM method of structuring complex problems as a tool for the analysis of variables.

According to Wright (1995), this methodology may be applied in diverse fields of business administration. In this study, it was verified that the analysis of interaction between the elements of the ISM matrix may also help support some methodologies of future scenario building.

For the purpose of illustrating the application of ISM in the structuring of scenario variables, captured from literature, it´s worth mentioning the experience "Brasil 3 Tempos". In 2002, the Institute of Advanced Studies of the University of São Paulo (IEA/USP), in attendance to an invitation placed by the Brazilian government, via the Strategic Themes Nucleus of the Republic´s Government & Strategic Management´s Bureau, took part in a project concerning the preparation of scenarios for Brazil, named Brazil 3 Timings: 2007, 2015, 2022" (Br3T). According to Polesi (2006), the Br3T project aimed at producing a State Policy Document-Plan comprising strategic objectives to direct the country´s progress for the XXI Century.

This Plan was built as of the preparation of future scenarios by a relatively closed and limited group of specialists, followed by a public survey addressed to approximately 50 thousand Brazilians (encompassing political, economic, social and intellectual leaders). Amongst various scenario preparation study dimensions (amongst which: economic, environmental, knowledge and socio-cultural), the IEA was held accountable for two, namely: one pertaining to political party institutions and the shaping of Brazil´s democracy (Institutional Dimension); and another concerning the future of the international situation and it´s effects in Brazil (Global Dimension).

The chosen approach for the preparation of these scenarios followed the method prepared by the Future Studies Program (*Profuturo*/FIA) that, in given aspects, closely resembles Godet´s and Schoemaker´s techniques, especially in as much as the treating of variables is concerned, the reason that renders the citation of interest to this article. According to Wright and Spers (2006), the complexity of the proposed study, once added to the involvement of researchers of diverse fields with differing points of view, drove the team to applying the ISM tool so as to support the structuring activity.

At this stage, the authors mention that the ISM technique was employed as of the interrelationship between variables matrix, obtained upon consulting specialists. In this case, the project coordination team, with the assistance of the software, took charge of structuring points raised by 200 specialists for the analysis of future situations developed by the groups concerned with the two Dimensions. As of the processing of information and the consultation with specialists, the logical relationship between analyzed variables came to light.

During the compiling of the morphological matrix stage, to combine the future states foreseen for each scenario variable in a consistent manner, ISM was utilized to structure the variables. The structure of relationships between the variables was of great value at the time of describing each variable´s possible state given that the ISM´s graphical presentation depicts the relationship and the path of the cause variables in a clearer and more direct manner.

Thus, with the support of ISM, four scenarios for each dimension were built to support the directives for Brazil in the XXI Century, demonstrating that the opinions of several specialists concerning an extensive number of complex variables can be integrated to ideate a set of plausible and consistent scenarios.

As discussed, the ISM methodology may be employed to support techniques such as those of Schoemaker or Godet, replacing or complementing their scenario variable analysis tools, yielding interesting results concerning the relationship between variables, facilitating structuring towards the construction of the various scenarios. The interface that analyses two variables at a time (via questions) concealing the design of a matrix and logical inference procedures which accelerate the analysis are some of the advantages of the ISM method versus the scenario techniques studied.

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