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Doctoral Thesis

Management Games for Research on Strategy:
Evidence of Team Diversity and R&D Orientation as Moderators of Consensus-Performance Relationship

by

José Henrique de Lima Corrêa Dieguez Barreiro

Ind. Eng. State University of Rio de Janeiro - Brazil
M.Sc. Ind. Eng. Federal University of Rio de Janeiro - Brazil

DIRECTORS:

Prof. PhD. Javier González-Benito

Prof. PhD. Jesús Galende del Canto

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Tesis Doctoral

Juegos de Empresas e Investigación en Estratégia:
Evidencia sobre la Diversidad del Equipo y la Orientación a la I+D como Moderadores de la Relación Consenso-Resultado

AUTOR:

José Henrique de Lima Corrêa Dieguez Barreiro

Ing. Ind. Universidade do Estado do Rio de Janeiro - Brasil
M.Sc. Ing. Ind. Universidade Federal do Rio de Janeiro - Brasil

DIRECTORES:

Dr. Javier González Benito
Dr. Jesús Galende del Canto

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DEDICATORY

To my wife Karla, my son Lucas and my daughter Érica.

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Directors

Prof. Javier González-Benito, Ph.D.

Prof. Jesús Galende del Canto, Ph.D.

ABSTRACT

This doctoral thesis deals with management games as a method to be employed in empirical research on strategic management. We believe that management games, as a kind of laboratory experiment, are underestimated in management in contrast to other sciences. The general aim of this thesis is demonstrate the viability of management games to access valid data for empirical experimentation in the field of strategic management. Specific aims include: (a) to provide an extensive theoretical study on the use of management games; (b) to describe the experience in the development of a management game; and finally; (c) to apply the developed management game on empirical studies related to strategic consensus, top management team diversity and firm R&D strategic orientation. The general results indicate that management games could play an important role in building theories, helping the researchers by replicating and criticizing prior field research; testing new conditions and variables by controlling the experiment; and proposing new alternatives for visualizing models and correlations among variables and constructs. The experiments indicate that the developed management game facilitated the test of new consensus measures and the access to reliable data. The results for the consensus-performance relationship also indicate that: (a) the bivariate consensus-performance relationship is positive and statistically significant considering that consensus were taken on sequence of decision making; (b) that consensus-performance relationship could be strengthened in presence of a task-related diversity team moderator; and (c) the firm R&D strategic orientation, an uncertain and risky issue, negatively moderates the consensus-performance relationship.

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Prof. Dr. Jesús Galende del Canto

RESUMEN

En la presente Tesis se propone a los juegos de empresas como posible método a utilizar en las investigaciones empíricas relacionadas con el campo de la dirección estratégica. Se considera que, hasta la fecha, los juegos de empresas, como experimento de laboratorio al alcance de nuestra disciplina, han sido poco explorados como metodología de investigación. El objetivo general de esta tesis es demostrar la viabilidad de los juegos con el propósito de acceder a datos válidos para la realización de investigaciones empíricas en el campo de la dirección estratégica. Los objetivos específicos incluyen: (a) la realización de un detallado estudio teórico sobre la práctica del uso de juegos de empresas en investigaciones; (b) describir la experiencia en el desarrollo de un juego; (c) utilizar un juego en dos estudios relacionados con el consenso estratégico: diversidad de equipos de alta dirección y orientación estratégica a la investigación y desarrollo. Los resultados generales indican que los juegos pueden tener un papel importante en la construcción de teorías, permitiendo replicar y criticar estudios empíricos anteriores, testar nuevas variables, controlar el experimento y proponer nuevos modelos y relaciones alternativas a la teoría existente. Los resultados empíricos indican que el juego desarrollado facilitó la prueba de nuevas medidas de consenso, además de permitir el acceso a datos fiables. Los resultados indican que: (a) la relación bivariante entre consenso y resultado es positiva y estadísticamente significativa, considerando que el consenso ha sido verificado en una secuencia de toma de decisiones, (b) la misma relación puede ser más fuerte en presencia de equipos con alta diversidad, y (c) la orientación estratégica a la investigación y desarrollo, actividad caracterizada por un alto grado de incertidumbre, modera negativamente la relación consenso-resultado.

JOGOS DE EMPRESAS E A PESQUISA EM ESTRATÉGIA:
Evidência sobre a Diversidade de Equipe e a Orientação à P&D como Moderadores da Relação Consenso-Performance

Universidade de Salamanca – Espanha
Departamento de Administração e Economia da Empresa

por

José Henrique de Lima Corrêa Dieguez Barreiro

Orientadores

Prof. Dr. Javier González-Benito

Prof. Dr. Jesús Galende del Canto

RESUMO

Esta tese de doutorado trata de jogos de empresas como um método a ser utilizado em pesquisas empíricas relacionadas à administração estratégica. Acreditamos que os jogos de empresas como um tipo de experimento em laboratório, é pouco explorado pela ciência da administração se comparado ao uso de laboratório que outras ciências fazem. O objetivo geral desta tese é demonstrar a viabilidade dos jogos de empresas com o objetivo de obter dados válidos para a realização de pesquisas empíricas no campo da administração estratégica. Objetivos específicos incluem: (a) realizar um estudo teórico extensivo sobre o uso de jogos de empresas em pesquisa; (b) descrever a experiência de desenvolvimento de um jogo; (c) aplicar o jogo desenvolvido em estudos relacionados a consenso estratégico, diversidade de equipes de alta direção, e orientação estratégica em pesquisa e desenvolvimento. Os resultados gerais indicam que os jogos podem jogar um papel importante na construção de teorias, auxiliando pesquisadores no replicar e criticar estudos empíricos anteriores, testando novas variáveis controlando o experimento, e propondo novas alternativas de visualizar modelos e correlações entre variáveis e construtos. Os resultados empíricos indicam que o jogo desenvolvido facilitou o teste de novas medidas de consenso, a o acesso confiável a dados. Os resultados ainda indicam que: (a) a relação entre consenso e performance é positiva e estatisticamente significativa considerando que o consenso foi verificado em uma seqüência de tomadas de decisiões; (b) que a mesma relação pode ser reforçada com a presença de equipes com alta diversidade; (c) a orientação estratégica de uma firma à pesquisa e desenvolvimento, um assunto com inerente alto grau de incerteza e risco, modera negativamente a relação consenso-performance.

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THESIS INTRODUCTION

About Management Games on Research Agenda

Examining the scientific literature on management, laboratory experiments are identified with ease as a method to access data for empirical research purposes. However, experiments in management sciences which effectively use them are rare if compared to other sciences like biology, chemistry, physics, and so on. Within laboratory experiments we identify the use of management games, specially developed in order to simulate firm environment, enabling the exercise of the decision-making of the players, and to evaluate the consequences of this decision-making.

Resorting to the literature in order to explain why this rareness occurs, it seems that the use of this method is underestimated. One possible explanation could be that laboratory experiments are misunderstood methods, or simply ignored by researchers given their 'lack of validity' or even their complexity to develop.

Bearing in mind the problems concerning management sciences, one of the greatest is related to accessing data from firms. The means that researchers possess to access data are basically two: (a) direct information accessed from firm subjects, direct observation or internal reports; or (b) building proxies from financial (and others) statements variables, and alternative ways like laboratory experiments.

In sum, the researcher's choice is made taking into account the rigor of the experiment in order to achieve an acceptable 'experiment validity'. The

consequences of the lack of validity could be resumed in one question: *to what extent could the result of this experiment be extrapolated to real life?*

In the literature on laboratory experiments in management, we identify two factions. On the one hand there are those authors who defend field research as the sole way to do research. On the other hand another group, who argue that laboratory experiments are a valid instrument to access valuable findings to improve the theories.

It is clear that ideal data must be directly measured within firms, observing the phenomena, specifically resorting to managers, who are the responsible to conduct the firm following a previously developed plan. However, this desirable situation rarely occurs. Despite this fact, field research methods also present lack of validity. For example, the questions formulated and respondents could present biases like: (a) do such questions really embrace the phenomena that are the objects of study? (b) did he or she who answered the question present an accurate frame of the phenomena within the firm? (c) were the answers to the questions 'in time' of the occurrence of the phenomena? Who really responded the mailed questionnaire? In sum; *is the quality of the information provided from a field research more reliable than that generated in laboratory conditions?*

Research that has been conducted on problems such as those listed above relied on laboratory experiments in order to access data. In general the experiments used case studies, traditional games (paper based) and computer based games. In most occasions the experiments used subjects like undergraduate and MBA students, and few managers enrolled in company courses. Several critiques could be identified in the literature surrounding the use of laboratory experiments in

strategic management and decision making. The main argument used to reject the validity of this kind of methodology is based on the idea that situations created by this kind of experiment do not reflect the complex business environment. That is, the experiment is a simplification of the 'real business world', as the context is created and the subjects are inappropriate to generalize the conclusions.

Within the laboratory experiments, we highlight the use of management games, in particular those developed in a computational manner. Computational management games present at least one advantage over other games and case study. Given the capacity of computer processing, it is possible design a business environment with high levels of reality-complexity, mainly because in general games are designed under the auspices of computational simulation concepts.

Despite this discussion, given the relevant number of empirical studies that relied on management games to access data, and mainly the current stage of development of management games, we believe that management games could play an important role in management science, as observed with other sciences.

Several questions could emerge as a consequence of this prior assertion, for instance:

(a) What exactly are management games? (b) What is the difference between management games and simulation? (c) What are the odds and advantages in the use of management games in management research? (d) In which specific issues of management science might management games be useful? (e) What are the advantages that could be exploited, and precautions that must be taken when

developing and using management games? (f) Is this a feasible methodology for empirical studies?

Aims of the Thesis

The general aim of this thesis is demonstrate the viability of management games to access valid data for empirical experimentation in the field of strategic management. Specific aims include: (a) to provide an extensive theoretical study about the use of management games; (b) to describe the experience on the development of a management game; and finally, (c) to apply the developed management game on empirical studies related to strategic consensus, top management team diversity and firm R&D strategic orientation.

Thesis Organization

This thesis is organized in five chapters. The first chapter is dedicated to study the use of management games on the empirical research agenda. From the specific literature and empirical experiments we attempt to explore benefits and odds on the use of this kind of methodology. Additionally we shed light over what areas and in what specific conditions management games could be useful in management research.

In the second chapter we describe a management game software named IMIS, abbreviation of International Multidivisional Industry Simulation. This software was designed in order to, firstly, be used on empirical studies related to strategic consensus and, secondly, as an educational instrument for undergraduate and MBA classes in Brazil. Design requirements take into account some specificity that is necessary to test relevant aspects suggested in the strategic consensus

literature. Additionally, they consider the subjects and situations to be used in the experiment. This specificity embraces some desirable and controllable situations in order to avoid eventual biases, thus facilitating measures and analysis.

In the third chapter we provide the theoretical background on strategic consensus, the management research streamline that will be used in the two following empirical pieces of research presented in the chapters 4 and 5.

In the fourth chapter we use the management game to access data and contrast hypotheses related to strategic consensus. Two hypotheses are develop in this chapter, one that relates TMT consensus to firm performance on a single bivariate relationship, and another which tests the moderation of TMT diversity over the consensus-performance relationship.

In the fifth chapter we develop and test a moderator variable of consensus-performance relationship named strategic orientation on R&D activities. Again, we rely on management games to contrast the moderation, and additionally in an exploratory fashion, we test the robustness of the findings by comparing the R&D strategic orientation with other orientations like marketing and quality.

Finally, we conclude this thesis by extracting some reflections about the use, design and use games to test hypotheses in the field of strategic management, and additionally some conclusions about the issues strategic consensus; TMT diversity; and firm strategic orientation around R&D activities.

CHAPTER 1

The Use of Management Games in The Management Research Agenda

1.1 INTRODUCTION

Of the multitude of fundamental problems that always come to the minds of those who militate in the academic field of organization/management is that of the scientific methodology that is more appropriate to study a certain organizational phenomenon. In sum, according to Harrison, Lin, Carroll and Carley (2007: 1230) the choices are two: (a) theoretical analysis or deduction; and (b) empirical analysis or induction.

When taking empirical analysis into account, the following problem is raised: *how to access data from real firms to empirically contrast theories?* An obvious consequence to this problem is the difficulty to decide which is the most appropriate empirical methodology (Schwenk 1982). Saunders and Thompson (1980: 125) refer to five sources of data for empirical research used in the field of management *(the insertion is ours)* (a) interviews *(direct observation)*, (b) company reports, (c) government documents, (d) questionnaires, and (e) laboratory experiment.

In an attempt to help researchers select from these options, Keys and Wolf (1990) refer to McGrath (1982) who orients the decision taking on board three dimensions: (a) the capacity of an experiment to extrapolate the results from an

available sample to an entire population; (b) the level of control and precision available to evaluate the behavior; and (c) the level of realism where the subjects (elements on study) behave.

Dealing with strategic decision-making, a specific area of strategic management, we could infer that ideally, data ought to be directly measured interviewing (or observing) 'in loco' and 'on line' those who are responsible for strategic decision: the top managers. This desirable situation unfortunately rarely occurs, as Nees (1983: 176) illustrates in her study about divestment: "divestors in Europe were reluctant to invite researchers on board, making the access to field data very difficult." A second choice is the questionnaire survey that has its inconveniences, too. For instance, there are those related to 'what to ask' and 'to whom to send', and the following problems 'who actually responded' and it 'he/she responded high after to make a decision?' Once company reports and government documents are considered, the problems that arise are related to the quality of information provided (whether the information is reliable[1]) and the availability of mainly qualitative detailed information (Harrison et al. 2007).

The last option of sources of data for empirical research listed by Saunders and Thompson (1980) is the laboratory experiment. According to Keys and Wolfe (1990), it presents similar problems to those of other research options: an inevitable 'trade off' among all three dimensions, as suggested by McGrath (1982). *But what exactly is a laboratory experiment?*

[1] We refer, for example, by those countable auditing problems that occur with Arthur Andersen and the ENRON that collapsed on December 2001. Source: "Enron executives pay out in settlement." By Doug Cameron and Bloomberg in Houston. Published: January 8th 2005 00:00h. Website of Financial Times – www.ft.com.

We could define laboratory research, in a simple and direct way, as an experiment in which a certain environmental condition is recreated in an artificial manner, and where a phenomenon can be observed, studied, and easily repeated. By laboratory research we can observe the use of limited replicas of real organizational conditions, created basically by three means: (a) games[2]; (b) case studies; and (c) management games.

Why propose this text about laboratory as an instrument for basic research? A first reason was given by Cohen and Rhenman (1961: 158) who stated that *(the emphasis is ours)*:

> "the success of natural sciences like physics, chemistry, and biology in the use of laboratory experimentation has always been a challenge to social scientists. But the *equipment* of the latter for performing laboratory experiments has been meager, and this has often been thought to be one of the major reasons preventing more rapid progress in the social sciences."

We believe that part of the *equipment* referred to by Cohen and Rhenman (1961) for the social scientist is already available, albeit misunderstood. The equipment we refer to is management games.

The general reason that leads us to believe that management games are a useful research instrument is related to the appropriate (not to say enhanced) level of accuracy, accessibility, and complexity that business games hold nowadays, basically as a result of hard background work developed since the 50's. The

[2] Games, not necessarily made by computer, created generally to investigate individuals and teams issues (e.g. games like Prisoner's Dilemma Game, see Schlenker and Bonoma 1978).

evolution of computational and software systems has transformed the technology of simulations used in management games. This transformation leads to a set of maneuverable programming tools available for social scientists.

In the following we will concentrate our analysis on management games as an instrument for research on management/organizational issues, presenting their advantages, shortcomings, precautions and suggestions.

1.2 MANAGEMENT GAMES

1.2.1 The Concept of Management Games

We begin this discussion by proposing a definition for the term management games. In the literature we can also observe references like: (a) management simulations; (b) business simulations; (c) business games; (d) game simulation; or (e) simply abbreviated as game or simulation. In this text we opted for *management games*, the term used by Keys and Wolfe (1990), two experienced authors on the design and use of management games. *But why such confusion to define a term for this issue?*

A Simulation?

An important concept that evolved from management games is linked to 'simulation'. On definitions for simulation Nees (1983: 176), referring to Abelson (1968), asserted that simulation is "the exercise of a flexible imitation of

process and outcomes for the purpose of clarifying or explaining the underlying mechanisms involved." Keys and Wolfe (1990: 308) provide us with another definition "a simulated experiential environment is a simplified and contrived situation that contains enough verisimilitude or illusion of reality to induce real world–like responses by those participating in the exercise."

Management game, in simulation terms, is a simplified replication of a business observed reality. In other words, it is a 'relaxed' simulation, as reality is represented in a simplified manner, despite simulations being designed building upon well known theoretical fundaments. As an example we cite economic theory (e.g. microeconomics) which is strictly followed to help demand modeling in business simulations (Gold and Pray 1990: 119). Then, as Nees (1983) observed, "the objective of management game is not to duplicate reality 'in vitro' but to create and observe a system that complies to the same behavioural pattern" (p. 176). In sum, management games use simulation techniques to replicate the economic, and/or industrial environment (Cohen and Rhenman 1961).

At this time, it is important to highlight the difference between management games and computational modeling (also referred to as simulation). Both rely on mathematical and computational simulation to achieve distinct objectives. Management games use simulation to artificially create a business environment where 'real' subjects (players) will be exposed and their behaviors will be observed. Computational modeling, on the other hand, uses simulation to generate models which try to explain the relations between firm data inputs and outputs, in the absence of subjects (players) except the researcher. As Harrison et al. (2007) claim *(the insertion is ours)*, "while simulation can be distinguished

from deduction and induction *(recognized methods to do science)*, it does have similarities with these other methods" (p. 1230).

A Game?

'Game' is the other concept related to management games. This could be easily observed when we include the subjects (players) in the simulation, who will be exposed to a simulation. Keys and Wolf (1990: 308) made this link between simulation for the users and their behavior stating that "management games are used to create experiential environments within which learning and behavioral changes can occur and in which managerial behavior can be observed." Babb, Leslie and Van Slyke (1966) were more specific and related management games to a complex context where players compete among each other. In their words "business games are decision–making exercises in which teams compete in satisfying specified objectives … players make sequential management-type decisions which affect their current and future positions" (p. 466). In a similar way Larréché (1987: 559) defines game as "… a tool that allows individuals to use and develop their decision-making skills in a fictitious competitive environment."

Management games, in 'players language', is a place where players (subjects) can express their behaviors and exercise their skills in a competition, making sequential decisions, individually or in teams, and where the decisions of each individual or group affect simultaneously their results as well those of others.

An additional difference between the concepts is related to game theory and management games. Game theory (based on prisoner's dilemma) is considered an important instrument to investigate conflict between individuals in a competitive/cooperative view of analysis. Cohen and Rhenman (1961), for example, argue that the mathematical approach of the game theory helps clarifying concepts, such as strategy, coalition, game value, and game solution. At the same time, they believe that management games are more effective stating "… game theory offers very little for the analysis and nothing for the solution of the very complex situations involved in many business games" (p. 134). Babb, Leslie and Van Slyke (1966) state that management games have a different approach to 'game theory'. In their words 'game theory' *(the insertion is ours)*:

> "… is normative or prescribes how 'rational' people ought to behave under specified conditions … these games *(game theory)* are generally characterized by decision making on only one variable and by players knowing in advance the 'payoff matrix' or possible results of specified decisions …" and conclude "… by comparison, these experimental games are not nearly so complex or comprehensive as business games" (p. 466).

Management Games: Simulation & Games

Babb, Leslie and Van Slyke (1966) summarized the complete vision of management games, comparing simulation to games, and raising important aspects related to this method. In their words *(the insertion is ours)*:

> "The *(management)* game is a model that represents a business and market situation. There are definite relationships between decisions made by players and game results. Some of these relationships are described to players and some must be inferred. Decisions made by one team usually influence the positions of all competing teams. Teams sometimes compete indirectly by comparing final results, where the environment is established by the game administrator" (p. 466).

Along the last text definition, we can identify and follow a list of important embedded information about management games. That information will be detailed in the sections below.

(a) Different kinds of management games. The authors refer to management games classified as *Total Enterprise or Top Management Games*, defined by Keys and Wolfe (1990: 308) as "simulations that deal with the entire organization, provide a balanced number of decisions variables in marketing, production and finance, and thus require the strategic integration of several subunits for organizational performance … (Horn 1977; Keys 1987)."[3] Another class of management games are the *Functional Business (Management) Games*, defined by Key and Wolfe (1990: 309) as "simulations that concentrate on a single subunit of the firm."

(b) Role of the game administrator. This is an important feature of management games, where there exists a game administrator who can play an important role,

[3] For an example of existing games see Keys and Wolfe (1990), Biggs (1990) and Dickinson, Gentry and Burns (2004). For a list of some management games available visit the ABSEL web site www.absel.org.

influencing to varying degrees the conditions of the game environment, for example, changing some values of macroeconomic variables; creating environment situations; encouraging subjects; and so on (Larréché 1987).

(c) Level of information provided to player. The level of information could vary according to game design and/or to the desire of the game administrator. This could facilitate the control of the environment and to test some desirable behaviors that may or may not occur among players. This is an important feature of management games for researchers (Babb, Leslie and Van Slyke 1966; Nees 1983; Keys and Wolfe 1990; and Hambrick 2007).

(d) Direct influence of player's decisions on the results. This particular aspect of the game provides an important issue related to the motivation of the players on a 'decision-result' base. Players are quickly provided with the results and feedback about their decision-making, normally a few minutes right after the decision is handled to the game administrator.

(e) Interdependence among team (players) decisions modeled by the game designer, mainly those between firms and industry. This issue is related to a 'real world' similitude where the decisions of the firms have some degree of interdependence among each other and jointly affect the firm and industry results. This aspect could be an important feature to be controlled by the game/administrator designer, who defines for instance, different levels of interdependence among firm and industry related variables, adapting the game to specific research requirements.

(f) Sequential decision making and the longitudinal aspect of decision making. This is a noticeable characteristic of management games, which provides an opportunity for researchers to study a phenomenon for which time is an important variable to be considered. Since decision makers are exposed to sequential decision-making, their decisions and their results can be followed with time. This facilitates, for example, experiments where the environment could be modified, during a certain period of time by some circumstances. In this case, results can be compared to ulterior and posterior conditions and results.

(g) Existence of decisions influencing immediate or future the results. This issue leads us to more 'real world' situations where in the present and future, for instance, advertising efforts influence firm and industry demand. A researcher could include in his/her research design, for example, disturbance effects over player decisions and results, taking this into account.

To conclude this section, we are reminded of Biggs (1990: 24) who observed "in computerized business games, game players (participants, students) assume the role of decision-makers in organizations." In our understanding, it is important to highlight the role of computers in facilitating the firm-reality complexity, and the game administrator's role, in generating faster and more reliable results, if compared to games without computer assistance.

1.2.2 The Role of Management Games on Research

Despite this appreciated preliminary discussion on management games, it is important to remember that the primary objective of management games when

they were first created in the late 1950s was for educational purposes. As part of this objective, researchers who militate in this field state that the main goal of this methodology was to produce a 'dynamic environment' by the use of computer programming. They believe that this provides a perfect environment to exercise 'complex strategic management'. Over this 'dynamic' and 'complex' stream there is a secondary objective identified by researchers who effectively used it: management game as a research instrument (Cohen and Rhenman 1961). Dickinson, Gentry and Burns (2004) study identified research related to management, which used business game to acquire data for empirical tests, the earliest of which by Cangelosi and Dill (1965). More recently we identified two articles. One by Mathiew and Schulze (2006) who used business simulation to test team process-performance relationships. The other, theoretical in essence, written by Hambrick (2007) which advocates that management games could be an important research instrument to achieve data and advance on the 'upper echelons theory'[4].

According to Keys and Wolfe (1990: 307) "business games arrived on the scene in the late 1950s, spawned by the fusion of developments in war games, operations research, computer technology, and education theory." Perhaps this apparently chaotic and complex genesis could have affected the perceived value attributed by researchers to the use of management games as a research tool. In an attempt to illustrate this we refer to Hambrick (2007) who confessed with great honesty that he had been considering the use of management games to clarify the 'upper-echelons theory', but he had "… been intimidated by the technical challenges of designing the simulation *(management game)*" (p. 338)

[4] In brief, upper echelons theory states that Top Management Teams (or simply the top managers) composition (i.e. homogeneity/diversity) has a direct effect over firm performance.

(the insertion is ours). Several issues have risen in the literature questioning the use of management games for research purposes. The main problem seems to be related to the lack of generalizability, in a sense that a game does not provide a real-life firm environment (Dickinson, Gentry and Burns 2004; Keys and Wolfe 1990 only to list the more recent ones). On the other hand, other authors consider management games as an important instrument for social research, like Schlenker and Bonoma (1978) who argued *(the insertion is ours)*:

> "… *(management)* games could serve as a skeletal analogy of many social situations and contexts. In constructing a game analogy, an attempt is made to dissect from the complexities of real social interactions some fundamental structural aspects that can be employed to facilitate our understanding of the actual situations" (p. 09).

Despite the rarity and scarcity along time of literature on the use of management games in basic research, we basically identified three fundamental questions that surround the issue: (a) realism and validity; (b) subjects (players) and validity; and (c) other 'minor' questions related to: experiment control; costs; data accessibility and availability; and ethical problems.

1.3 REALISM VERSUS VALIDITY

One of the most questionable aspects of business simulations is related to the generalizability of the results found in this kind of research method. When

deepening the discussion on this aspect, we identify two foregoing problems, *experiment realism*, and *experiment validity*.

1.3.1 Experiment Realism

Keys and Wolf (1990: 324) using the arguments of others (Lant 1989; McGrath 1982) state that "business simulations have often provided a realistic group decision-making context, but not a realistic organizational context." This dichotomy of realism could be interpreted as a problem when we try to generalize the findings made in laboratory research in a broad manner. To the list of odds we could add (a) firm/industry conditions that are not the same as those in real life; (b) that laboratory experiments are artificial and their results are not representative of the real world; and (c) that laboratory experiments are not adequate to identify and define variables as field research could do (Schwenk 1982). Dickinson, Gentry and Burns (2004) synthesize the list of problems with the statement "limited mundane realism, i.e., face validity" (p. 346).

Extending the discussion, we introduce Gentry, Tice, Robertson and Gentry (1984) who referring to Aronson and Carlsmith (1968), delineate two types of realism: (a) *mundane realism*, or how likely the experiment is in the real world; and (b) *experimental realism* or the degree to which the subjects (players) who are evolved in laboratory research take the experiment seriously.

Cohen and Rhenman (1961) alerted to some odds related to the level of reality of a management games. According to these authors, and at that time and up to their last analysis in the 1960's, games do not include all the challenges that managers

could find in a real business such as, particularly, personnel, psychological, and organizational problems. These authors increment the list of problems and advocate for the easy (i.e. cost free and quick) way with which the players could receive the information (mainly generated by the computer), oblivious of how difficult it really is in the real world. Another alert is related to the dangerous feeling that players could present. They may "feel so strongly that they really know how to run a business as a result of their experience in playing management games" (Cohen and Rhenman 1961: 152). In our experience with management games these are still valid statements.

Another aspect of the realism is related to game complexity. We infer that the more a game follows a real world appearance, the higher the number of variables, which can increase in an exponential rate. Consequently, the complexity of the game (including mathematical modeling and computer programming) is directly proportional. This complexity could affect two other important practical questions on laboratory research:

> (a) the time available to do the experiment, which could be divided into two: first, the available time for the class or meeting; and second, the time available for the subjects (players) to perform the decision making, and eventually supplementary tasks as required by research issue; and
>
> (b) the capacity of the subject (players) to manipulate information created by the 'complex' situation on which the firm and industry environment were designed.

The main problem of the realism issue could be defined as a game/research designer's paradigm: *to find equilibrium between game complexity-reality and research proposals*. The problem to be addressed by the game/research designer concerns the adequate limits of subjects (players) to manipulate/process information and the time available to perform the experiment, both in order to guarantee a faithful experiment.

This problem resonates in the game 'designers dilemma' (Teach 1990) which indirectly refers to the problem of 'equilibrium' presenting three aspects which a game designer must deal with: (a) the true simulation, which is the complexity to represent industrial systems in mathematical formulae; (b) the games, being a set of rules that govern the game, the level of acceptance among players and the limits imposed to the players; and (c) the context: the competition that the game evokes among players versus him/herself; and/or players versus nature; and/or players versus players.

It is reasonable to assume that the complexity to simulate the environment is only limited to two aspects: (a) know perfectly the firm and industry environmental models, that is, the variables involved in both environments and the interrelations among these same variables; and (b) the limitation to develop the game on paper (as a classic game based on table, cards etc.) or even on a computational way (programming software and capacity to process it on a hardware). It is also reasonable to conclude that the second aspect is not a problem, since computational technology has become very accessible. As observed Cohen and Rheman (1961) more than four decades ago, "the use of computers has provided an opportunity for the designers of games to incorporate in them a great deal of

realistic complexity while still keeping their administration relatively simple" (p. 134).

The game played by a computer permits an increasing number of variables in more complex relations (Biggs 1990; Keys and Biggs 1990), being processed in a speedy way and reducing the time spent by the game administrator on data input, processing and releasing the results, and information to the subjects. Bearing the realism in mind, once more Cohen and Rhenman (1961: 134) alert to the advantage of using computer in the game play stating that, "an electronic computer also adds considerably to the drama of game play." The same authors also reinforce the facility that computers provide to use stochastic or random variables adding more reality to the management game.

Some characteristics that we think are relevant to consider in an analysis of the level of reality of a management game for research proposal are, in sum: that (a) it provides interrelations between functional areas; (b) it recreates a similar dynamic situation found in real life; (c) it provides some level of a sense of risk and uncertainty; (d) it provides a systematic collection of information, for the players, and the game administrator-lecturer-researcher; (e) it provides opportunities for the players to learn and reinforce a variety of analytical tools in a sequence of events (dynamic environment); (f) it provides a place where organizational problems (at least some of then) could be illustrated; and (g) it could demonstrate the value of planning and policy-making. (Cohen and Rhenman 1961; Biggs 1990; Keys and Biggs 1990)

Finally, in a comparison of other laboratory experiments to management games and highlighting the level of reality given by the latter, Gentry et al. (1984), stated:

> "… it should be remembered, though, that one of the advantages of the simulation game over the laboratory experiment is its increased realism. 'Realism' can be viewed as a continuum, and just how much more closely the simulation is to the field study than the laboratory experiments depends upon the nature of the game itself and the manner in which it is administered" (p. 2).

By this statement we must play up the importance of the game administrator who has an important role in creating and maintaining the level of realism and dynamism of a game play. This rule is also highlighted in the follow sections.

1.3.2 Experiment Validity

Examining the concept of validity, we identify progress basically in two classifications: (a) *internal validity*, and (b) *external validity*. Other classifications are also utilized on the literature like *face validity* (Keys and Wolfe 1990) and *ecological validity* (Schlenker and Bonoma 1978: 23). In our research, we considered the former two.

According to Schlenker and Bonoma (1978: 22) *internal validity*:

> "… refers to whether an effect produced in study resulted from the experimental manipulations or whether the effect might have been

> coincidentally produced by such factors as subject manipulation, history, prior testing, or any of the host of artifacts to which the experimental endeavor is prone."

In other words, internal validity is concerned with the possible negative influence that laboratory simplification of reality and researcher manipulation could create in defining and correlating variables. This influence could create artificial (and unreal) measures or relations among the variables, that is, a lack of internal validity. A concomitant advantage emerges from the use of the laboratory experiment to clarify or to check any aspects of variables and their correlations previously investigated in the field experiments. This check could be done by controlling some aspects of the variables and/or correlations, thus, an instrument for confirmatory research purpose instead of exploratory ones (Schwenk 1982).

External validity, according to Schlenker and Bonoma (1978: 22) refers to "the ability to generalize the findings obtained from an experiment toward (a) different subject populations, (b) different ways of measuring the same variables, and (c) different situations and settings." In other words, external validity is concerned with how an experiment could be replicable in another experiment with different sets (i.e. subjects and place) and ultimately, it replicates *ipsis litteris* the real world.

Whether in the field or in the laboratory, the main problem of research[5] is related to validation in a sense that: (a) first, is the identification and description of

[5] We excluded exploratory research from this analysis. The reason, citing Schwenk (1982: 214), is that "… in an emerging discipline … exploratory field research is necessary in order to identify and define variables."

variables reliable? (b) second, is the interdependence found among these variables reliable? (c) third, are there any other experiment and researcher biases?

From another perspective, we could analyze this problem evoking the 'control' introduced over the variables on experiments. If we 'control' an experiment, in the field or in laboratory, by omitting a confounding variable in an intentional manner, we ensure a better internal validity. But if we manipulate the internal validity we influence the external validity, in a sense that the former is a prerequisite of the latter (Schwenk 1982). The lack of external validity leads to a lack of generalizability. In another situation, if we do not 'control' the experiment but omit an important variable on the experiment we are lacking with external validity. Schwenk (1982) remember that researcher biases may occur when "the researcher makes his own guesses about the relationship between critical variables" (p. 215).

An important conclusion made by Schwenk (1982) illustrates this problem of external validity on field experiments:

> "… it has been claimed that field research of the sort advocated by Mintzberg (1977) and others has at least two major weaknesses. First that is difficult to control confounding variables in the field settings and second, that the results may be coloured by experimenter bias" (p. 215).

On the other hand, some advantages of management games, as laboratory research, that uses management games were stated by Key and Wolf (1990: 323):

"… (a) simulation provides more precise measurements of behaviour than field research because decisions are made in a closed organization/environment system, and the similar decision responses are made repeatedly over time."

and … "(b) further, the environment, though complex and realistic, is a known entity to the researcher. Thus the causal relationships between the organization and environment can be determined by the researcher in a way that is impossible in field research (Lant 1989; Lant and Montgomery 1989; McGrath 1982)."

1.3.3 Conclusions about Reality and Validity

An important conclusion in the discussion on reality and validity is that management games have an increased aspect of firm-reality when compared to other kinds of laboratory experiment. The complexity of the game determines the level of reality required by the experiment. The level of validity could be measured by the issue of the research, that is, the variables and the model and the strength of their relation to the organizational environment, and the level of difficulty in accessing data to test the desired models. Taking into account the latter and arguments, and evoking Schwenk (1982), *why are we still sacrificing laboratory research by using field research?*

1.4 SUBJECTS (PLAYERS) BETWEEN REALITY AND VALIDITY

When we refer to subjects used in the research we are also referring to *realism* and *validity* aspects. Subjects used on research which employs management games were basically undergraduate students, MBA students or managers, who experienced the game in a course, taken as part of an undergraduate university program, MBA or corporate/industry education programs. Our analysis about reality will be focused on two subjective aspects, one related to the differences between students and managers, and the other related to the subjects' commitment to the experiment.

Important differences among these groups could be observed on prior researches which used management games. An important study was conducted by Babb, Leslie and Van Slyke (1966) who identified significant differences between these two groups, namely, in sum: (a) managers seem to be conditioned by their prior experience; (b) managers seem to follow "more conservative policies than students, particularly in pricing" (p. 470); (c) "students expenditures on advertising and promotion were about the same as managers, but were erratic" (470); (d) students seem to be more impulsive in decision-making and with a lack of skill in controlling factors that affect costs; (e) "students performance was usually much lower than experienced managers in early decisions but quickly came to an equal level (performance curves)" (p. 471). In the same way, Cosier and Rechner (1985) also found differences between these two groups, in which the MBA students were more conservative and more profitable in their decisions than undergraduate students.

Babb, Leslie and Van Slyke (1966) state that students in general were more erratic in their decisions and complete stating that "apparently felt (the students) the need to learn something about the industry by experimenting with the game"(p. 470). They conclude that there are important differences between the two groups, such as professional experience, temperament, personality factors, conditioning factors, and others.

Despite this, both groups, indistinctly, could not behave properly (realistically) and affect the experiment (the validation), in a sense that players could be interested in experimenting in the game or playing the game in a 'playful manner', and would not consider the consequences of decisions (Babb, Leslie and Van Slyke 1966; Dickinson, Gentry and Burns 2004). Nees (1983) warns of 'pay-off' factors related to the 'playful manner' that could affect the experiment. As she stated, despite the seriousness, aggressiveness, commitment, and the like, among players "there is always a risk that the simulation remains a 'game'" (p. 183). In her experiment, she observed that the subjects do not bear the consequences of their decisions, despite the warning about possible penalizations and the possibility of leaving with their undertakings after the game experience. The incredible observation made by her was that the subjects were managers who had participated in a management development program! On the other hand, Bass (1966: 471) believes that the motivation to play could come from the interest in the game and the ranking positions and concludes "... these were apparently enough to discourage playfulness." Similarly, Lerréché (1987) advocates that aspects like the dynamism of competition and quick feedback, motivate the subjects to improve decision-making. Dickinson, Gentry and Burns (2004: 346) synthesize the general enhanced perception of management games and assert that

management games provide high participant involvement. These statements are corroborated by the educational theory where we highlight the general tendency to have a desirable level of participation of the subjects on experimental exercises, management games included. As Keys and Wolf (1990: 310) observed:

> "The experiential learning methods create an environment that requires the participant to be involved in some type of personally meaningful activity. Such an environment allows the participant to apply prior knowledge of theory and principles while developing commitment to the exercise and experiencing a real sense of personal accomplishment or failure for the results obtained (Walter and Marks, 1981)."

Another important aspect was raised in the literature: the influence of incentives over MBA and manager players' commitment to perform as they would do in a real firm. The incentives mentioned in the literature includes monetary and non-monetary. We are referring to job security, real monetary reward, or even career development and status satisfaction. Bass (1964: 554) concludes the following on the experience of using experienced managers in management games:

> "… nevertheless, the simulation was different in many respects from real-life operations. The powerful motivations of real job security and real monetary reward were absent. The incentives for playing were a consequence of competitive desires and the habitual concerns about winning rather than losing a game, and a sense of loyalty to one's team."

An important finding was made by experiments developed by Bass (1964), who found evidence of the validity of the game when a significant correlation between overall satisfaction of the players and their status was observed (i.e. importance of functional position on the simulated organization) "… duplicating the usual correlation found in the real-life industry" (p. 550). His findings, in some aspects, were contrary to those of Nees' (1983) research observations. An important conclusion is that some incentives that we identify in real-firms are very difficult to be provided or even manipulated on laboratory experiment.

On incentives for students, Gentry et al. (1984: 02) believe that "the grade environment which exists in the classroom places an incentive on student subjects to do well." This is corroborated by other researchers like Slusher, Sims and Thiel (1978). Bass (1964) adds to this statement claiming "it is probable that much of the significant behavior generated would not appear if the exercise were run by *untutored* college students" (p. 549). The remark is ours, in order to refer to the role played by the tutor or game administrator, in observing and managing several aspects of the game and experiment, avoiding eventual undesirable disturbances.

Another important issue related to the subjects' commitment is linked to the level of reality in the management game, as perceived by the players. Managers could be more critical about the business reality than undergraduate students and the interest in making decisions could be diminished. Likewise, students could be less interested in highly complex games. To illustrate this, Bass (1964: 550) observed in his previous experiments that "there was a steady increase in satisfaction with company operations in the simpler organization, while there was

a correspondingly steady decrease in satisfaction in the complex organization." The complexity of the game, then, could play an important role in affecting directly the way players react to the experience. For example, frequently the decisions must be taken in a short period of time and require that participants must be organized, sharing the labor and responsibilities, and delegating authority among team players (Bass 1964).

To end this section, we highlight the main critical points related to the two kinds of subjects used on management games laboratory research. One is related to cognitive aspects inherent to the players, that is his/her professional skills, accumulated knowledge, firm experience, firm tenure and so on; that are certainly much more developed in managers and MBAs rather than in undergraduate students. The second point is related to behavioral aspects, in other words, attitudes, propensity to work in groups, personality, comprehensiveness, kindness, and so on. Another point is game complexity and competition and players' commitments. Complex management games could create greater commitment among MBAs and managers in comparison to undergraduates, through the more realistic appearance of the game. On the other hand, they might not provide the same interest for undergraduate students due to the lack of comprehensiveness and the capacity to manipulate a great deal of complex information.

The general conclusion of the literature is that some precaution must be exercised regarding the generalizations of results found in studies that used undergraduate students (Babb, Leslie and Van Slyke 1966; Schwenk 1982; Cosier and Rechner 1985; Keys and Wolfe 1990; and Dickinson, Gentry and Burns 2004). We can

conclude that the issue of experiment must be carefully considered in order to choose among undergraduates and MBAs/managers, and actions should be taken to avoid some of these problems, like providing concrete rewards and warm-ups in order to prevent 'test decisions' among players (Nees 1983).

1.5 OTHER FACTORS

1.5.1 Experiment Control

Several authors agree on the crucial advantage of management games for research activities, known as *experiment control*. In the literature, we identify three sometimes interrelated aspects that explain researcher expectation about experiment control, which are: (a) control, in a sense of constrain, on the number of variables and information in the experiment; (b) time management; (c) control on the possibility to observe the behavior of the subjects.

The most important aspect of this discussion is the possibility of a management game to replicate a firm and industry environment (Bass 1964), in a controlled and straightforward way (Larréché 1987), in other words, by controlling the number of variables in a model; the information and context provided to the subjects; and the subjects *per se* who participate in the experiment (Schweiger, Sandberg and Ragan 1986). Schwenk (1982) and Anshen and Guth (1973) argue that laboratory (in a general manner, which include management games) possibly permits the systematic control of a specific variable that a researcher is interested in studying. According to Nees (1983: 182) laboratory experiment could facilitate observations such as those "… where the independent and dependent variables

are closely controlled and then manipulated… in a similar fashion, various contextual variables … could be manipulated to observe their influence on the decision-making process." This is an important advantage over field experiments, once we consider the statement of Moser (1965: 05 in Schwenk 1982) that "there is no denying that strictly controlled experimentation is rarely feasible with human populations." Ray, Barney and Muhanna (2004) exemplify the developed aspect by stating that in real world firm performance could depend on other more complex things. As they stated, "…a firm's overall performance often depends on, among others things, how it implements numerous business processes" (p. 25). In other situation, Ramos-Garza (2009) cited the problem on access data across industry multiple contexts, in order to guarantee statistical significance. Considering situation like that, a controlled experiment where the industry 'is the same', although fictitious, permits compare firms decision and performance without any other industry interference effect's.

Several experiment suggestions can be identified on the literature. One example is supplied by Bass (1964: 554) who believes that "radically different models for arranging productive organizations might be developed and tested taking advantage of the revolution in computer technology and automation." The same author exemplifies with another statement "… national differences in style of organization could be simulated and contrasted" (p. 554). Another author, Hambrick (2007) suggests that the use of management games facilitates the control of information provided and accessed by the players organized into teams, thus it is a valuable way of testing some aspects of the 'upper echelons theory'. This amalgam between subject behavior and the controlled context created by management games can also be observed in claims like those made by

Babb, Leslie and Van Slyke (1966). According to them, management games provide the possibility of isolating and measuring the separate effects of variables under experimental conditions and (additionally) "could be supplemented with studies of related actual situations faced by subjects" (p. 468). This means that a great deal of management games (with a same game, same conditions and eventually same subjects) can be tested and compared in several contexts, in a simple way. Beyond this, the authors describe what was accomplished in an experiment "the market environment was controlled so as to improve the comparisons of individual performance" (p. 468). This opens an important frame to test models in different contexts but with the same comparable measures. Along similar lines, but with a radical suggestion Bass (1964: 555) prompts "… organizations can be designed starting with radically different primary goals: one could maximize internal satisfaction and efficiency; the other, success in meeting the external environment" and the results be compared. As a last example we refer to Babb, Leslie and Van Slyke (1966), who suggest the possibility for the game administrator to introduce a 'stimulus' or a given situation, in which players perceive a random effect from the market as apparent, and observe eventual distinct reactions in subject decisions.

Another important aspect of management games is the possibility of controlling the time of the experiment allowing the compression that grants the appearance of a certain phenomenon and the possibility to schedule (e.g. to decide when to stop and start) the experiment. As stated by Bass (1964: 554) "more may happen in simulation in less time than ever might occur under similar circumstances in real life." Babb, Leslie and Van Slyke (1966: 469) believe that "since decision making in the game can be interrupted, dissected, and reconstructed, the

researcher could study organizational effects on decision making." On the other hand, the control of time in the experiment could cause collateral effects, identified by Gentry et al. (1984: 02) as "lack of control in dynamic games." The authors explain the effects stating that laboratory experiments in general are time-short and the "randomization process should ensure that the subjects face the experimental manipulation from the 'same frame' of reference" (p. 02).

When the longitudinal aspect of decision making in the experiment in taken into account, the 'same frame' is no longer observed, since the results related to individual past decisions influence the actual decision making (path dependence). As observed by Gentry et al. (1984: 02) "in a longitudinal simulation, the player's status at any given time is a function of his/her previous decisions as well as the starting conditions." Dickinson, Gentry and Burns (2004) reinforce this statement: "… confounding effects evolving from the longitudinal dynamism of the game, i.e., while experiment manipulations may remain constant, actual participation conditions vary as a function of differentially evolving conditions, e.g., performance success, as the game progresses" (p. 346). On the other hand, 'real life effects' like influences of past decisions on actual decision (path dependence) may be observed or considered in the experiment, given the long term or time sequential decision-making.

A third aspect of experiment control is the joint effect of time and behavior. As specified by Bass (1963: 184) "what we see here in miniature is a collapsing of time coupled with potential overexcitation of behaviour illustrative of what might occur in much less dramatic form or actually only be felt, but not acted out in real-life industry". This is reinforced by Bass (1964: 554) who concludes that on

management games "many of the same feelings and tendencies are generated in a much shorter, quicker and sharper way than in real life." This condition allows the researcher to observe the distinct effects of behavior over decision-making, for example when the subjects "… are placed in a non-stressful, less time-constraining situation" (Nees 1983: 182).

1.5.2 Data Quality and Accessibility

Some notable features of the use of management games for research purposes are based on the straightforward generation and access of data, as it presents an ideal site in which to collect reliable information (devoid of external interference). In addition, we highlight the ease in replication if compared to field experiments (Dickinson, Gentry and Burns 2004).

With regards to the generation and access of data, we refer, for example, to the natural setting provided by management games. In this setting, players make decisions sequentially during a certain period of time, linked to the fact games run on computers. The decisions, partial data and results could be easily accessed by the researcher. As observed by Larréché (1987: 563) "measures of performance are readily available." These advantages are widely recognized by several scholars such as Dickinson, Gentry and Burns (2004), and Slusher, Sims and Thiel (1978), and others. These longitudinal aspects provide the experiment with an additional advantage related to cross-sectional data, a possibility to provide a long-term effect on variable relationships, and also allowing the players to avoid decisions solely on short-term results. Despite this advantage we must

recognize that ‘some lack of control in dynamic games’ could occur like those discussed above in Dickinson, Gentry and Burns (2004) and Gentry et al. (1984).

To illustrate the power of data accessibility we relate to Bass (1964: 550) who found evidence that a simple organization “showed a considerable greater profit after four production periods than the more complex organization”, based on this advantage. In another example we have the report of Babb, Leslie and Van Slyke (1966) which identified “a number of different leadership patterns, methods of resolving conflict, and organizational structures” (p. 470). It is hard to believe that this kind of information could be accessible by the use of conventional research techniques.

Another issue related to management games concerns the quality of data they generate. Nees (1983), in her experiment, stated that games based on case study, in contrast to those based on computer simulation, provide qualitative combined with quantitative data. In our analysis, management games based on computer simulations actually provide the quantity and quality of information that a game designer could program. It is very common to identify among game ‘periodicals’ (e.g. newspapers and other formats) and information reports, a large series of analyses, descriptive situations and others, as the game administrator could create and manage in a limited period of time. The result of this qualitative and quantitative information can be evaluated by researchers in several forms, despite the traditional decision-result reports, such as: (a) direct observation over the sections (including the possibility to record the section on video and audio taping); (b) questionnaires; (c) interviews of individuals and/or groups; (d)

analysis of individual and group writing reports from players; (e) individual and group oral presentations; and so forth.

1.5.3 Costs

We initially refer to Cohen and Rhenman (1961) who alerted that business games are generally not for free and some related costs are thus imposed. The authors refer to costs associated to: (a) capital costs related to peoples' time, computer time, materials and supplies involved in developing the business game[6]; (b) 'out-of-pocket' costs of running the game; (c) the opportunity cost for the participant, that is "while playing a business game the participants are thereby prevented from using that time in any other way" (p. 151).

Other authors such as Dickinson, Gentry and Burns (2004) and Gentry et al. (1984) consider that the costs of data collection of games are far below those of a field study. In general, this position is agreeable when a prompt comparison is made to interviews and field observation. When using a management game, it is evident that a researcher has at his disposal students, classrooms and the infrastructure to run the game.

Babb, Leslie and Van Slyke (1966: 471-472) state that management games are "relatively expensive to use, particularly if suitable games are not already available … even more simple management games require substantial inputs of time on the part of player and administrator." On the other hand, as the same

[6] We could include the acquisition costs if there is a ´ready-to-use` software or business game service.

authors asserted *(the insertion is ours)*, games "may be very inexpensive compared to alternative approaches … *(and)* would have been many times more costly and might have been impossible."

We must conclude that in general the costs of using management games could be considered cheaper than other kinds of research methods. This is the case if we consider the possibility of preparing game software, equipment and all necessary infrastructure for the experiment, notably in universities or places where this method is commonly available (i.e. university laboratories). These costs are increased when a specific game needs to be developed in order to attend research specificity, and a special location (infrastructure) is required to perform the experiment.

1.5.4 Ethical Problems

Sewall (1978) cautions on problems in using individuals in research experiments, arguing that the latter "involves both psychological and social components" (p. 283), and on the 'risks' and 'consequences' of systematically manipulating the experiment context, in addition to the unexpected and undesirable effects (eventually hazardous) over these individuals. As observed by Cohen and Rhenman (1961: 152), "there is some danger that the participants will feel too strongly that they really know how to run a business as a result of their experience in playing management games."

In the table 1.1 we note a summary of the problems related to the use of management games, and also advantages, inconveniences, and suggestions.

Table 1.1. Problems Related to the Use of Management Games. Advantages, Inconveniences and Solutions

Problem	Advantage and Inconveniences	Solutions
Realism vs Validity	This issue addresses problems related to the level of realism that the games could present and the experiment validity, that is, the extent to which the games represent the 'real world' and the extent that the results could be extrapolated to the reality of the firm. The advantage of using management games is related to the possibility of designing a 'quasi' real firm, using a large amount of variables simulated on a computer base. The disadvantages are that, in the most complex games, the capacity of manipulating the game is highly proportional and the complexity of the design and the eventual disinterest of the subjects in playing the game.	Find a trade-off between reality and research needs. That is, consider the necessary variables to perform the experiment, with the necessary complexity to avoid making the design an unfeasible task, and stimulating the players towards a correct and interesting way of playing.
Subjects vs Validity	This issue addresses the problem related to the subjects (the players) exposed to the experiment with the management game, and the expected 'real manager'. Most of the criticism converges on the idea that the players do not behave as real managers, mainly the undergraduate and even the MBA´s students. On the other hand, it is difficult, or even impossible, to access real managers deciding on the 'real world'.	Make warm-up plays in order to familiarize the players with the game; Encourage competition among groups of players; Promote financial and other incentives related to final class scores and grades in classes; fit the complexity of the game to the experiment necessity and the subjects capacity.
Minor issues	The 'minor' issues are related to experiment control; costs; data accessibility and availability; and ethical problems. The experiment possibly controls the design of an experiment defining the number of variables to be tested, as well the conditions in which these variables will behave. The odd of this control could be undesirable biases from the lack of an important variable in order to better explain certain phenomena. On the costs, in general the laboratory research could be considered a less expensive experiment, in contrast to other field experiments. This advantage could be highlighted considering the existence of a 'ready-to-use' game and the necessary infrastructure usually found in universities. On the other hand, a customized game could be expensive to	The experiment designs could explore the advantages of some of these 'minor issues. For example, using the aspect of 'experiment control' in order to test variables and constructs considering special conditions leading to important conclusions to be addressed in the theory. On the costs, the use of a 'ready-to-use' game is always preferable, but in some occasions, the costs of data access using field research could be easy, for example, using executive meetings or 'in

	design and develop. Another advantage in the use of management games is related to the access of data, in situations where this is impossible, dangerous or very difficult to access. Ethical problems address questions about the effects that a controlled experiment could induce on the players. One of these effects could be the notion that successful players in the game make good managers in the real world.	company' courses to access necessary experiment data. On ethical problems, we argue that the experiment could be carefully prepared and debriefing classes must provide the players with the adequate advice on the differences between 'playing a firm game' and 'deciding in a real firm'.

1.6 USING BUSINESS GAME ON BASIC RESEARCH

At this point two important questions emerge from the preceding sections of this work:

(a) *In what areas of knowledge could management games be used?* and;

(b) *Under which conditions should we use management games?*

1.6.1 Areas of Knowledge

Three key articles identified studies which used management games as a research tool. The first is by Babb, Leslie and Van Slyke (1966) which presented the experience developed by the authors (among others), at Purdue University, to develop and use management games in basic research. The authors briefly presented three experiments using three distinct software games, in areas related to (a) behavioral studies; and (b) organization studies. In another more extended study, Keys and Wolfe (1990) identified and grouped several studies in five areas

of knowledge (a) decision support systems and information processing; (b) strategic management research; (c) group behavior and decision-making; (d) organizational research, and (e) leadership research. In another article, Dickinson, Gentry and Burns (2004) identified six areas under which the studies where organized (a) cross sectional organizational behavior; (b) longitudinal organizational behavior; (c) management; (d) decision-making; (e) forecasting; and (f) marketing.

In order to provide a more complete and recent list of the research studies which relied on management games, we have compiled information on the articles identified in the three previous studies, and have added more recent studies. The result is following presented on Tables 1.1 and 1.2.

Table 1.2: Studies and Games Used for Basic Research

Game	Authors and Year	Game	Authors and Year
Carnegie Tech Management Game	Cangelosi and Dill (1965)	Versions of Business Management Laboratory	De Sanctis (1982) Kasper (1983)
Dairy Business-Management Game	Babb, Leslie and Van Slyke (1966)	Farm Game	Gentry, Tice, Robertson and Gentry (1984)
Purdue Farm Supply Management Game	Babb, Leslie and Van Slyke (1966)	Executive Simulation	Cozan (1984)
Purdue Supermarket Management Game	Babb, Leslie and Van Slyke (1966)	In Basket Simulation	MacCrimmon and Wehrung (1984)
Marksim	Rowland and Gardner (1973)	Organization Game	Frost, Mitchell and Caywood (1984, 1985); Smith, Mitchell and Summer (1985)
Finansim	Biggs (1975)	Quantsim, Simq	Cosier, and Rechner (1985)
Kubsim	Urban (1977)	Tycoon	Gladstein, and Reilly (1985)
Quantsim, Simq	Slusher, Sims and Thiel (1978)	Management Game	Segev (1987)
Organization Game	Miles and Randolph (1979)	Market Place	Gundlach and Cadotte (1994); Achrol and Gundlach (1999)
Markstrat	Hogarth and Makridakis (1981); Glazer, Steckel and Winer (1987); Lant and Montgomery (1987); Utsey (1987); Larréché (1987); Glazer, Steckel and Winer (1989); Glazer, Steckel and Winer (1990); Curren, Folkes and Steckel (1992); Glazer, Steckel and Winer (1992); Clark and Montgomery (1998); Clark and Montgomery (1999)	Marketing Management Experience	Dickinson (2002)
		Business Strategy Game	Cruz Perez and Ramos (2007)
		Capstone	Mathieu and Shulze (2006)
Organization Game	Cameron and Whetten (1981)	Version of Distributed Dynamic Decision-Making Simulation	Ellis (2006)

Source: Keys, and Wolfe (1990), Dickinson, Gentry and Burns (2004), and the author.

Table 1.3: Studies that Used a Laboratory for Basic Research

Seashore (1954)	Gray and Graham (1968)	Lucas and Nielsen (1980)	Davis and Grove (1986)
Purdy (1959)	Lewin and Weber (1969)	Muhs and Justis (1981)	Glazer, Stecel and Winer (1987)
Dill (1961)	Baumler (1971)	Remus and Jenner (1981)	Ross (1987)
Teish (1964)	Jancowiez (1973)	Randolph and Posner (1982)	Keys, Burns, Case and Wells (1988)
Van Slyke (1964)	Mock (1973)	Schwenk (1982)	Streufert, Pogash and Piasecki (1988)
Weick (1965)	Hodgetts (1974)	Davis (1982)	Wolfe, Bowen and Roberts (1989)
Hutte (1965)	Sims and Hand (1975)	Remus (1983)	Affisco and Chanin (1989)
McKinney and Deal (1966)	Dickson, Senn and Chervany (1977)	Nees (1983)	Wolfe and Gregg (1989)
Fife (1966)	Biggs (1978)	Wolfe and Chacko (1983)	Lant and Montgomery (1989)
Deep, Bass and Vaughn (1967)	Remus (1978)	Chanin and Scheer (1984)	Haley and Stumpf (1989)
Vance and Gray (1967)	Norris and Niebuhr (1980)	Sackett and Ryan (1985)	Lant (1989)
Hughes (1968)	Gentry (1980)	Kaplan, Lombardo and Mazique (1985)	

Source: Keys, and Wolfe (1990) and Dickinson, Gentry and Burns (2004). These studies do not identified a computer based game, that is, they used a paper based game, case study, or other method for laboratory experiment.

1.6.2. Conditions

Many authors have suggested the use of management games for research purposes. Some of the suggestions are based on areas of knowledge - which already use and/or have a potential for - where the general environment and conditions created by management game are believed to be appropriate for use in research. Other suggestions are based on specific conditions or circumstances for research, like data accessibility, security, stage of research, prior field result validation, and so forth. Rather than attempting to identify areas of knowledge where management games could be used, we will suggest some general issues and key aspects that could be used by researchers to decide the appropriateness of the use of management games, irrespective of knowledge area. We think that this approach is more adequate than restricting to the appropriateness of specific areas. The dynamic and interdependent aspect of knowledge could present new opportunities for relying on management games, which awards them roles unexplored until the present. With this 'less normative and more descriptive' approach we believe we can assist researchers in the difficult task of choosing the empirical instrument that is most adequate for their reality.

According to our studies and our experience with management games, we believe that management games are appropriate for experiments which deal with issues and necessities such as: (a) *decision making*; (b) *individuals and team behavior* and tasks; (c) *information* use and processing; (d) *difficulty in access to data* from environments where some grade of uncertainty, risk and other limitation may exist; (d) *confirmatory* field research or validation; (e) the *control of the experiment* over variables - including undesirable effects - and over subjects; (f)

longitudinal aspect of the games and a possibility to make a sequential time observation of a phenomenon; (g) limited access to resources to achieve field data; and (h) *reality versus validity* - finding similar settings of patterns to those encountered in other field research (e.g. risk, uncertainty, etc.).

Because of the complex nature of the interrelationships among these issues and patterns, it is a difficult and inaccurate task to identify areas of research related to business and organization that could became targets for management games. For us, the issues and necessities could be easily identified within the literature. By attempting a 'less normative and more descriptive' approach, we will provide some examples from references in the literature.

Strategic Decision Making

Some authors, such as Bass (1964), present their vision about management games, stating that several games reflect organizational processes, mainly those related to the process of strategic management. More specifically, the author refers to processes like: (a) allocation of workforce, monetary resources and physical resources/materials; (b) investments, scheduling, and arranging; and (c) selection and evaluation of alternatives. In sum, according to Bass (1964: 547), such games "engage (the players) in a wide variety of management decisions primarily associated with the interplay of economic factors." In our perception, such processes are intimately related to strategic decision making.

Decision Making, Team Behavior and Longitudinal Aspect of Experiment

With regards to the issue of 'strategic decision making' and its relation to team behavior and the longitudinal aspect of experiment (time), we can identify some authors that evoke the appropriateness of using management games for research, such as Key and Wolf (1990). They assert that "… simulation provides more precise measurements of behavior than field research because decisions are made in a closed organization/environment system, and similar decision responses are made repeatedly over time" (p. 323). Cohen and Rhenman (1961), in another example, highlight an important conclusion that management games seem to be a highly valid way to experiment individual and team behavior and related issues. This is basically due to the "high degree of emotional and psychological involvement of the players in such a training game ... they become highly receptive to learning new ideas" (p. 166). The authors also linked this conclusion to decision-making, and problem-solving to general firm behavior in terms of decision processes, decision outputs and performance. This raises the issue related to teams. It seems that management games are appropriate to analyze questions concerning teams, behavior and decision making. This is due to the fact many of the decisions must be taken in a short period of time, and thus requires that participants must be organized, sharing labor and responsibilities, and delegating authority between team players (Bass 1964). Another author, Larréché (1987: 563), argues that: since "decisions are made successively over several simulated periods, allowing an explicit consideration of the time dimension … individual and group behavior can be observed and analyzed." This author believes that 'simulation' provides a natural setting to analyze decision-making

processes that information can also be monitored within the context of a simulation.

Decision Making, Reality and Experiment Control

Keys and Wolf (1990. 320) identified several researchers that "have chosen total enterprise games and complex simulations because they permit the careful monitoring of the decision-making process, better control of external threats, and a realistic context for participants." The authors they refer to are Cameron and Whetten (1981); Fife (1966); Gladstein and Reilly (1985); Hutte (1965); Larréché (1987); and Purdy (1959).

Information, Decision-Making, Behavior, Teams and Difficulty in Access to Data in Field Research

Babb, Leslie and Van Slyke (1966: 465) suggested that management games could be used "in studies of the effect of informational and organizational variables on decision making and the effect of market structure and psychological and related factors on individual and group behavior." According to the authors, these type of contexts are very difficult to "research with traditional methods" (p. 465).

Behavior, Complexity, Decision-Making, and Data Accessibility

Babb, Leslie and Van Slyke (1966: 469) suggest in their study some areas where management games could be appropriate: (a) in behavioral studies, where "market structure, psychological attributes, and other variables affecting conduct or behavior of firm"; (b) in organizational studies, mainly focused on decision-making, where "the effect of information and other factors on complex decision-making processes can be readily examined."

Decision Making, Behavior and Experiment Reality

As observed by Babb, Leslie and Van Slyke (1966: 468-469) "business simulation may offer advantages … in that realism may be important in a study of business behavior. Decisions are not normally made on one isolated variable. There is interaction among decisions and results, as well as interaction among decision-makers."

Behavior (leadership) and Team

Keys and Wolf (1990: 320) identified two critical studies whose findings relied on management games. As described by the authors *(the insertion is ours)* "Dutton and Webster (1988) found the simulation *(The Looking Glass Simulation)* appropriate for examining strategic and operational decisions and for examining leadership processes." In other section Keys and Wolf (1990: 321), referring to Gray and Graham (1968) study about leadership research, wrote "…

one of the early research thrusts in gaming has been in the area of testing and prediction of managerial performance."

Behavior, Information, Similarity with Field Research Context and Costs

According to Keys and Wolf (1990: 318), several authors "have discovered that games elicit a rich set of behaviors similar to those observed in field studies and limited more by participant background than by game possibilities." Another finding that Keys and Wolfe (1990) raised from other authors is the conclusion that games, on the one hand have a high development cost, but on other the hand are very useful in investigating cause-and-effect variables relationships, in the realm of confirmatory field research findings. According to Keys and Wolf (1990: 319), "Mock (1973) concluded that the simulation/gaming methodology is a feasible and moderately inexpensive environment in which to consider information systems alternatives."

Time-Longitudinal and Complexity Aspects of Experiment

One of the greatest advantages of using games in business strategy research is related to its longitudinal aspect. Dickinson, Gentry and Burns (2004: 346) argue that management games provide an environment where the "compression of longitudinal phenomena" is possible. It stems from this that, since management usually provides a possibility for a sequence in decision making, Cohen and Rhenman (1961: 160) suggest that "the idea that management games can be used

for discovering optimal business strategy rests upon an implicit assumption that formal solutions to games can be discovered by repeated plays of the game." Despite this advantage, Mintzberg (1977: 93), cited on Schwenk (1982: 215) argues against the use of laboratory research in 'management policy' because:

> "… at the policy level, the very complexity of phenomena determines the organization's behaviour. In other words, processes such as strategic formulation are characterized by the inherent complexity and dynamic nature of the environments in which they create; recreating these processes in artificially simplified environments in the laboratory, eliminates the very characteristics that determine the organization's responses" (p. 93).

Information, Complexity, Behavior and Individuals and Teams

Cohen and Rhenman (1961) suggest the use of business games in experiments that deal with the ´behavioral theory of the firm` where players act as a team. Effects like team size on performance, morale, and adaptability could be explored. Time constraint on decision-making process could be used to examine the effects of time pressure on team performance. In the same way, the effects of the variation in information (quantity and quality) delivered to teams could be explored. The authors further suggest that business games provide a complex environment where problem-solving tasks could be studied taking into account the psychological and learning behavior dimensions of individual and team as a whole.

Behavior and Experiment Control

Larréché (1987: 564) states that "between the artificiality of a contrived experiment and the problem of isolating causal relationships in real situations, simulations offer an appropriate context in which to study the various facets of corporate behaviour." Competitive firm behavior is an example of a topic that could be explored with management games. On the same vein, Rajagopalan, Rasheed and Datta (1993: 366) argue that laboratory experiments could be used in order to clarify aspects related to decision making and organizational moderators. Accordingly to them, *(the insertion is ours)* "… given the number of confounding factors in such settings *(field surveys and case studies)* and the variety of factors examined, there are serious concerns of internal validity. In order to improve future theory building, researchers may need to make greater use of laboratory and carefully controlled field settings."

Similarity to Field Research (risk-taking)

Keys, and Wolfe (1990: 319) refer to some studies where management games where used, and the results validated by past studies. Referring to MacCrimmon and Wehrung (1984: 386) study of risk propensity of top-level executives when reacting to threats *(the insertion is our)* … "the in-basket *(the game simulator)* provides a means for assessing risk propensity that appears to have a stronger validity than previous measures" (p. 386).

Individuals and Team and Reality

Keys and Wolfe (1990: 322) transcribes Rowland and Gardner (1973: 280) claim "...there are strong individual and group factors brought to the game that are more critical in determining game performance that anything that might be learned in playing the game itself…" (p. 280).

Information and Reality

Keys and Wolfe (1990: 321) referring to several authors' recommendations (Cangelosi and Dill 1965; Smith, Michel and Summer 1985; Weick 1965) on the use of management games on organizational research area, wrote:

> "… the game elements are necessary to provide a complete organizational simulation. First, some participants must report to others in a realistic fashion (Keys 1974; McCall and Lombardo 1982; McKenney 1967). Second, each role should be provided with some information not available to other participants in order to add the element of specialization, opportunities to withhold information, communication requirements, etc. (Lombardo, McCall and DeVries 1982), and third, all participants should not be allowed to meet at the same place at the same time (Dunbar and Stumpf 1989; Lombardo, McCall and DeVries 1982)."

Experiment Control

Nees (1983), with the intent to determine when and how management games must be used on research, states that:

> "As we have seen, simulation together with field research produced hypothetical propositions that linked identified variables into possible causal relationships. Once developed into testable format, these hypotheses could be subjected to a 'laboratory' experiment where the independent and dependent variables are closely controlled and then manipulated … in a similar fashion, various contextual variables in cases such as ours could be manipulated to observe their influence on the decision-making process" (p. 182).

Bass (1964) suggests that management games could provide control by the researcher over the experiment, by creating situations where different contexts could be created and evaluated. As he exemplified "… organizations can be designed starting with radically different primary goals: one could maximize internal satisfaction and efficiency; the other, success in meeting the external environment" (p. 555). Another example given by Ness (1982) was "… this enables the researchers, for instance, to observe the difference in behavior when the decision-makers are placed in a non-stressful, less-constraining situation" (p. 182). On a similar note, Schwenk (1982) states that laboratory research, in a controlled environment, could help field research confirming or not the relationships found in the field. Eventually, the laboratory could test other relationships, untested or even impossible to test by field research. Some confounding effects caused by variables could be neutralized in the laboratory.

With this condition, the controlled environment facilitates a situation where variables and their interrelationships could clearly be observed, without interference. The laboratory experiment also partially permits the test of variables, that is, sequentially including variables in the experiment, and testing different models. As Festinger states (1953: 10) "in the laboratory, however, we can find out exactly how a certain variable affects behavior or attitudes under special, or 'pure', conditions." On the other hand, constraining the complexity of the environment, some variables (observed or unobserved) that could influence the relationships could be omitted and the results interpreted in an inappropriate way, as a result of the artificiality or lack of reality created by the lab experiment. In field research, there is a chance for the researcher to identify other variables (i.e. those not previously identified) or at least, indirectly consider the effects of unobserved variables in the tested model. It is clear that there exists a trade-off between reality and validity when we use experiment control.

Difficulty in Accessing Data

Some authors argue in favor of management games when the access to data (and occasionally very specific data) is difficult or even impossible in some situations. Dickinson, Gentry and Burns (2004) exemplify this argument and the situations when this could be observed through "the capacity to investigate subjects infeasible via questionnaire surveys and field studies due to complexity and time consumption, e.g., decision making process, infrequent environmental conditions, e.g., labor negotiations, or sensitivity, e.g., disinvestment strategies" (p. 346). For Babb, Leslie and Van Slyke (1966), in some situations, data is inaccessible in real

life, and, as a result, management games have grown on importance to achieve the necessary data. The authors clarify their statements:

> "… decisions are not normally made on one isolated variable. There is interaction among decisions, as well interaction among decision-makers. Time lags, uncertainties, and conflicting goals cloud the focus of the decision making. Many of these elements may be necessary in this study of behavior patterns of firms" (p. 468).

Dickinson, Gentry and Burns (2004: 346) referring to Dukes (1973: 04) also include that the use of management games to access data could be essential in order to "safely investigate potentially dangerous or costly situations and … provide a situation for players which offers its own rewards for participation" (p. 04).

1.7 CONCLUSIONS

Based on the extended discussion above, and in our experience on designing and conducting classes and empirical research with management games, we are now at ease to list some aspects that should be considered by those who intend to obtain data from laboratory research using management games.

1.7.1 The Research Objective/Nature versus Management Game

This is a crucial inflection point, to consider the choice between laboratory research and field research. It is hardly preferable to conduct research in the field, where the reality of a firm is available without any fortuitous interference by the researcher or any other artificial laboratory conditions. It is known that some conditions of the firms are difficult, impossible or eventually dangerous to be accessed. Inference from surrounding variables is possible but incurs upon problems related to the validity of experiment. The main point here is *the objective of the research and the adequacy to the kind of experiment*. Based on our experience and in an attempt to illustrate the question, a research objective that considers direct access to the TMT (top management teams) of firms, visualizing a sequence of strategic decision made over a period of time (once or twice a year), is very unlikely to be feasible in the real world. Some may argue that decisions could be accessed by analyzing countable reports, and inferences could be made. But, on the one hand, we are not available to measure some individual and group conditions embedded in the subject behaviors which influenced the decision-making and their results. On the other hand, some could argue that questionnaires could be used to access these executives and provide the experiment with data. In our view: *Would this be reliable data? Who would actually respond to the questionnaire? Would the executive's answers really represent their thoughts and beliefs? Would the data be collected after their (the TMT) decision making experience?*

Our *first conclusion* comes in line with Schwenk (1982) and Nees (1983) who state that management games are not adequate in exploratory experiments, where

variables must be identified and described. These authors also agree that management games could be used together with field research, in a sense that (Nees 1983: 182) “once developed into testable format, these hypotheses could be subjected to a ‘laboratory’ experiment where the independent and dependent variable are closely controlled and then manipulated.” Schwenk (1982: 214) “the laboratory research helps to refine the researcher’s understanding of the nature of and the relationship between the variables.” In other words, once the variables are identified and well defined, laboratory research, with a special feature of experiment control, could provide other important and useful evidences on the interrelationships among the variables.

A *second conclusion* is that, in some occasions, games could be the ‘only option’, mainly those related to behavior and work in a broader sense of TMT. Studies which attempt to understand the nature and the essence of the decision-making process must access the decision makers in close proximity, that is in their natural site. Management games could provide a complex environment, enough to be appreciated by the subjects and be considered a ‘very-near-real’ experimentation. Despite this welcome approach to games, some other questions must be considered in the analysis, for example, (a) the subjects used; (b) the time available for an experiment; (c) the costs related to the selection; (d) eventual development; and the time consumption of the research designers and subjects. In the what follows, we discuss these issues.

1.7.2 Use a 'ready on' Game or Develop One?

An important decision to be made by researchers who intend to use management games relates to the following choices: *to use an 'ready on' or 'on-the-shelf' game software or design a new one*[7]*?* There are many advantages of using standard software, which are: (a) the lower costs if compared to the own design option; (b) the reliability and low risk of using a commercial and already tested software; (c) the researcher can be advised by the game developer in most of the cases; (d) the researcher can be more concentrated on the research activities than on lab activities/problems. On the other hand, we can list some disadvantages of using standard software: (a) in some cases, depending on the kind of software and the sample size, the costs could be a problem; (b) the majority of software are 'closed systems' where researchers access some variables, however most of them are difficult or impossible to visualize and modify; (c) the games are not always portable, and additionally do not necessarily provide an immediate result. Several games are provided as 'game service' usually played using the Internet (on line or by e-mail), and where the use of the software is limited by rounds or fixed periods; (d) eventually, the removal of the researcher from the daily routine of the laboratory could provide undesirable biases within the research, due to the game manager and other lab conditions.

In our analysis, the main problem with 'ready on' games is related to the lack of control by the researcher over some variables, especially those that are critical for the experiment. One example based on our experience is the control provided

[7] We could also mention a third alternative, adapt an existent game, which will not be considered because it can be seen as a middle term option and with a mix of advantages and disadvantages of the other two options, for our analysis.

over the demand elasticity of expenditures in marketing (advertisement), R&D and quality, firm simulated activities. The control of this elasticity, maintaining an equilibrium and with the same level of importance, could avoid some biases by those teams (players) who choose one of these expenditures as a 'strategic priority'. By this, they might be penalized or rewarded in their 'firm' results. In our case, we used a measure of team consensus based on a measure of strategic priorities in expenditures: that is marketing, R&D, quality, plant capacity, on manufacturing; besides price policy (definition); and one of the objectives of the research was to analyze the existence of differences in team consensus over three kinds of expenditures (marketing, R&D and quality).

1.7.3 Specifying a Business Game

What aspects should concern a researcher when defining a business game?

Reality versus Validity

We must conclude that a trade-off between reality and validity has always permeated and will permeate the use of management games as research tools. In the literature, we identified that an equilibrium between reality and complexity must be found. Dickinson, Gentry, and Burns (2004) reaffirm the suggestion made by Gentry et al. (1984: 01) "… sufficient control so as to ensure internal validity while at the same time being sufficient realistic so as to have some external validity." As we discussed above, a more realistic game may provide

the players (subjects) with less playful attitudes, stimulating the competition and the interest in the game that could be helped by a system of rewards to avoid undesirable situations. We also agree with Larréché (1987), and others, on the importance of the role played by the instructor or game administrator in conducting the game in an appropriate manner in order to achieve experiment aims and avoid experiment biases.

On the other hand, more complex games are usually more expensive and more difficult to design and program on a computer. This complexity could potentially stimulate disinterest among players who might find difficulty in understanding and using the information provided by the complex game interrelationships. This is particularly important when we intend to use undergraduate students as subjects in laboratory research. By the way, it is important to recognize that, given their experience and accumulated knowledge, executives and MBAs are more precise and reliable in their behavior. This is particularly true when we try to extrapolate to the real world from their professional conduct, evaluated in a simulated environment. However, to some extent, undergraduates could achieve similar levels of final results despite their apparent "erratic" (Babb, Leslie and Van Slyke 1966: 470) way of doing the things.

It is imperative to conclude this section naming Cohen and Rhenman (1961) who suggested that management games could be used "if care is exercised to make the structure simulated by the management game sufficiently realistic and if the participants making the decisions are sufficiently well aware of good business practice to behave in a reasonable intelligent manner" (pp. 159-160). These authors justify this statement arguing that:

> "… it has usually been impossible to solve most business games in formal terms to discover optimal strategies, at least for games sufficiently complex to be any kind of reasonable approximation to reality" (p. 160).

Cohen and Rhenman (1961) go beyond and warn of the problem of complexity stating …

> "It is evident, … that as we succeed in designing more and more realistic games and perhaps approach the requirements stated here, we will simultaneously meet many of the problems of complexity that we are trying to avoid when going from the field to the laboratory. The game will, e.g., be complex enough to make measurements almost as formidable as in field research" (p. 162).

and further …

> "the network of relations in the mechanisms under study will be so large that it will be very difficult to understand and explain what is happening in an experiment" (p. 162).

The authors finally conclude that …

> "… we shall have to admit that a compromise between satisfactory realism and tolerable complexity will always be necessary" (p. 162).

Research Nature and Objectives

We start this section with the following statement "the more complex management games should be used only where clearly required by the nature of the problem" (Babb, Leslie and Van Slyke, 1966: 471). In other statement, Keys and Wolfe (1990: 318) caution that "simulation design should ideally focus on behavior elicited by games rather than predetermined design criteria." These statements converge towards the link that exists between the prior issues listed above, and others related to the objectives and the nature of the research to be developed. Since a management game is a tool to be used as a laboratory experiment, the aspects related to experiment controlling could be well explored in favor of the research. Additionally, the nature of research could be a determinant in the choice of management games and their designs. We refer to experiment control as: (a) manipulating the experiment avoiding some variables and their interrelationships, that is control undesirable conditions that some variables could affect other variables, interfering in the measure; (b) measuring variables in 'ready' and 'on station' situations avoiding biases from field research measures; (c) providing the experiment with a longitudinal feature with compressed time and according to time availability; and (d) providing the researcher with the possibility to access qualitative and quantitative information in a fast way.

Issues that Must be addressed by a Management Game to became a Useful Research Tool

Larréché (1987: 564) warns of one of the most critical and problematic elements to be handled by a game designer stating that "the interface between the firms, its competitors, and the market" must be simulated in the most realistic manner. Further, Larréché (1987) also cautions of the difficulty in designing some aspects of reality by asserting that "the modeling of financial accounts or the flow of goods in manufacturing is a relatively deterministic process although not always straightforward. Market and competitive interfaces cannot be completely specified by research, since they are specific to different business activities" (p. 564). Despite this, and in search of general specification that could be used to select or design a management game for research purposes, we compiled and suggested the following:

(a) a management game must provide competition (Bass 1964; Larréché 1987);

(b) a tangible product (Bass 1964);

(c) with an economic environment where, for example, a dynamic effect of market[8] decisions could be appreciated over time (Bass 1964; and to some extent Larréché 1987);

(d) create an industrial climate, or situation in which a subject is immersed and believes that is trustworthy enough;

(e) a longitudinal aspect that could or could not be used by the researcher;

[8] e.g. decisions like price, advertising expenditure, competitors prices, etc.

(f) could provide access for the researcher to the model specification, who could alter some variables or constants (like our example of demand advertising, R&D and Quality expenditure elasticity) according to research needs;

(g) the game could facilitate the choice of the researcher to control information given to players, that is, the quantity and the quality of given information, according to the research specifications (suggestion by Hambrick 2007). This may include specific facilities or special screens, where a researcher may insert analytical information or additional data; define its availability to the players and where the researcher could visualize the number (frequency) and the kind of information accessed by players.

1.7.4 Final Remarks

Cohen and Rhenman (1961), with the intent to exemplify the usefulness of laboratory experiments in social research, describe labor in a chemistry laboratory:

> "… when collecting empirical data to test his fundamental theories, the scientist accepts the artificial test tube experiment. But when he wants to test, e.g., a complex production process, these simple laboratory experiments are not regarded as reliable. He knows that work in a laboratory might cause him considerable trouble in the full scale plant. This is why he wants to test the process in a pilot plant designed to make experimentation possible… considering its size, cost, and purpose, a laboratory for experimental games … really is a

> pilot plant test station. But even with this limitation, organizational 'pilot plant test' should be very valuable. A simple test which shows that an organization works in a tolerable way provides valuable knowledge" (p. 164).

But one conclusion provided by Festinger (1959: 10) is important to consider: that "a laboratory experiment need not, and should not, be an attempt to duplicate a real life situation."

Along a similar line, for Gentry et al. (1984, p. 01), a management game is a middle range between field and laboratory research. They also state that "in general, the hope is that simulation games can allow sufficient control so as to ensure internal validity while at the same time being sufficiently realistic so as to have some external validity."

Bass (1964) argues that a management game "is not the tool with which to test specific individual cognitive processes, one-by-one, any more than a pilot plant is usually necessary to test a specific chemical reaction, or a wind tunnel is necessary to test the tensile strength of a particular alloy" (p. 546). Bass (1964) likewise believes that management games are a recommended experimental procedure to examine questions related to "organizational mix, particularly of real men, processes and materials as they interact" (p. 546).

Babb, Leslie and Van Slyke (1966) claim that "some real-life comparisons may be necessary to validate findings based on gaming experiments" (p. 468) but "the gaming method may even provide further empirical evidence on the theoretical issues of the controversy" (p. 469). The authors conclude that "management

games become a desirable device for obtaining research data which would not be possible using conventional techniques" (p. 472). These authors express concern on the subject choices, "the objectives of the experiment should be considered in the selection of subjects" (p. 471). By those who intend to design a management game, Larréché (1987) warns that *(the insertion is ours)* "the development of the simulation should be driven by the theoretical knowledge of market and competitive mechanism and not by the pedagogical *(or research)* concepts it is designed to illustrate." (p. 564). For him, a management game needs to "exhibit both theoretical validity (coherence with existing body of knowledge) and behavioral validity (coherence with the behavior in the real world)" (p. 565).

Along similar lines, Keys and Wolfe (1990), Schwenk (1982) and Nees (1983) strongly believe that laboratory research could interact further with field research. Additionally, this movement could occur sequentially, in a virtuous cycle, in a sense that the former and the latter mutually improve one another. They could also reinforce theories with their findings.

To illustrate these statements, Camerer (1985: 06) argues that "seeing models as intermediate steps in ongoing model-building makes it clear that the realism of today's model is relatively unimportant, and blatantly unrealistic models may be better 'building blocks' than realistic inductive frameworks."

As such, we believe that management games can be used as an experiment research tool and might be an adequate testing ground for empirical results generated by other kinds of research instruments. For many authors, management games are a valid instrument to contrast theories, if the experiment and the games are carefully designed. However, the virtuous cycle of laboratory and field

researchers proposed by Schwenk (1982) needs to exist to reinforce the findings and guarantee an increase in the body of knowledge. As Jemison observed, (1981) “managerial environment that is inherently more complex than the degrees of freedom available to the researcher” (p. 640), and in our belief, through the use of a laboratory, the degrees of freedom could be efficiently manipulated in order to provide new important and valid critiques to current theory.

To conclude this chapter, we provide a last reference on management games to researchers deep reflection that is “when no simple experiment with all-but-one variable held constant will provide the answers we seek, it will be profitable to simulate the organization” (Bass, 1964, p. 547).

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CHAPTER 2

International Multidivisional Industry Simulation

2.1 FOUNDATIONS FOR BUSINESS GAME DESIGN

The design and development of the International Multidivisional Industry Simulation (IMIS) was oriented basically by four "classics" references (Gold 2005: 203): Goosen (1981); Teach (1990); Gold and Pray (1990); and Gold and Pray (2001). Our choice concerning these references was basically motivated for (a) the ease with which these authors present and explain a game simulator is produced; (b) the ease of access to these references, of which three are freely available on the Internet; and (c) the extensive space dedicated by these authors to the issue. Bearing this in mind, we hope to provide the readers with appreciable and detailed information on the practical and theoretical fundaments of management game designing.

We begin the discussion by introducing the instrumental study of Goosen (1981) which is considered one of the most important in the management game literature (Wolfe and Gold 2007). His work aimed to propose several steps to be taken in business designs (see Table 2.1).

Table 2.1: General Steps of Simulation Design (Goosen 1981: 41)

1. Develop a general outline or scenario of the simulation
2. Translate this broad scenario into a set of financial statements and other desired reports
3. For each element of the financial statements (assets, liabilities, capital, revenue and expenses)

create an equation which determines the ending balances or amounts
4. Construct the mathematical functions which give the simulation dynamics and realism necessary to achieve participants' acceptance
5. Construct the functional algorithms necessary to produce the decision values required by the financial statement equations.
6. Assign specific values for all parameters and simulation constrains, mathematical functions, and functional algorithms
7. Write a computer program for processing decisions and producing simulation results
8. Write a student manual

Table 2.2: IMIS Designing Steps (adapted from Goosen 1981)

1. Develop a general outline or scenario of the simulation, respecting the necessities of the experiment/class, basically considering three aspects: (a) the object of research, which in our case is consensus on strategic priorities; (b) the subjects (players) involved in the experiment and their capacity to manipulate complex situations; (c) the time available to conduct the experiment.
2. Translate the desirable broad scenario into a set of variables categorized as: (a) player decisions; (b) game administrator decisions; (c) default data settings; (d) output variables.
3. Describe, correlate and ponder the variables and integrate them into mathematical functions, basically focusing on two broad model functions (a) demand and (b) supply models.
4. Assign specific values to all variables and initial parameters, their limits and constraints. Link them to mathematical functions, build the algorithms and pre-test them. Adjust the values, ponders and correlations, if necessary.
5. Integrate the two model functions (demand and offer) and link them to desirable output variables. Design the desirable output reports: financial, marketing, manufacturing, R&D and quality.
6. Write a computer program for processing decisions and producing simulation results.
7. Test the whole program and adjust the specifics values of the parameters, functions, algorithms and output reports.
8. Write a student manual and auxiliary material necessary to experiment or class.

The business game was designed with a 'competitive orientation', in which players are responsible for developing strategic decisions. This 'orientation' means that the participant decisions influence the general industry demand as

well the individual firm level. The orientation follows the general idea of management games that is *(the insertion is ours)*: "… to conform *(the game)* to theoretically derived models of general industry economic structure *(like)* (Porter 1980)" (Teach 1990: 107). For instance, Gold and Pray (1990: 117) assert that management games must follow "… the properties of modern demand theory" in order to be considered the most realistic simulation as possible. Following this general idea, we used recommended techniques like harmonic mean and exponential smoothing. The use of techniques such as these incorporates intertemporal effects of decisions on demand and additionally provides some limits on inadvertent or malicious decisions, like extremely low price practices and consequently excessive demand concentration.

2.2 GENERAL SCENARIO OF SIMULATOR

International Multidivisional Industry Simulation, or simply IMIS, is a business game built on computer-based simulation technology that tries to represent an industry of global microprocessors (specifically memory chips). The game provides an environment where participants can manage one of the ten available firms (limited in the game) making strategic decisions in order to stimulate demand and provide goods. The general propose of the game is to provide a simulated business environment where important issues regarding strategic management can be experimented by participants, especially those questions related to international venture. Then, the game provides students with an experience in decision making and also the possibility of studying the effects of such decisions on market and firm results, considering the 'virtual global

competitive scenario'. The game present important issues that are dealt with by the players, very common in this kind of industry, like: (a) the importance of plant location; (b) the risk/opportunities of investments and their relation to manufacturing costs; (c) global market, sales and production; (d) importance of quality, R&D and firm marketing activity efforts; (e) the complex 'integrative view' of strategic management; and (f) competitive strategic management, that is, managing business units (those knowledge managed by international strategic management, e.g. Certo and Peter 2005; Kluyver and Pearce II 2007; Porter 1980, 1986; etc).

In the industry, these firms compete among themselves in a 'global market' and their executives (the players) are responsible for strategically managing a division (the electronic devices) from a central office. This division has business units (manufacturing plants) which are located in one or more of the three 'global regions'. The main challenge for the 'executives' is to make six (6) strategic decisions, but stimulating them to use management tools like SWOT analysis; strategic aims and goal definition; competitive strategy choice; and defining strategic priorities.

The six strategic decisions (the strategic priorities) that are effectively entered into the simulator are basically budget allocation, investments/disinvestments and price definition. In detail, they are as follows:

(a) increase/decrease manufacturing plant;

(b) budget for manufacturing activities;

(c) budget for marketing activities;

(d) budget for research and development activities;

(e) budget for quality assurance activities;

(f) final product price.

The decisions are presumed to be the annual limits for operation of all business units and are made, for instance, at the beginning of the 'simulated year', reflecting the players' strategic priorities. The reports for the functional areas of finance, production/operation and marketing are related to the entire year of operation, according to the decisions and the firm's external influences (e.g. microeconomics – consumers and competitors; and macroeconomics – government policies).

Participants have an additional decision which is to define the regions where they will locate the manufacturing plants, considering the new investments on new plant location, or even incrementing or reducing the current plant. The game offers three possible regions and the firms start with a plant only in the 'Region 2'. Each region has different costs of production and related risks to social, economic and politic stability (see Table 2.3). The consequence is that the costs may vary more or less according to the stability of the chosen region.

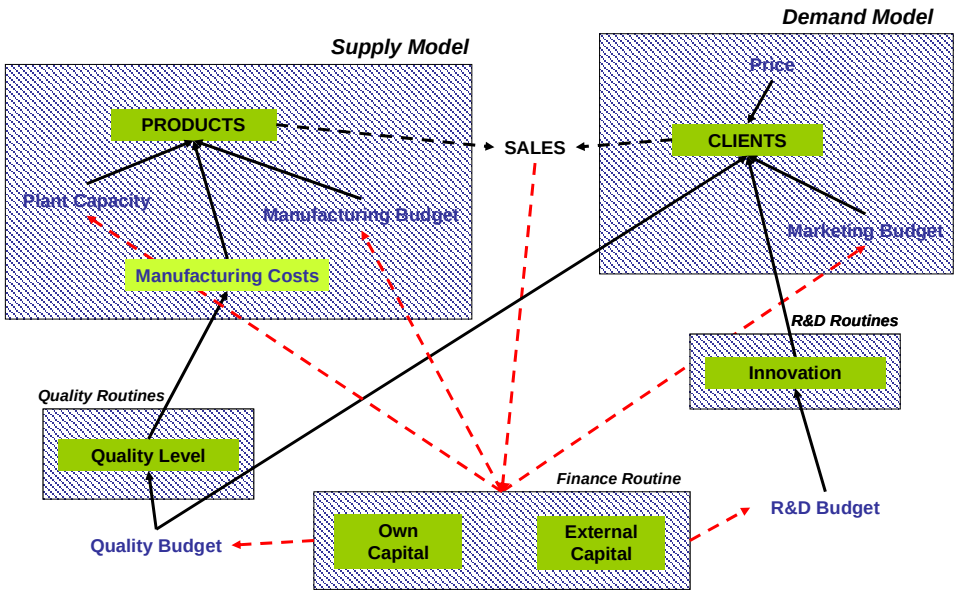
Table 2.3: The characteristics of the three IMIS game Regions (Dieguez-Barreiro 2007)

Region 1 – this region is the most stable among the three and could be classified as a region of 'developed countries'. It indicates a low risk for investments, but it reflects the high costs of manufacturing when compared to the other two regions. The higher costs are related to a more expensive workforce and services (logistics, taxes, etc.).
Region 2 – this region is where the firm's manufacturing plant is located at the beginning of the game. The region presents a medium level of risk for investments because manufacturing costs may occasionally oscillate significantly. We could classify the region as a group of 'developing countries'. This oscillation could appear mainly because of economical reasons despite the low salary of workforce and raw materials. Much of the problem is related to the external trade balance (trends) and potential increments in export and import taxes.

Region 3 – this region is by and large unfamiliar to the firm. The region presents a workforce and raw material with extremely low costs compared to the other two regions. This region could be classified as a group of 'low developed countries'. Despite this, an important issue emerges with the low costs: the inherent risks to political, social and economic instabilities. The latter could cause unexpected high increments on costs and eventually the plant could be sabotaged.

The business game is built on two central models and three complementary routines (see Figure 2.1). One model represents firm products or supply (goods available to go on sale), and the other, the clients or demand (persons in the market who desire the goods). The routines are related to finance, R&D and quality activities. Confronting the supply with demand gives the general performance of the firms and the reaction level of the industry.

Figure 2.1: Graphic representation of IMIS models and routines (Dieguez-Barreiro 2007)



The simulator is designed to simulate up to twelve decisions (each one relates to a period or an entire year). However, at least one decision/period must be

considered as historical, that is, the firms already exists when the players make their first decision. The number of historical periods must be decided by the game administrator according to course plan, research interest, the subjects involved in the competition, and so on.

Designing IMIS takes into account 'good practices' in business game simulation development prescribed by the Association for Business Simulation and Experiential Learning - ABSEL[9]. We particularly highlight the use of the Guide to Business Gaming and Experiential Learning (Gentry 1990); the proceedings emanated from the annual meetings of ABSEL; and the Simulation & Gaming Journal.

2.3 THE VARIABLES

The variables in business simulation are organized into four categories: (a) player decisions; (b) game administrator decisions; (c) default data settings; and (d) output variables.

2.3.1 Player Decisions

The players have six decisions to make, of which five are related to budget allocation and one related to price definition (see Table 2.4). All decisions are based on a fictitious currency '$'. From the five budget allocation decisions, two

[9] Please refer to the ABSEL web page on www.absel.org.

of them must be made considering the region where the manufacturing plants are, or will be located.

Table 2.4: Decisions on Strategic Priorities of IMIS (Dieguez-Barreiro 2007)

(a) Manufacturing budget ($) for regions 1, 2 and 3
(b) Budget ($) for new manufacturing plants, increment existing plants or potentially the amount to be reduced for manufacturing plants in regions 1,2 and 3
(c) Budget ($) for research and development (R&D) activities
(d) Budget ($) for quality assurance programs
(e) Budget ($) for marketing campaigns (advertising, promotion, etc.)
(f) Price definition ($)

2.3.2 Game Administrator Decisions

The game administrator has the mission to provide adequately prepared macro and microeconomic environments from class plan objectives (or research objectives), relating theory to practice that students will be experiencing in the game. 'Basically' the administrator has to make four decisions, of which one will be made considering the three regions (refer to Table 2.5).

Table 2.5: Game Administrator Decisions (Dieguez-Barreiro 2007)

(a) Long Term Interest Rate which will be used to remunerate the loans made by the firms
(b) Economy Increment Rate that indicates the growth or the reduction of the entire economical activity – with direct influence on demand
(c) The Manufacturing Costs for Regions 1, 2 and 3
(d) Value of the expenses related to administrative functions for each manufacturing plant

The term ‘basically’ was employed considering the objectives of the game according to the game administrator class plan. For instance, the game starts with default values for the first year, taking into account a firm with positive results in general (financial, marketing and production). According to the desire of the administrator, firms may vary their outputs. For example, firms could start with some level of debts and potentially negative results, creating an emergency or crisis challenging the players. The game administrator could prospectively provide more than a year as historical data. This option could favor the use of long term forecast instruments, for example: regressions to estimate future demand and sales. Besides this, the administrator has a special frame within the software to introduce information that will be used by the players, constituting a special feature of the game. We regard this a special feature because the game administrator could manage the quality and quantity of the extra information (despite the manual) with which to provide the decision makers (players). In sum, this feature enables us to control research experiments and provide the lectures (teachers and game administrator) with an important teaching tool when this information is associated to analysis about the firm/market performance, referring to theory and concepts.

2.3.3 Default Data Settings

The default values (see Table 2.6) are used in the models which compound the simulator. They are related to previous values which set initial parameters for simulated firms and some parameters and constants which regulate the equations on the models.

Table 2.6: IMIS Default Data Settings (Dieguez-Barreiro 2007)

(a) Constants and other parameters such as: elasticity for price, R&D, marketing, and quality
(b) Value of the initial demand
(c) Quantity of manufacturing assets in each region
(d) The initial value of already manufactured goods
(e) Initial stock of products (Period 0)
(f) Asset manufacturing capacity
(g) Depreciation on assets sales
(h) Minimum and maximum limits over players decisions

2.4 SUPPLY'S MODEL AND ALGORITHM

The 'supply model' is fueled by decisions made by the participants, from default software values and by decisions by the game administrator. In short, the firm offer is calculated considering two values (a) plant capacity, and (b) budget for manufacturing activities. The value of plant capacity, measured as a countable issue – assets – provides the limits for the production of goods based on a simple and direct relation 1 good = $ 10,00 in assets.

The production is also limited by the availability of financial resources (manufacturing budget) for manufacturing activities to cover (a) worker salary; (b) acquisition of raw materials and other supply materials; (c) maintenance and other outsourced manufacturing services; (d) costs of electricity, gas, and water supplies; and etc. The financial resources are distributed by the players in each manufacturing plant in the three available regions. The game administrator

defines the unitary costs (the cost to manufacture each product) according to each region (see Table 2.7 for default costs in each region).

Table 2.7: Default Values to Manufacture One Good in Period 'Year 1' (Dieguez-Barreiro 2007)

CR1 = $ 4,00
CR2 = $ 3,50
CR3 = $ 3,00

Caption:
CR1/2/3 – Cost of manufacturing in Region 1, 2 and 3 respectively

The 'supply algorithm' is calculated individually by each firm taking each region where the firm has manufacturing plant into account. The calculus begins with the 'prior assets capacity', or the assets available at the end of period 't-1' (PA_r), to which the 'flux of assets' (increment or reduction of plant capacity) in period 't' is added or deducted (FA_r), to reach the 'final assets capacity' in period 't' and region 'r' (FC_r). The 'final capacity' (FC_r) in product terms could be calculated by al divided by 10 (as indicated on Equation 2.1), thus providing the maximum capacity a given plant has in number of products.

Equation 2.1: The Calculus of Plant Capacity on Period 't'

$$FC1 = \frac{PA + FA1}{10}$$

Caption:

FC1 – Final assets Capacity on Region 1

PA1 – Prior Assets (initial assets) capacity on Region 1

FA1 – Flux of Assets for (manufacturing) capacity on Region 1

Another production limit is calculated by the 'limit of budget for manufacturing' (LB_r) (see Equation 2.2). The budget is the amount of resources available that the business unit has to acquire: raw materials, pay personnel, contract outsource services, etc. The calculus is made by dividing the decision made by the participant, by the cost of manufacturing (CR_r). This cost could vary according to a specific region (as indicated in Table 2.7) and additionally vary according to results of the investments in quality assurance programs of each firm. The investments in quality could reduce the costs of manufacturing by up to 30% (RD_r). The formula which defines the percentage of cost reduction takes into account the investments of the other firms and past firm investments, rewarding firms which have the larger accumulated investment. Thus, the cost reduction (RD) is specific to each firm according to its quality investment when compared to other firms, and it has a direct impact over the costs of manufacturing in all three Regions.

Equation 2.2: Limit of Production Over Manufacturing Budget

$$LB1 = \frac{MB1}{CR1 - (1\text{-}RD)}$$

Caption:

LB1 – Limit of production provided by the Budget for manufacturing in Region 1

MB1 – Manufacturing Budget decision for Region 1

CR1 – Cost of manufacturing in Region 1

RD – Reduction Costs in %

The algorithm which defines manufactured products (MR_r), relates two variables, the plant capacity (FC_r) and the budget available for manufacturing (LB_r) and takes the lowest value, that is, that which presents the lowest manufacturing limit, as shown in Figure 2.2.

Figure 2.2: Algorithm for Supply Decision of Region 1

if, FC1 < LB1

make MR1 = FC1

… if not make

MR1 = LB1

Caption:

FC1 – Final assets capacity in Region 1

LB1 – Limit of production provided by the Budget for Manufacturing in Region 1

MR1 – Number of manufactured goods in Region 1

Obs. The routines to calculate the manufactured products in other regions are the same.

The final firm goods supply (S) for each firm on period ´t` is calculated taking into account the number of manufactured products in each Region (1, 2 and 3), to which the products in stock from period 't-1'are added (see Equation 2.3):

Equation 2.3: Final Firm Goods Supply

$$S_t = MR1 + MR2 + MR3 + STK_{t-1}$$

Caption:
S_t – Goods to supply in year 't'
MR1/2/3 – Goods manufactured in R1/R2/R3 respectively
STK_{t-1} – Stock in early period (t-1)

We highlight that the costs of manufacturing are no known in advance by the decision makers. These costs will be known through reports generated after decision making, thus the situation involves decisions concerning risk/opportunity and uncertainty, one of the aims of the IMIS game.

2.5 DEMAND MODEL AND ALGORITHM

The demand algorithm is based on economic theory (e.g. Gold and Pray 1990; Salvatore 2006), which states that the demand is a function of price, as well as a number of non-price factors like: marketing (i.e. advertising, promotion, sales force etc); product quality; product innovation (R&D investment results); price of related goods (substitutes or complementary goods); consumer income; other

factors (demographics, expectations, etc.) (Gold and Pray 1990). In sum, the demand could be represented by these variables, but each of them could have distinct forms of interfering with the demand calculus. The 'law of demand', for example, states that the quantity demanded is inversely related to the price of the good, that is, the increment of price in one good leads to demand reduction, considering that other variables (marketing, quality, R&D etc.) are held constant. Another important concept is that of elasticity of demand. This entails the effect on the percent change in quantity demanded due to a percent change in price, taking the price as an example (Gold and Pray 1990).

In this game, we opt to use the log lineal demand function, described in detail by Gold and Pray (1990), in which the economy theory fundaments briefly described above are employed. The reasons that lead us to use this demand function is primarily because it is the most common used form in simulators (Gold and Pray 1990). Additionally, it is the oldest simulation model for demand, (designed by Pray and Gold on 1982; by Gold and Pray on 1984 and 1997, 1998) adequately revised in Gold and Pray (1999). We highlight the substantial experience of these authors in developing their own models, in synthesizing, comparing and testing existing simulation models (Gold and Pray 2001). For IMIS we opted to use four variables that directly influence the demand calculation: Price, R&D, Marketing, and Quality (see Equations 2.4 and 2.5).

Equation 2.4: General Function for Industry Market Demand based on Gold, and Pray (1990)

$$D = g_1 P_t^{-(g2+g3Pt)} M_t^{+(g4-g5Mt)} R_t^{-(g6-g7Rt)} Q_t^{-(g8-g9Qt)}$$

Caption:

D – Industry demand (all firms)

P_t – Average[10] price in the industry in period 't'

M_t – Average marketing expenditure in the industry

R_t – Average R&D expenditure in the industry

Q_t –Average quality expenditure in the industry

g_i – parameters for i =1,7

Equation 2.5: Function for Firm Market Demand based on Gold, and Pray (1990)

$$W_i = k_0 (P_i+k_1)^{-(k2+k3pi)} (M_i+k_4)^{+(k5+k6mi)} (R_i+k_7)^{+(k8+k9ri)} (Q_i+k_{10})^{+(k11+k12qi)}$$

Caption:

W_i – Weight (i.e. market share) for firm ´i`

P_i – Exponentially[11] smoothed price of firm ´i`

M_i - Exponentially smoothed marketing expenditures of firm 'i'

R_i - Exponentially smoothed R&D expenditures of firm 'i'

Q_i - Exponentially smoothed quality expenditures of firm 'i'

K_h – Constants or parameters for h=0,12

[10] The average used is the harmonic mean. Accordingly to Gold and Pray (1990: 125), "the harmonic mean computes the average market price by weighting low prices relatively more than higher prices" and "in accordance with economic theory, low-priced products (firms) generate higher quantities demanded than high-priced firms."

[11] The exponential smoothing simulates the effects of past decisions (t-1) on present and future decisions (t and t+1).

To calculate the 'initial firm demand' (ID_i) we established the product between the firm weight (W_i) by the 'industry demand' (D) as shown in Equation 2.6.

Equation 2.6: Firm Initial Demand based on Gold, and Pray (1990)

$$ID_i = W_i \times D$$

Caption:
ID_i – Demand for firm 'i'
W_i – Weight for firm 'i'
D – Industry Demand

To calculate the 'final firm demand', (FD_i) a fundamental calculus must be considered: the so-called 'stock out' (SO_i). The 'stock out' is the difference between a firm initial demand (ID_i) and supply (SP_i) and represents the number of clients that were not provided with goods in the period (see Equation 2.7).

Equation 2.7: Firm Stock Out based on Gold, and Pray (1990)

$$SO_i = ID_i - SP_i$$

Caption:
SOi – Stock out of firm 'i'
IDi – Initial demand for firm 'i'
SPi – Supply of firm 'i'

The simulator penalizes the firms which do not provide the total of the demand. The 80% of the demand excess (or the stock out) is redistributed among other firms. Thus, it simulates the number of unsatisfied clients. The remaining clients

(20%) are those who maintained their fidelity with the firm. The final demand (FD_i) is calculated by adding 20% of the stock out (SO_i) to the firm supply (SP_i) (see Figure 2.3).

Figure 2.3: Algorithm Final Firm Demand with Stock Out based on Gold, and Pray (1990)

if, $SO_i > 0$

make $FD_i = SP_i + (SO_i \times 0.20)$

… if not, make

$FD_i = ID_i$

Caption:
SOi – Stock out of firm 'i'
FDi – Final Firm 'i' Demand
IDi – Initial demand for firm 'i'
SPi – Supply of firm 'i'

2.6 THE IMIS DYNAMIC

To demonstrate the dynamic of the game, we decided to simulate an example of decision-making. In this demonstration we will show (a) the prior two historical data, (b) the decision sheet that must be filled out, and (c) the output data for this decision.

2.6.1 The Historical Data: Preparing the Decision Making

For this simulation, we decided to use the historical data of two years of a firm. The historical data considers two reports, one related to individual aspects of a firm organized into areas such as (a) decisions made for the period; (b) results in operation & manufacturing, quality, R&D; (c) financial results; (d) and marketing results.

The Managerial Report (on the left of Figures 2.4 and 2.5), shows for instance (refer the numbers in parenthesis to):

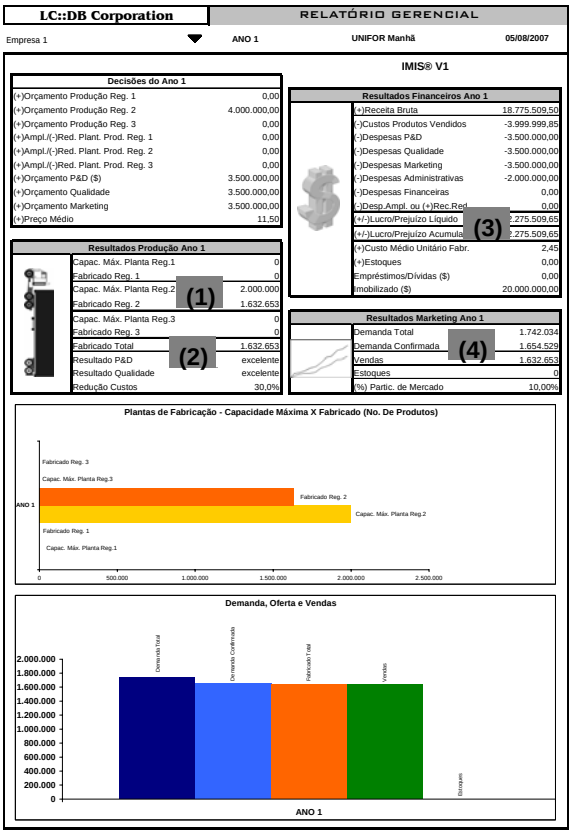
(1) manufacturing limits considering the plant capacity;

(2) results of R&D function with level “excellent”;

(3) free cash flow / benefits flow available for the next period;

(4) demand, sales and stock.

Figure 2.4: Historical data for Year 1, the Managerial Report and the Sector Inform (Dieguez-Barreiro 2007)



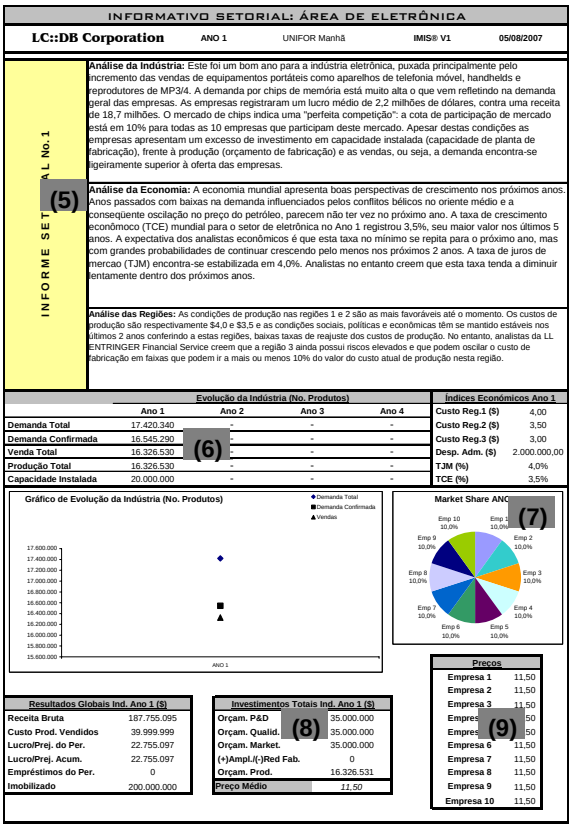
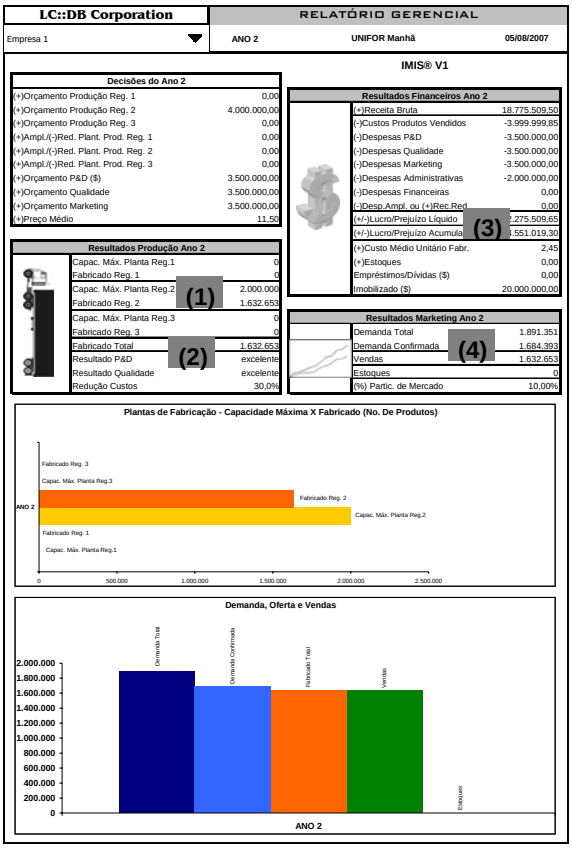
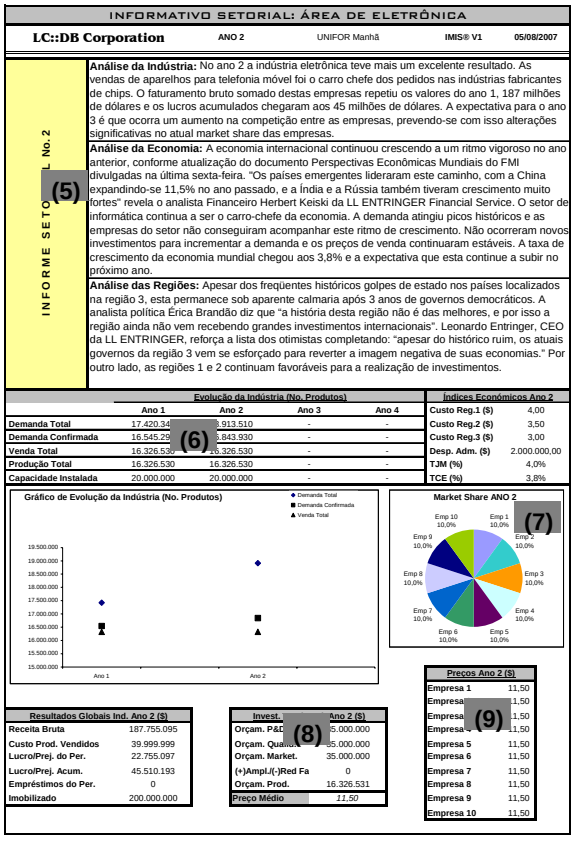


Figure 2.5: Historical data for Year 2, the Managerial Report and the Sector Inform (Dieguez-Barreiro 2007)





The Sector Inform report (Figures 2.4 and 2.5, on the right), provides the player with general information about: the industry and competence data; macroeconomic data; and notes on past performance and future trends, and on the industry. With this report it is possible to know, for example:

(5) industry, macroeconomic and regions analysis;

(6) the general industry demand, supply and sales;

(7) the market share of all firms;

(8) firm prices;

(9) the total expenditures of firms in the industry.

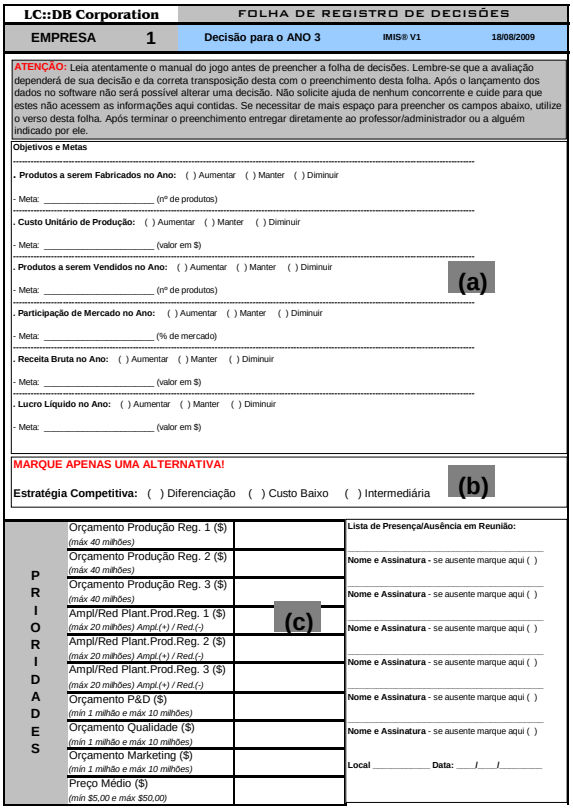
The purpose of these reports is to ground the subsequent decision, by demonstrating past performance and the capacity of a firm. Additionally, it informs about the future, indicating tendencies or performance variation by comparing period 1 – year 1 (Figure 2.4) to period 2 – year 2 (Figure 2.5).

2.6.2 Decision Making: Strategic Objectives, Aims and Priorities

Taking into account information from the historical reports, the players must decide using the decision sheet provided to them. The sheets are divided into three main parts (refer the letters in parenthesis to Figure 2.6): (a) suggested firm objectives and aims; (b) the preferred competitive strategy; (c) the strategic priorities – firm budgeting and price definition. We present below a decision-

making sheet (Figure 2.6) and the decisions made – named strategic priorities - for Period 3 firm 1 (Figure 2.7) and the other firms, from 2 to 10 (figure 2.8).

Figure 2.6: Decision Making Sheet



LC::DB Corporation — FOLHA DE REGISTRO DE DECISÕES

EMPRESA 1 — Decisão para o ANO 3 — IMIS® V1 — 18/08/2009

ATENÇÃO: Leia atentamente o manual do jogo antes de preencher a folha de decisões. Lembre-se que a avaliação dependerá de sua decisão e da correta transposição desta com o preenchimento desta folha. Após o lançamento dos dados no software não será possível alterar uma decisão. Não solicite ajuda de nenhum concorrente e cuide para que estes não acessem as informações aqui contidas. Se necessitar de mais espaço para preencher os campos abaixo, utilize o verso desta folha. Após terminar o preenchimento entregar diretamente ao professor/administrador ou a alguém indicado por ele.

Objetivos e Metas

. **Produtos a serem Fabricados no Ano:** ( ) Aumentar ( ) Manter ( ) Diminuir
- Meta: _____ (nº de produtos)

. **Custo Unitário de Produção:** ( ) Aumentar ( ) Manter ( ) Diminuir
- Meta: _____ (valor em $)

. **Produtos a serem Vendidos no Ano:** ( ) Aumentar ( ) Manter ( ) Diminuir
- Meta: _____ (nº de produtos)

(a)

. **Participação de Mercado no Ano:** ( ) Aumentar ( ) Manter ( ) Diminuir
- Meta: _____ (% de mercado)

. **Receita Bruta no Ano:** ( ) Aumentar ( ) Manter ( ) Diminuir
- Meta: _____ (valor em $)

. **Lucro Líquido no Ano:** ( ) Aumentar ( ) Manter ( ) Diminuir
- Meta: _____ (valor em $)

MARQUE APENAS UMA ALTERNATIVA!

Estratégia Competitiva: ( ) Diferenciação ( ) Custo Baixo ( ) Intermediária

(b)

PRIORIDADES		
	Orçamento Produção Reg. 1 ($) *(máx 40 milhões)*	
	Orçamento Produção Reg. 2 ($) *(máx 40 milhões)*	
	Orçamento Produção Reg. 3 ($) *(máx 40 milhões)*	
	Ampl/Red Plant.Prod.Reg. 1 ($) *(máx 20 milhões) Ampl.(+) / Red.(-)*	(c)
	Ampl/Red Plant.Prod.Reg. 2 ($) *(máx 20 milhões) Ampl.(+) / Red.(-)*	
	Ampl/Red Plant.Prod.Reg. 3 ($) *(máx 20 milhões) Ampl.(+) / Red.(-)*	
	Orçamento P&D ($) *(mín 1 milhão e máx 10 milhões)*	
	Orçamento Qualidade ($) *(mín 1 milhão e máx 10 milhões)*	
	Orçamento Marketing ($) *(mín 1 milhão e máx 10 milhões)*	
	Preço Médio ($) *(mín $5,00 e máx $50,00)*	

Lista de Presença/Ausência em Reunião:

Nome e Assinatura - se ausente marque aqui ( )

Nome e Assinatura - se ausente marque aqui ( )

Nome e Assinatura - se ausente marque aqui ( )

Nome e Assinatura - se ausente marque aqui ( )

Nome e Assinatura - se ausente marque aqui ( )

Nome e Assinatura - se ausente marque aqui ( )

Local _____ **Data:** ____/____/_____

Decisões do Ano 3	
(+)Orçamento Produção Reg. 1	0,00
(+)Orçamento Produção Reg. 2	6.000.000,00
(+)Orçamento Produção Reg. 3	0,00
(+)Ampl./(-)Red. Plant. Prod. Reg. 1	0,00
(+)Ampl./(-)Red. Plant. Prod. Reg. 2	0,00
(+)Ampl./(-)Red. Plant. Prod. Reg. 3	0,00
(+)Orçamento P&D ($)	3.000.000,00
(+)Orçamento Qualidade	5.000.000,00
(+)Orçamento Marketing	4.000.000,00
(+)Preço Médio	11,15

Figure 2.7: Strategic Priorities for Firm 1 on Period 3

Decisões do Ano 3	
(+)Orçamento Produção Reg. 1	0,00
(+)Orçamento Produção Reg. 2	4.000.000,00
(+)Orçamento Produção Reg. 3	0,00
(+)Ampl./(-)Red. Plant. Prod. Reg. 1	0,00
(+)Ampl./(-)Red. Plant. Prod. Reg. 2	0,00
(+)Ampl./(-)Red. Plant. Prod. Reg. 3	0,00
(+)Orçamento P&D ($)	3.500.000,00
(+)Orçamento Qualidade	3.500.000,00
(+)Orçamento Marketing	3.500.000,00
(+)Preço Médio	11,50

Figure 2.8: Strategic Priorities for Firms 2 to 10 on Period 3

According to these decisions, firm 1 increased the budget for manufacturing in its plant in region 2 from $4 million to $6 million. The other firms maintained the

same budget at $4 million. Firm 1 decreased the price to $ 11.15 and the other firms maintained theirs at $11.5. Firm 1 also kept the budget for R&D (at $3.5 million), increased the marketing and quality activities (from $3.5 million to $5.0 million and $4.0 million respectively). The other firm investments remained at 3.5 million for each activity.

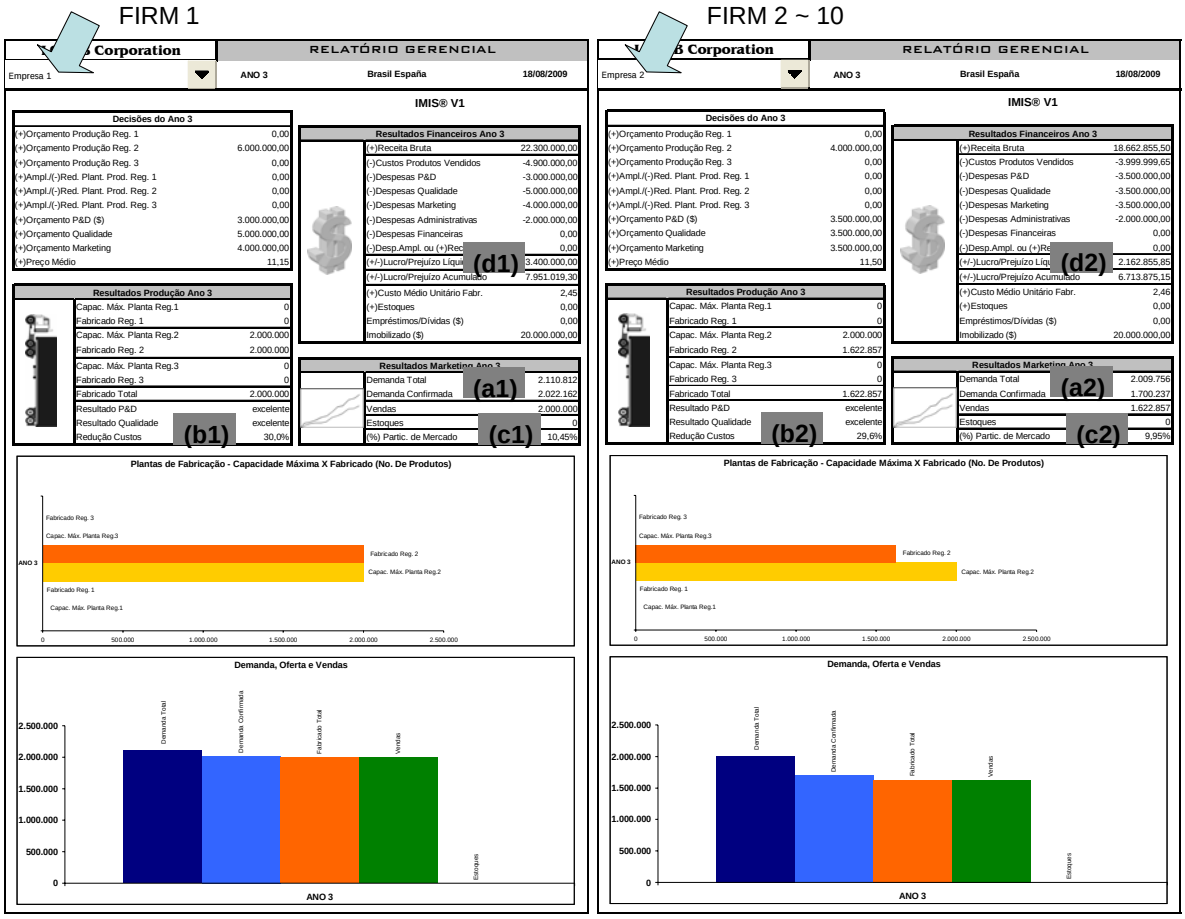
2.6.3 Post Decision: The Firm and Industry Result

The consequences of these decisions must be viewed in the reports in Figures 2.9 and 2.10 (follow the letters in parenthesis in the Figures). For example: firm 1 increased its demand from 1.89 million of goods to 2.1 million (a1) and the other firms achieved 2.0 million (a2).

The sales of firm 1 increased from 1.6 million of goods to 2.0 million (a1), and the other firms remained at the 1.7 million (a2).

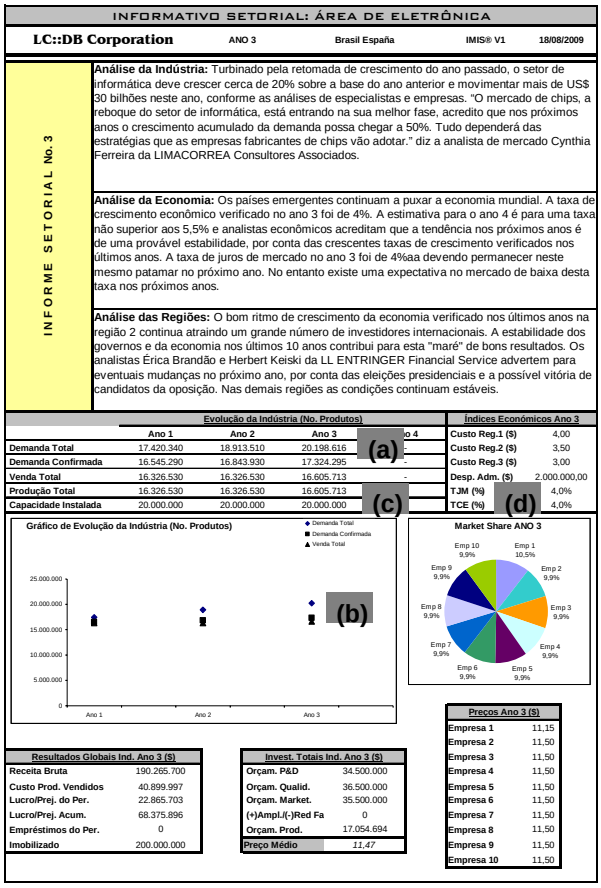
Continuing with the example, the manufacturing costs of firm 1 were held constant, at 30% (b1), and for other firms the number was slightly reduced to 29,6% (b2). The market share of firm 1 increased from 10% on period 2 to 10.45% (c1), whilst that of other firms decreased to 9.95% (c2). The net benefits in period 3 for firm 1 reached $3.4 million (d1) and the competence $2.1 million (d2).

Figure 2.9: Managerial Report of Period 3 for Firm 1 on the left and for Firms 2 to 10 on the right



The general results of the industry could be appreciated in figure 2.10. Refer to the numbers in parenthesis in the following text to access the data in the figure. The inform reveals that the demand increased from periods 1, 2 and period 3 (a). The supply increased little and the demand was still superior to the firms capacity to supply goods (b). The total plant capacities remained the same in the industry and stood at 20 million (c). The economy growth indicated an increase value, from 3.5% on period 1, for 3.8% on period 2 and 4% on period 3 (d).

Figure 2.10: Sector Report of Period 3 for all Firms



INFORMATIVO SETORIAL: ÁREA DE ELETRÔNICA

LC::DB Corporation | ANO 3 | Brasil España | IMIS® V1 | 18/08/2009

INFORME SETORIAL No. 3

Análise da Indústria: Turbinado pela retomada de crescimento do ano passado, o setor de informática deve crescer cerca de 20% sobre a base do ano anterior e movimentar mais de US$ 30 bilhões neste ano, conforme as análises de especialistas e empresas. "O mercado de chips, a reboque do setor de informática, está entrando na sua melhor fase, acredito que nos próximos anos o crescimento acumulado da demanda possa chegar a 50%. Tudo dependerá das estratégias que as empresas fabricantes de chips vão adotar." diz a analista de mercado Cynthia Ferreira da LIMACORREA Consultores Associados.

Análise da Economia: Os países emergentes continuam a puxar a economia mundial. A taxa de crescimento econômico verificado no ano 3 foi de 4%. A estimativa para o ano 4 é para uma taxa não superior aos 5,5% e analistas econômicos acreditam que a tendência nos próximos anos é de uma provável estabilidade, por conta das crescentes taxas de crescimento verificados nos últimos anos. A taxa de juros de mercado no ano 3 foi de 4%aa devendo permanecer neste mesmo patamar no próximo ano. No entanto existe uma expectativa no mercado de baixa desta taxa nos próximos anos.

Análise das Regiões: O bom ritmo de crescimento da economia verificado nos últimos anos na região 2 continua atraindo um grande número de investidores internacionais. A estabilidade dos governos e da economia nos últimos 10 anos contribui para esta "maré" de bons resultados. Os analistas Érica Brandão e Herbert Keiski da LL ENTRINGER Financial Service advertem para eventuais mudanças no próximo ano, por conta das eleições presidenciais e a possível vitória de candidatos da oposição. Nas demais regiões as condições continuam estáveis.

Evolução da Indústria (No. Produtos)

	Ano 1	Ano 2	Ano 3	Ano 4
Demanda Total	17.420.340	18.913.510	20.198.616	-
Demanda Confirmada	16.545.290	16.843.930	17.324.295	-
Venda Total	16.326.530	16.326.530	16.605.713	-
Produção Total	16.326.530	16.326.530	16.605.713	-
Capacidade Instalada	20.000.000	20.000.000	20.000.000	-

(a)

Índices Econômicos Ano 3

Custo Reg.1 ($)	4,00
Custo Reg.2 ($)	3,50
Custo Reg.3 ($)	3,00
Desp. Adm. ($)	2.000.000,00
TJM (%)	4,0%
TCE (%)	4,0%

(c) (d)

Gráfico de Evolução da Indústria (No. Produtos)

(b)

Market Share ANO 3

Resultados Globais Ind. Ano 3 ($)

Receita Bruta	190.265.700
Custo Prod. Vendidos	40.899.997
Lucro/Prej. do Per.	22.865.703
Lucro/Prej. Acum.	68.375.896
Empréstimos do Per.	0
Imobilizado	200.000.000

Invest. Totais Ind. Ano 3 ($)

Orçam. P&D	34.500.000
Orçam. Qualid.	36.500.000
Orçam. Market.	35.500.000
(+)Ampl./(-)Red Fa	0
Orçam. Prod.	17.054.694
Preço Médio	11,47

Preços Ano 3 ($)

Empresa 1	11,15
Empresa 2	11,50
Empresa 3	11,50
Empresa 4	11,50
Empresa 5	11,50
Empresa 6	11,50
Empresa 7	11,50
Empresa 8	11,50
Empresa 9	11,50
Empresa 10	11,50

2.7 CONCLUSION

The design of management game presents challenges, as any research, to those who choose engage with it. As exposed by Hambrick (2007: 338) *(the insertion is our)* "To be honest, I've been hoarding this idea *(design and use of management game)* for years, thinking that I would eventually get to it. But I've been intimidated by the technical challenges of designing the simulation." As we observed in this work, management games are a mix of creativity, knowledge about economic theory, simulation modeling and computer programming. Given the complexity involved to observe, understand and test the variables related to

strategic management research stream, we believe that management games, as a laboratory experiment, could be seriously considered in the research agenda. The lack of significant quantity of laboratory experiments in management if compared with other scientific areas like biology, chemistry, physics and the like, show us the potential that this kind of research methodology possesses.

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CHAPTER 3

Theoretical Background on Strategic Consensus (Introduction to Chapters 4 and 5)

A great effort has been deployed by management science scholars to understand the apparent chaotic, at least complex world of enterprises. Top managers, frequently called Top Management Teams (TMT), and their characteristics and outcomes – such as strategic decisions – are believed to be key elements for firm performance. Regarding the TMT and their work we could highlight two important theories (see Table 3.1) which will be extensively used in the two foregoing researches (a) the resource based view; and (b) the upper-echelons theory (based on the behavioral theory of the firm).

Table 3.1: Macro Theories Used on this Research

Authors	**Theoretical Posture**
Barney 1991	**Resource based view** - Barney (1991) affirms that the resources and capabilities of a firm are sources of competitive advantages, as: "assets, capabilities, organizational processes, firm attributes, information, knowledge, etc" (p.101). The author also affirms that these resources and capabilities could be classified according to their: value, rareness, inimitability, and substitutability.
Eisenhardt, and Martin (2000)	**Strategic decision making (and others), as a firm resource** - According to these authors, dynamic capabilities (an extended concept of the resource based view) are "a set of specific and identified processes such as product development, strategic decision making, and alliances" (p. 1105). These authors also consider that a TMT and their processes are a firm resource and capability.

Helfat, and Peteraf (2003)	**Resource based view and the Dynamic capabilities -** these authors state that a resource and/or capability present an aspect of dynamism "involves adaptation and change, because they build, integrate, or reconfigure other resources and capabilities" (p. 997).
Cyert, and March (1963)	**Behavioural theory of the firm** - The firm could be viewed as a coalition of individuals or group of individuals. These individuals or group of individuals have goals but the firm does not, that is, the firm goals are the reflection of the individuals' goals. Rather, the authors argue that organizational goals are formed through a bargaining process involving the members of the coalition.
Hambrick, and Mason (1984)	**Upper echelon theory** - "Organizational outcomes – both strategies and effectiveness [performance] – are viewed as reflections of the values and cognitive bases of powerful actors in the organization" (p. 193).

Source: the author

According to the resource based view, a firm must pursue and must efficiently exploit its resources and capabilities in order to achieve competitive advantages. Barney (1991), points at three categories of resources and capabilities: physical, organizational and human capital. This same author includes in the human capital category "training, experience, judgment, intelligence, relationships and insight of individual managers and workers in a firm" (p. 101). Eisenhardt and Martin (2000) state that top managers (the TMT) are an important resource and capacity of the firm by stating: "strategic decision making, is a dynamic capability in which managers pool their various business, functional, and personal expertise to make the choices that shape the major strategic moves of the firm" (p. 1107). From these statements we can highlight the fundamental role played by the firm's strategists, or simply TMT, in defining the future strategic direction of a firm on the market.

The other theory, the behavioral theory of the firm (Cyert and March 1963), states that a firm is a reflection of the individuals and group of individuals. Moreover, these individuals have goals and the firm does not, that is, the firm reflects the behavior of the individuals who work there. The upper echelons theory (Hambrick and Mason 1984; Hambrick 2007), a theory with background in the behavioral theory of the firm, argues that a TMT lend their characteristics to shape the firm characteristics and consequently the firm performance is a reflection of these characteristics. This theory presents two central interconnected ideas:

- First, a TMT act taking their own individual, and collective perceptions and interpretations concerning the strategic situations the firm is involved in.

- Second, these perceptions and interpretations are influenced by executive experience, technical abilities and capacities, values, and personalities.

The premise that permeates such ideas is based on the bounded rationality concept (Cyert and March 1963), where the complexity and uncertainty of the firm environments make an objective and perfectly rational analysis of a strategic firm situation difficult. Instead, individuals (and 'collectives' as the TMT) probably do not have the full or necessary information to decide on an efficient manner, given the difficulty in access to, transmission and processing information without interference and biases. The consequence is a TMT interpreting a given firm strategic situation (limited information) according to their perception, and then deciding over this more subjective situation. As a conclusion, the upper echelon theory sustains that TMT characteristics affect strategic choice and

consequently the firm performance, that is, the TMT characteristics definitely mark the firm strategic behavior.

According to those theories, we conclude that a TMT is a resource of a firm which presents some level of rareness, inimitability and irreplaceability, charged with high levels of subjectivism and complexity or, in other words, a complex and unique institution, with distinct individual and collective expertise, cognitive, abilities, capacities, work procedures and so on, available to the firm.

However, we highlight some problems concerning the issue: how to measure the result of a strategic TMT decision (output) considering the subjective and complex influence of human behavior over the team work? Furthermore, how to link it (the output) to firm performance? These problems could be identified in the resource based view theory, as observed by Ray, Barney and Muhanna (2004: 23) "… it seemed that every empirical test of resource-based logic began by observing that relatively few empirical tests of this assertion had yet to be published." Rajagopalan, Rasheed and Datta (1993) remind us that strategic decision process must present antecedent and outcome variables (among other intervening variables). Following the authors above we identified in the literature a research streamline named *strategic consensus* which in sum studies, in an aggregated manner, the objectivism and subjectivism of TMT decision-making processes, and has related it to firm performance.

Agreement, cohesiveness and a final coined form, and usually disseminated in the literature, *consensus* represents the level of shared perceptions (Dess and Keats 1987) or coalition (Bourgeois 1980) among members of a team after a discussion-process about specific topics related to strategic decision-making.

Several other definitions of consensus could be identified in the literature (see Table 3.2). In our study we are dealing with consensus as an output of team process and not as team process[12]. Recent academic studies state that teams working on decision-making processes often try to achieve consensus (Horwitz and Horwitz 2007). When we resort to practitioners to evaluate if the issue is really important we find Priem (1990) who, in the conclusion, cited field research that found only eight out of ninety-eight executive respondents who considered consensus in strategic decision-making 'not very important' or 'not at all'. Until now, the main stimulus to research this area was cited in the general assumption that desirable levels of strategic consensus are positively associated with coordination and cooperation during the implementation of strategy, and consequently associated with good organizational performance (Kellermans, Walter, Lechner and Floyd 2005). Besides the discussion on team strategic consensus and strategy implementation, a question yet unanswered: *is the high level of consensus on a top management team a guarantee that a better strategic decision choice was made and consequently a better firm performance would be achieved?*

Table 3.2: Definitions of Strategic Consensus and Related Constructs

Author(s)	**Definition**
Grinyer and Norburn (1977-1978)	Consensus as "a statistically significant level of shared perception. It could therefore be used in calculating the extent of agreement between executives" (p. 103).
Bourgeois (1980)	Consensus as agreement within the dominant strategy-making coalition on means and ends.
Bourgeois and Singh (1983)	Strategic discord as the "extent that TMTs differ in their perception of what the environment holds, what organizational goals are important, and what strategies should be pursued" (p. 45).

[12] For a detailed discussion on consensus and other conflicting team work processes we suggest read the Schweiger, Sandberg and Rechner (1989) study.

Dess and Keats (1987)	Consensus as the "degree to which perceptions of the nature of the environment are shared by top management teams members" (p. 21).
Dess and Origer (1987)	Consensus as "agreement of all parties to a group decision; it occurs only after deliberation and discussion of pros and cons of the issues, and when all (not the majority) of the managers are in agreement" (p.313).
Priem (1990)	TMT consensus as "general agreement in the opinions held by all or most" (p. 469).
Wooldridge and Floyd (1990)	Consensus as the "product of middle management commitment to, and understanding of, strategy" (p. 235).
Dess and Priem (1995)	Consensus as the "level of agreement among the TMT or dominant coalition on factors such as goals, competitive methods, and perceptions of the environment" (p. 402).
Bowman and Ambrosini (1997)	Consensus as the "extent to which managers from a strategic business unit (SBU) share similar perceptions of the strategic priorities. Consensus is understood here as shared understanding" (p. 244).
Hombourg, Krohmer and Workman (1999)	Strategic consensus as the "level of agreement among senior managers concerning the emphasis placed on a specific type of strategy" (p. 340).
Knight, Pearce, Smith, Olian, Sims, Smith and Flood (1999)	Strategic consensus as "shared cognitions among team members. This term mainly refers to agreement or overlap among individual team members´ mental models of strategy" (pp. 446-447).
Menon, Bharadwaj, Adidam and Edison (1999)	Consensus commitment as the "extent to which members of the strategy team agreed with and supported the chosen strategy" (p.22).
Dooley, Fryxell and Judge (2000)	Consensus as "agreement of all parties to a group decision that the best possible decision has been made" (p. 1238).
Markókzy (2001)	Strategic consensus "is achieved through the development of some shared understanding and common commitment" (p. 1014).
Kellermans, Walter, Lechner and Floyd (2005)	"Strategic consensus is the shared understanding of strategic priorities among managers at the top, middle, and/or operating levels of the organization" (p. 721).

Source: Kellermans, Walter, Lechner and Floyd (2005) and the author

Another important reason to study the consensus issue is the belief that TMT level of consensus after decision-making could be a good predictor of the team/firm performance. The main argument is based on the idea that strategic consensus represents the perceptions of the members of a TMT with a single

measure by drawing cognitive and behavioral aspects present in team discussion. That is to say, the consensus measure could simultaneously aggregate the level of knowledge, experience, conflict, agreement, accordance and other variables that could explain the multiple facets which were present in the debate including the climate/atmosphere where the decision-making was involved. Hence, authors such as Wooldridge and Floyd (1989, 1990) believe this measure could represent an adequate level of the quality of the decision-making, and so, a reliable measure to forecast team or firm performance.

The historical evolution of empirical and theoretical research on strategic consensus considered the issue from several frames as exemplified in Table 3.3.

Table 3.3: The Research Frames on Strategic Consensus

Frame	Authors
degree or level of consensus	Bourgeois 1980, and 1985; Dess 1987; Wooldridge and Floyd 1989; Markókzy 2001
content of consensus	Wooldridge and Floyd 1989; Markókzy 2001
locus of consensus	Markókzy 2001, Rappert, Velliquette and Garretson 2002)
scope of consensus	Wooldridge and Floyd 1989; Markókzy 2001
consensus as a process	Whitney and Smith 1983; Tjosvold and Field 1983; Schweiger, Sandberg and Ragan 1986; Schweiger, Sandberg and Rechner 1989; Amason 1996; Knight, D., Pearce, C.L., Smith, K.G., Olian, J.D., Sims, H.P., Smith, K.A. and Flood, P. 1999
consensus as an outcome	Dess and Origer 1987; Dess 1987, Wooldridge and Floyd 1989; Dess and Priem 1995; Hombourg, Krohmer and Workman 1999
consensus as shared understanding and/or commitment	Dess 1987; Wooldridge and Floyd 1989, 1990; Bowman and Ambrosini 1997; Noble 1999
consensus as agreement	Dess 1987; Dess and Priem 1995; Hombourg, Krohmer, and Workman 1999; Knight et al. 1999
consensus as shared perspectives	Dess and Origer 1987; Bourgeois 1980 and 1985

consensus in longitudinal studies	Schweiger, Sandberg and Rechner, 1989; Dooley, Fooley, Fryxell and Judge 2000; Markóczy 2001
consensus and strategy implementation speed	Dooley, Fooley, Fryxell and Judge 2000

Source: Rapert, Velliquete and Garretson (2002) and the author.

Very few theoretical studies were identified in the literature on strategic consensus (see Table 3.4). Most attempted to develop the idea of multiple relationships instead of the single bivariate relationship consensus-performance, and additionally elaborated conceptualizations regarding consensus. Much theoretical debate could be identified in the empirical studies.

Table 3.4: Review of Consensus Literature - Theoretical Studies

Study	Concepts
Dess and Priem (1995)	Consensus "defined as general agreement among all or most, is viewed as an important outcome of group decision making" (p. 401). "… consensus by a TMT can have both positive and negative consequences for an organization" (p. 401). "On the positive side, consensus may result from the open sharing of information and the expressing of opinions and perceptions pertaining to a firm´s competitive environment, goals and strategies". On the negative side they states that a TMT could be involved in an excessive consensus acquisition causing "blindness", "tunnel vision", or feelings and moral attitudes which do not promote a deep discussions. Propose several multivariate models using antecedent, conditional and interviewing variables to better explain the single relationship consensus-performance: (a) mediating effects model; (b) moderating effects model; (c) independent effects model; and (d) interaction effects model.
Floyd and Wooldridge (1992)	Consensus as "agreement among top, middle, and operating level managers on the fundamental priorities of the organization. This agreement shows itself in the actual decisions taken by managers, and its strength can be assessed along both cognitive and emotional dimensions". (p. 28)
Dess and Origer (1987)	Consensus as an outcome of the TMT decision making process (p. 313). The authors suggest that firm environment could explain the differences among consensus-performance relationship. The authors also states that the consensus performance could vary along time.
Priem (1990)	The author highlights the importance of consensus as an output of the strategy formulation process, taking the rational-normative strategic management literature. The author suggests factors like

	TMT homogeneity, structure and decision process, and environmental dynamism that could be considered on consensus-performance studies.
Kellermans et al. (2005)	The authors suggest that the inconsistent findings on consensus literature are related to differences found in: (a) construct definition - like consensus locus (´who` is evolved on the measure of consensus) and content (´what` is the object of consensus; (b) model specification - the use or the absence of antecedents, how the outcomes are conceptualized and the use of moderators to better explain the consensus-performance phenomena; (c) methodology – "…distinct approaches to the construction of survey"(p. 728)

Source: the author.

Previous empirical studies (Table 3.5) have tried to link consensus to performance in a single-bivariate relationship. Some of them have found a positive relationship between consensus and performance, others negative, and others still found no statistically significant results.

Table 3.5: Review of Consensus Literature - Empirical Studies

Study	Subjects/ Research Method	Consensus Type	Dependent Variable	Key Findings
Stagner (1967)	217 executives from Fortune 500 companies; mailed questionnaire.	"managerial cohesiveness" – amount of agreement on responses to questionnaire items by executives	Profitability	Positive correlation between executive's satisfaction and decision-making process and profitability; supported view of corporation as a coalition; found 3 important dimensions of decision making process: managerial cohesiveness, formality, and centralization.
Grinyer and Norburn (1977-1978)	91 CEOs and senior managers; 21 UK firms in 13 industries; field study using questionnaire.	Consensus on: objectives, role perception, degree of perceived formality of planning systems, an information monitoring.	Return on net assets.	Higher financial performance is associated with the use of more information processes; use of informal channels is associated with high performance; agreement on desirable changes may not be high when a percentage of companies suggest a change in the status quo; no evidence to support common perception of objectives, perception of objectives by executives with financial performance; when performance

				is good, there is little desire for change – struggling companies are anxious to change.
De Woot, Heyvaert and Martou (1977-1978)	123 firms followed by series of in-depth studies to document the conclusions; no details on research method.	Agreement on means for innovation activities.	Long term profitability – 15-year trend (profit/owner´s equity).	More "efficient" groups making decisions on change are characterized by: heterogeneity of orientation (functional); frequent disagreement on means of innovation; low concentration of influence among decision makers; problem-centered conflict-solving; no irrelevant disagreement; communication difficult but faster implementation.
Bourgeois (1980)	12 CEOs, on-site interviews; 67 top managers, field study with questionnaires.	Consensus on firms goals and means.	Factor scores of performance index of five-year growth in: ROTA, capital, net earnings, EPA, and ROS.	Consensus on means always leads to higher performance than disagreement on means; disagreement on less tangible goals tends to be associated with better performance; worst performance occurs with goals agreement – means disagreement combination.
Hrebiniak and Snow (1982)	247 top level managers, 88 firms, four industries	Agreement on firm´s strengths and weaknesses regarding environmental complexity.	Return on assets	Positive relationship between top management's agreement on firms strengths and weaknesses and return on assets; interaction among top managers and commitment to plans and objectives have positive implications for strategy implementation.
Whitney and Smith (1983)	88 students assuming roles of product managers or strategic planers; laboratory study.	"cohesiveness" – inferred from the number and strength of mutual positive attitudes among the members of a group.	Attitude polarization and knowledge of the strategic plan.	Increased polarization between strategic planers and product managers underemphasized group cohesiveness condition; high cohesiveness within groups leads to reduced receptivity to information and may interfere with the ability to use information fully.
Bourgeois and Singh (1983)	24 CEOs, on site interviews; questionnaires by 4-10 managers in each firm; no sample size.	"strategic discord" – disagreement among TMT on environment, goals, and strategies.	"organizational slack" – available (e.g., dividends/net worth); recoverable (e.g., inventory/sales) potential (e.g., P/E).	Infusions on slack seem to promote goal consensus and reduce strategic discord; slack resources provide the wherewithal and opportunity for policy conflicts and coalition formation necessary to achieve goal consensus.

Bourgeois (1985)	99 top executives/CEO´s of 20 nondiversified public corporations and 17 industries; questionnaires and secondary data.	Consensus on perceived environmental uncertainty (PEU); consensus on goals.	Same as bourgeois (1980)	Firm performance varied inversely with divergence of TMT average PEU from objective volatility; performance varied directly with goal or PEU diversity among TMT members; the number of goals a firm pursues is not related to firm performance.
Dess (1987)	24 CEOs and 74 TMT members in 24 privately-held firms, 1 industry; on-site interviews and questionnaires.	Consensus on objectives and methods	Subjective measures (sales growth, profitability, and overall performance); self-report objective measures (sales growth and profitability).	Positive relationship between consensus on objectives and measures of firm performance even when controlling for consensus on methods; positive relationship between consensus on methods and measures of firm performance even when controlling for consensus on objectives.
Wooldridge and Floyd (1990)	157 questionnaire respondents from 7 to 20 second- and third-level managers on each firm. The sample consisted of 11 banks and 9 manufactures.	Consensus among middle managers over strategy involvement and measures of organizational performance.	Subjective measures on overall competitive position, return on assets, efficiency of operations, overall financial performance, and growth rate.	"… the purpose of increasing strategic involvement should be to improve the quality of decisions, not to facilitate implementation. Second, top management should clearly define the strategic context" (p. 240). The middle managers expected from TMT the strategic direction. The experiment does not found relationship between middle managers consensus and firm performance.
West and Schwenk 1996	CEO´s and General Managers and their designated executives resulted on 39 machine tools and 26 electronic components firms valid questionnaires.	Consensus on goals and means.	Subjective, self-reported measures on net profits, ROA and overall performance.	No significance was found on the relationship consensus on goals and means, demographic homogeneity and firm performance.
Iaquinto and Fredricson 1997	95 CEO´s response questionnaires on paint, and coating and forest products industry.	Consensus measured as agreement about the comprehensiveness of a firm´s	Five years average of ROA	"… agreement about the comprehensiveness of the strategic decision process was positively related to organizational performance" (p. 72).

		strategic decision process.		
Homburg et al. 1999	101 usable responses from a survey with marketing and R&D managers of SBUs in three industries in US and Germany: consumer packaged goods, electrical equipment, and components and mechanical machinery.	Consensus on differentiation and low cost competitive strategies.	Subjective perceptual measures of performance consisting of effectiveness, efficiency, and adaptiveness.	Consensus on a differentiation strategy presented a positive relationship over firm performance
Rapert, Velliquet and Garretson 2002	332 questionnaire response from CEO and marketing from firms of healthcare industry.	Consensus on competitive methods on functional (marketing) and organizational (strategic) areas.	Subjective response on firm comparison over competitors among marketing and strategic issues.	Negative relationship between strategic consensus and organizational performance, and functional performance.
Ramos-Garza (2009)	29 CEO´s and TMT´s questionnaires on Mexican industries on Monterrey	Consensus on firm´s strategic orientation.	Subjective measure by asking the TMT member the firm ROI profitability relatively to other firms in their industry.	No significant relationship between consensus and firm performance on a bivariate test.

Source: Dess and Origer (1987) and the author.

The problems of ambiguity that arouse in past research have theoretical and methodological bases (Kellermans et. al. 2005). These authors categorized the problems in: (a) differences in *construct definition*; (b) differences in *model specification*; and (c) differences in *methodology*.

In previous studies, the *consensus construct* was based on four variables: *scope* of consensus that refers to 'who participates' in consensus (Wooldridge and Floyd 1989); *content* of consensus or 'what decision-makers' agree about (Wooldridge and Floyd 1989); the *degree* or *level* of consensus, or 'how strongly' the consensus is (Bourgeois 1980) and; the *locus* of consensus refers to 'where or the extent' of the consensus within the organization structure (Markóczy 2001).

The *model specification* is related to the existence, or not, of a set of possible variables that could influence the consensus-performance relationship. These variables were classified by Dess and Priem (1995) as antecedent variables, interviewing variables and conditional variables. The models proposed by these authors were four: mediating effects model, moderating effects model, independent effects model and interaction effects model.

The *methodological* problems listed by Kellermans et al. (2005), are based on distinct approaches to the construction of surveys, placing the consensus construct stability in checkmate. Additionally, these same authors pointed out another problem, consensus is measured at only one point in time during the ongoing process of decision making, thus raising the question: "How does strategic consensus change over time?" (p. 733). The authors suggest longitudinal studies that could better reveal the extent of the relationship consensus-performance. An extra problem identified by Kellermans et al. (2005) is the plethora of distinct outcome or performance measures and the ones dealing with subjective measures used in previous research (i.e. indicated by interviewed on self-report measure), others using objective measures and sometimes a mix of

both measures. This problem is highlighted by Rapert, Velliquette and Garretson (2002) that complement the list of the problems with the difficulty in directly comparing previous researches because of the "ambiguities and variations in defining and operationalizing" (p. 302) the consensus construct.

Given the extent of the issue, the theoretical development in this research will focus on three problems identified in previous studies: the lack of longitudinal studies; the consensus construct based on consensus content; and consensus-performance model specification with the identification of contingency factors that had not already been tested in the model consensus-performance.

In what follows, we highlight three problems and propose suggestions to be developed in the two sequential empirical studies.

One problem, related to consensus construct definition, is a lack of a more accurate measure of consensus in a bivariate analysis of the consensus-performance relationship, known in the recent consensus literature as 'consensus content'. Bourgeois (1980) found differences in the results between the consensus-performance relationship using two measures of consensus, strategic aims (firm objectives) and strategic means (strategy). More recently, Kellermans et al. (2005) alerted to this problem and suggested the convenience of more accurate measures that could better represent the consensus in the consensus-performance relationship. In our research, we propose and test a new consensus measure based on 'budget allocation', as an strategic priority, which meets the need of tangible and concrete measures claimed in the literature (e.g. Wooldridge and Floyd 1989).

A second problem, related to problems on methodology in empirical studies, is related to variation that consensus might have over time when considering a team working on long term tasks. Dess and Origer (1987) summarized this problem stating that consensus on an issue could vary over time. According to Kellermans et al. (2005: 729), in prior empirical studies the consensus was "…measured at only one point in time during the ongoing process of decision making." This suggests that, in static studies, the consensus-performance relationship might be corrupted by specific contingent circumstances. We conclude that consensus could be more effectively measured with teams working on tasks developed over time, thus controlling the stability of the consensus construct and avoiding dependence on contingent circumstances.

The third problem, about differences in model specification, is related to the lack of use of a third variable (a moderator or contingency factor) which tries to extend the single consensus-performance model into a more complex, complete, and real model. As Dess and Priem (1995: 402) suggested "the conflicting results in the literature can be addressed if a more complete framework is developed and used in future research", mainly by using moderators. Our suggestion is for two moderators: (a) team diversity; and (b) R&D strategic firm orientation.

To conclude, linking the consensus issue to the previous theories of resource based view and upper echelons theory, it seems reasonable to assume that consensus could represent the objective and subjective aspects of the TMT and their work, that is, relating to the cognitive and emotional aspects of a strategic decision-making process. That is, the TMT consensus over strategic decisions is a reflection of the complexity of a resource and capacity named: TMT.

Thus, two empirical studies (Chapters 4 and 5) over the issue of strategic consensus by TMT will be presented. These studies rely on laboratory study using management games (IMIS presented on Chapter 2), specially developed to access specific, necessary experimental conditions.

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CHAPTER 4

The Team Consensus–Performance Relationship and the Moderating Role of Team Diversity

4.1 INTRODUCTION

Two questions summarize the challenge facing the field of strategic management: Why do some organizations perform better than others, and how can a firm achieve and maintain a competitive advantage? Teece, Pisano and Shuen (1997) suggest researchers use four paradigms to shed light on these two questions. The first paradigm is based on Porter's (1980) competitive forces and rooted in the 'structure–conduct–performance' paradigm of industrial organizations. The second, the strategic conflict approach, focuses on explaining how firms differ on the basis of strategic decisions, such as investments, pricing strategies, signaling, and the control of information. The third paradigm, the resource-based perspective, emphasizes firm-specific capabilities and assets to explain different performance levels by firms. Finally, the dynamic capabilities paradigm may represent an evolution of the other paradigms (Teece et al. 1997), as it considers the combination of competencies and resources that a firm can develop and deploy.

A closer look at these paradigms reveals two key aspects, one related to the firm's management of its resources and capabilities, in an attempt to identify an 'internal best practice' that might be used to achieve better internal efficiency,

and the other related to external factors, such as competitors, external resources, and macroeconomic variables, that influence strategic decisions and the ultimate competitiveness of a firm. Bourgeois (1985: 548) synthesizes these two aspects by affirming that "the central tenet in strategic management is that a match between environmental conditions and organizational capabilities and resources is critical to performance and that a strategist's job is to find or create this match." Bourgeois also highlights the fundamental role of strategists (i.e., top executives), often referred to in the literature as top management teams (TMT). Through synthesis, a team searches for and analyzes information in a complex and dynamic environment, proposes alternatives, and chooses one. The result of this 'team–process rally' influences the success of team outputs (i.e., strategic decisions) and thus the organization's performance.

The complexity and uncertainty of the economic environment renders decision-making a challenge for any top manager. In turn, the need to work in teams may be justified by the theory of bounded rationality (from the behavioral theory of the firm – Cyert and March 1963), which establishes limits that influence the human ability to process information and make a decision, even when the decision makers have complete information (Douma and Schreuder 2002). In order to reduce uncertainty and make more efficient decisions then, people should work in groups—or even better, in teams. This is because individually, decision makers may offer new or renewed information, but in a group, they can appreciate and share this information among all other members (Schweiger, Sandberg and Ragan 1986). Following this assumption, two correlated elements arise: team consensus and team diversity and their relation to firm performance.

Team consensus represents the level of shared perceptions (Dess and Keats 1987) or coalition (Bourgeois 1980) among members of a team after they engage in a discussion process pertaining to specific topics related to strategic decision-making. We interpret consensus as an output of the team process, not a team process itself. Recent academic studies state that teams working in decision-making processes often try to achieve consensus (Horwitz and Horwitz 2007). Demonstrating its significance also among practitioners, Priem (1990) cites a field research study in which only 8 of 98 executive respondents consider consensus 'not at all' or 'not very' important in strategic decision-making. More recently, Simons and Petterson (2006: 23–24) interview various CEOs and their respective TMTs and find that "group mistrust damaged the implementation only half as much when the decision was made by consensus than when it was imposed by the CEO or a subgroup"; therefore, they conclude that "teams whose members mistrust one another are less effective at implementing their strategic decisions."

Previously, the main stimulus for research in this area has been the general assumption that good levels of strategic consensus associate positively with coordination and cooperation during strategy implementation, which implies they are associated with good organizational performance (Kellermans et al. 2005). Yet beyond discussions of the nature of team consensus and its implementation, a question still remains: Is a high level of consensus among a TMT a guarantee of better strategic decisions and thus better firm performance?

Previous studies have tried to answer this question for years, from Bourgeois (1980) to more recent analyses such as Kellermans, et al. (2005). Some find a

positive relationship between consensus and performance, others indicate a negative relationship, and still others reveal equivocal results. In turn, several explanations for this controversy have emerged; we detail three of them below.

The first relates to the more accurate measure of consensus achieved from a bivariate analysis of the consensus–performance relationship, known in recent consensus literature as consensus content. Bourgeois (1980) uncovers different results when he uses two different measures of consensus, namely, strategic aims (firm objectives) and strategic means (strategy). More recently, Kellermans et al. (2005) warn of the persistence of this problem and suggest using more accurate measures for the consensus portion of the consensus–performance relationship. In our research, we propose and test a new consensus content measure based on budget allocation, which responds to the need for tangible and concrete measures (e.g. Wooldridge and Floyd 1989).

The second problem pertains to variation in consensus over time, especially if a team works on long-term tasks. Dess and Origer (1987) concur that consensus about an issue could vary over time, but Kellermans et al. (2005: 729) note that in earlier empirical studies, consensus was "measured at only one point in time during the ongoing process of decision making." Thus, in static studies, the consensus–performance relationship might be corrupted by specific incidental circumstances. We conclude that consensus could be measured more effectively among teams working on long-term tasks with a long term study, which would enable us to control for the stability of the consensus construct and avoid a dependence on possible contingencies.

Finally, the third source of problems in previous literature involves the lack of a third variable, which could extend the single consensus–performance model into a more complex, complete, and real model. We suggest team diversity, because existing literature posits that team diversity may be an antecedent of consensus. We instead propose team diversity moderates the consensus–performance relationship. To develop this proposition, we rely on team diversity literature that argues in favor of its use, such as the claim that "diversity enhances the breadth of perspective, cognitive resources, and overall problem-solving capacity of the group" (Hambrick, Cho and Chen 1996: 662–663). In turn, we attempt to analyze whether team diversity moderates the team consensus–performance relationship

In summary, this research aims to advance the relationship between team consensus and performance for theoretical and practical use by proposing (1) a more tangible and objective measure of consensus content based on budget allocation, (2) a measure based on a long term experiment, and (3) team diversity as a moderator in the relationship. The team decision-making result (team output process) represents the unit of analysis.

4.2 THE TEAM CONSENSUS–PERFORMANCE RELATIONSHIP

Researchers who contribute to team consensus literature tend to use strategic management studies as a background for their work (Kellermans et al. 2005). Many empirical studies result from examining a single relationship between consensus and performance, with the general hypothesis that once a team achieves consensus, an TMT output measured at the end of teamwork process, it

supports improved team performance. The results, however, offer only partial or no support for such hypotheses. The problems of ambiguity in prior research studies also have a theoretical (e.g. Markóczy 2001) and methodological basis. Kellermans et al. (2005), in a key and extensive study, categorize the problems into three issues: (1) differences in construct definition, (2) differences in methodology, and (3) differences in model specification.

4.2.1 Considerations for the Team Consensus Construct

Among the key problems involved in the consensus construct, one is related to consensus *content*, which refers to the topic about which decision makers agree (Wooldridge and Floyd 1989). One of the first studies to address consensus *content* (Bourgeois 1980) measures the final consensus reached after strategic decisions according to goals and means. Goals represent firm strategic objectives (i.e., what the firm must achieve in the future), whereas means are the firm's strategies (i.e., how it organizes its resources to achieve the objectives). The results of Bourgeois's (1980) experiment point to differential relationship strength between each measure of firm performance, such that the means measure offers a better result than the goals measure. He also attempts to explain this result according to the tangibility of the team discussion subject. That is, a measure of consensus based on strategic issues that are more tangible, concrete, and visible is more appropriate than a measure based on issues that are intangible, fuzzy, or difficult to see and understand. This is because the former can better capture the actual level of agreement among managers.

Some research highlights this problem by stating that earlier studies do not employ the most appropriate measure of consensus content (Bowman and Ambrosini 1997; Kellermans, et al. 2005; Marcókzy 2001; Wooldridge and Floyd 1989). Yet some authors defend a more efficient measure, based on strategic priorities, rather than goals and means. Wooldridge and Floyd (1989: 300) explain the efficiency of such a content measure, noting that "priorities define what is important to decision-makers and can be observed by focusing on how managers 'pay attention to, weigh, and actually use certain types of information' when making a decision." For example, they propose a measure based on priorities by "asking managers to allocate a limited resource among several competing considerations." Following the idea of resource allocation as a way to measure strategic priorities, we highlight the statement of Eisenhardt and Martin (2000: 1107) "resource allocation routines are used to distribute scarce resources such as capital and manufacturing assets from central points within the hierarchy (e.g. Burgelman 1994)." From these statements we conclude that resources in general could be considered scarce and the distribution among firm activities and functional areas is an important, critical and consequently difficult task for any TMT.

Extrapolating these conclusions, a more objective, direct, and tangible content of a group discussion facilitates the team work discussion, and consequently provides a more accurate measure of consensus. The consensus content measure based on budget allocation decisions follow the suggestion of Wooldridge and Floyd (1989), as it is a measure that will better reflect the level of agreement among individuals, compared to former measures based on ends, and means.

4.2.2 Considerations of Methodological Approaches to Consensus Measurement

The methodological problems listed by Kellermans et al. (2005: 728) relate to "distinct approaches to the construction of surveys", as well as a lack of previous studies that consider the stability of the consensus construct over time. In this sense, Dess and Origer (1987) warn of the problem of measuring consensus in a cross-sectional manner; they assert that eventually consensus in period t0 cannot be observed in period t1.

In accordance with these arguments, measuring consensus and performance through a sequence of time periods the experiment may reduce dependence on the specific circumstances of a particular moment, which prevents biasing the consensus–performance relationship with specific contextual circumstances.

4.2.3 Considerations of Model Specification

Using antecedent, intervening, and moderator variables in empirical studies provides a means to comprehend why and in what conditions variables may be understood and correlated (Ginsberg and Venkatraman 1985). Homburg, Krohmer and Workman (1999: 344) justify their research of moderators in the consensus–performance relationship by claiming that "in many fields of organizational strategy research, ambiguous results concerning the relationship

between two constructs have been better explained by looking at contingency or moderator effects."

Some empirical studies already consider additional variables, but their main focus remains on external environmental conditions (e.g., munificence, complexity, dynamism). Despite the contributions of these studies, "research should continue to explore the relevance of organizational-level moderators" (Kellermans et al. 2005: 731). In other words, the promise of organizational variables to explain the fit between team consensus and performance remains a rather unexplored topic.

4.3 RESEARCH MODEL AND HYPOTHESIS

According to existing considerations about construct definition and methodology, this research suggests that if consensus were measured with a more objective and tangible item (i.e., budget allocation), immediately after the debate, and over different teams as well as different instances, it would be possible identify a positive and significant relationship between team consensus and performance. With these empirical settings, we maintain the general assumptions underlying the consensus–performance relationship and propose the following hypothesis:

H1: Team consensus relates positively to team performance

Two key theoretical papers suggest team factors (e.g., diversity, homogeneity) as possible variables that may better fit the consensus-performance relationship. Priem (1990) suggests that group factors such as team homogeneity, structure,

and process influence team performance, could represent intervening factors in the nonlinear consensus–performance relationship. Dess and Priem (1995) focus extensively on the idea of a possible third variable and suggest several consensus–performance models. One of these models follows Priem's (1990) work and proposes team diversity as an influential factor that could be an antecedent. However: why not think that team diversity might act not only as an antecedent but also as a moderator of the team consensus–performance relationship? The main argument is that if consensus (working as an independent or predictor variable), measured just after a decision-making process, is positively related to team performance (dependent or criterion variable), the sum of the effect of a third variable (moderator) – team task-related diversity – could offer a positive influence over the independent-dependent strength. The foundations to this argument are based on the studies by Hambrick, and Mason (1984) and Hambrick (2007), which exploit the so-called 'upper-echelons' perspective by stating that an organization reflects its CEO, in the sense that the executive's characteristics and functioning can predict organizational outcomes. According to this perspective, team diversity provides a framework for understanding the relationship between team characteristics and team performance. Thus, team diversity can be a 'double-edged sword' (Milliken and Martins 1996) that might relate positively or negatively to team performance, depending on the situation.

Hambrick et al. (1996: 663) identify the negative effect of team diversity, namely, that "it may also create gulfs or schisms that make the exchange of information difficult." Hambrick and Mason (1984); and Dess and Origer (1987)

also state that diversity could lead to a lack of communication and increased conflict, and thus to poor team performance.

On the positive side, Hambrick et al. (1996) also acknowledge that diversity enhances each team member's perspective, cognitive resources, and overall capacity to solve group problems. Likewise, Cox and Blake (1991) argue that diversity can stimulate non-obvious alternatives. Thus, the positive impact of team diversity functions because it provides extra communication stimuli among team members and provokes more effective debate.

Some empirical studies point to a negative diversity–performance relationship, but others reveal a positive relationship; according to the literature, diversity could be classified in distinct ways and each kind of diversity could affect differently team performance. For example, Simons, Pelled and Smith (1999) find that diversity in educational level and company tenure positively influences the quality of debate and affects the team performance. A more recent and broader study, using meta-analysis procedures, suggests a positive impact of task-related diversity (i.e., acquired rather than innate individual attributes, such as functional expertise, education, and organizational tenure) on team performance (Horwitz and Horwitz 2007).

Until now, consensus (as team output) and team diversity were studied in an attempt to reveal the correlation between these two variables and team output. Why not assume these two variables could act in symbiosis, thus better explaining the consensus-performance relationship? The arguments in favor of this symbiosis are based on the idea that when teams achieve a positive consensus-performance relationship - for whatever reason - this relationship

could be reinforced by the team diversity characteristics. This strengthened relationship could be provided by a team environment that favors structured discussions and the free sharing of information (e.g., in the absence of negative criticism from other participants). Such an atmosphere should lead to greater cognitive conflict (i.e., different levels of knowledge among members that stimulate debate) but less effective conflict (i.e., different levels of personality and behavior that erode the debate). The positive consensus-performance relationship could be reinforced in teams with significant diversity accordingly. In other words, the strength of this relationship could be positively altered when team diversity grows. As observed by Nemeth (1986: 23):

> "minority viewpoints are important, not because they tend to prevail but because they stimulate divergent attention and thought. As a result, even when they are wrong they contribute to the detection of novel solutions and decisions that, on balance, are qualitatively better."

These assumptions are consistent with empirical studies carried out by Cohen and Levinthal (1990); Milliken and Martins (1996); Simons, Pelled and Smith (1999); Mohammed and Ringseis (2001); and Horwitz and Horwitz (2007), who find a positive relationship between a specific kind of diversity - a team task-related diversity - and team performance. Grounded on such arguments, the second hypothesis of this study is:

H2: Team task-related diversity positively and significantly moderates the relationship between team consensus and team performance.

To depict these propositions, a model (Figure 4.1) represent the single-bivariate relationship between consensus and team performance (H1), and then introduce the team diversity factor to test whether it moderates (or not) the team consensus–performance relationship (H2).

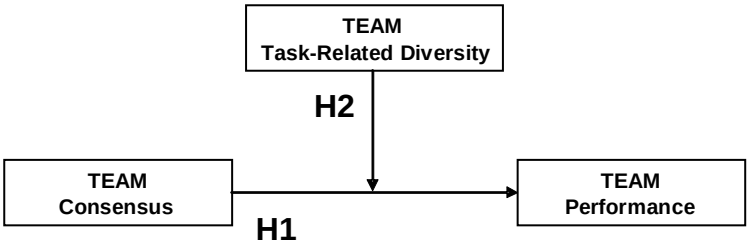

Figure 4.1: Model of Team Consensus, Team Diversity Moderation, and Team Performance

4.4 METHOD

4.4.1 Laboratory Study and Business Game Simulation

A laboratory study involving a business simulation game was employed in the present study. Laboratory studies appear extensively in research pertaining to decision-making, strategy, and consensus issues (e.g., ranging from Whitney and Smith 1983, to a more recent one by Mathieu and Schulze 2006).

The business game simulation offers several advantages (Gentry, Tice, Robertson and Gentry 1984; Larréché 1987; Dickinson, Gentry and Burns 2004). First, it avoids possible problems related to implementing the strategy process, to the

extent that the influence of the consensus scope and locus or problems related to employee commitment become irrelevant. In a computer simulation, the strategies implemented by the simulated firms are equal. In other words, the efficacy and efficiency of the operational areas remain the same across the firms, and performance variation occurs only at the firm's strategic decision level by changing the firms' environments and the mathematical model used in the simulation. Second, the simulation experiment provides free, timeless access to rich material that result from the decision-making tasks undertaken by the subjects. Furthermore, the method facilitates results based on computer reports and guarantees homogeneity in the measures of the firm's outcomes. Third, the simulation enables us to collect larger samples and answers from decision makers immediately after the decision-making process. In a real-life setting, it is difficult and sometimes impossible to access information directly from actual TMTs. Fourth, the economic elasticity that affects the demand variables (e.g., price, marketing expenditures, R&D, quality) was controlled, avoiding a possible imbalance in the variables that would favor one competitive strategy over other (e.g. differentiation versus low cost). Fifth, we can easily replicate the experiment with any kind of business game simulation available.

The simulation used in this research is called IMIS, an abbreviation for International Multidivisional Industry Simulation. This software was developed by the author within the Department of Management of a Brazilian University in collaboration with the Department of Business Administration at a Spanish University, specifically for this study.

This software offers another advantage specific to the experiment that complements those for any business simulation; namely, a special care was taken in order to adjust the complexity of the game (task-related complexity) to subjects' manipulation capacity (Bonner, Baumann and Dalalc 2002). As Cosier and Rechner (1985: 92) note, MBA students and undergraduates indicate different perceptions of the complexity of a simulation, such that "the complexity of the simulation game and the associated manipulations seemed to cause some subjects to decline participation or make 'outlier' decisions."

The IMIS simulation software provides a limited representation of real international competition among multinational firms. It simulates a market of ten manufacturers, and large consumers of memory chips, which compete to achieve the best financial performance. The team's mission is to manage one of the competing firms by analyzing the environment, defining goals, choosing the most appropriate competitive strategy, and defining priorities in terms of the budget allocation and price definition (the last too is the decisions entered into the computer). The strategic decisions that subjects can manipulate are (1) the site (location) of production, among three options (manufacturing plants) in regions with different degrees of risk and production costs; (2) the price of the memory chip (price definition); (3) the budget for expanding (or the value of reducing) plant capacity; (4) the marketing budget (e.g., media, advertising, sales force); (5) the manufacturing budget; (6) financial resources to expend on quality assurance programs; and (7) the R&D budget.

After all the teams make their decisions, the computer simulation processes the data and summarizes the results in two reports. The first, the Management

Report, indicates the firm's individual performance by area (financial; production + quality + R&D; and marketing), whereas the second collective report, the Economic Sector Report, presents data about the macroeconomic conditions, competitors, consumers, and costs by region, as well as information about the market and trends in the social, economic, and political situation of each region. Each decision is equivalent to an entire year, and subjects receive in advance at the beginning of the experience historical data about the firm and may make decisions about it for eight more years. In addition to the two reports, the business game includes a User Manual that supplies users with all the necessary information to understand the simulation and make decisions. The manual includes an appendix that offers insights about the steps in a structured decision-making process and information about competitive strategies, based on strategic management manuals and Porter's (1980, 1985) concept of competitive strategy.

4.4.2 Sample and Procedure

The method for this experiment provides 138 valid simulated decisions distributed in four periods, and 35 groups of 138 students in total. The students were formed with a random distribution and had 4 group members each on average in each team/firm. The subjects were students enrolled in the regular final year of management studies at the undergraduate level in two universities, one located in the northwest and the other in central-western Brazil. Both are traditional universities and register more than 18,000 students in at least 31 regular undergraduate programs, along with masters (MBAs and masters by

thesis) and a few Ph.D. programs. The distribution of subjects and groups is approximately 50% from each university.

A special precaution was also taken for this research: students were chosen in their final year of study to ensure that all participants had taken a minimum of 40 class hours pertaining to strategic management issues. To stimulate participation, an association was made between effective individual participation (individual score based on individual decisions and their results by period) and the results of the teamwork (collective score of a firm) a component of students' final grades in the courses. With this measure it is expected that students received encouragement to participate in the experiment with sufficient effort.

The experiment took place over six class periods (once per week), distributed as follows: (1) a briefing class to distribute the material, inform the subjects about the simulation, and distribute and collect an initial questionnaire with personal data; (2) four classes, each lasting one and a half hours, dedicated to group decision making; and (3) a debriefing class to reveal the final results and provide participants with feedback about their team performance.

In contrast with some simulation research (Kilduff, Angelmar and Mehra 2000), the teams started the simulation identically, with the same data and indicators for all areas (i.e., production, financial, and market statements), which facilitates the evaluation of the teams. In addition, they were initially encouraged not to work in groups in order to study the material and had to perform the decision exercise individually before each decision making in group. This implied that the students were competing and their final grade would be based on the individual's best performance. According to Schweiger, Sandberg and Rechner (1989: 755), this

exercise of individual decision-making assumes that in real life, managers prepare in advance for meetings. The individual decisions submitted during the second class meetings serve as the measure of individual performance.

The teams had approximately 1.5 hours to discuss and make a decision, in private and uninterrupted sessions, and then hand in another decision sheet. After this process, the group decisions were entered into a simulation, then the software reports (i.e., Management Report and Economic Sector Report) were printed and distributed to subjects. The next three classes followed the same procedure. Each student's decision was entered into the simulation at least two days after the group decision, and the compiled data (for each individual and group performance) according to market share, production, sales, and period earnings appeared in an e-mail sent to the participants; they could also access a printed sheet in the following class.

To ensure reliable measures (across individual and group decision measures) a reward was provided for the best individual final performance and to the members of the winning group during the last class. Thus, with this procedure, eventual free riding could be avoided in an attempt to guarantee each student's commitment to the group task. This kind of reward, according to Schweiger et al. (1989: 755), increases experimental effectiveness because it avoids "artificial breaks in groups' deliberations and … effectively replace[s] the grading incentive."

In line with existing simulation gaming practice (Fritzsche and Cotter 1990), the end of the simulation (the last decision) was not revealed and thereby helped avoid poor decisions, such as dismantling the company by selling assets to boost

cash flow and performance. Schweiger et al. (1989) also suggest teams should not receive feedback during the decision-making classes. As such, no extra User's Manual information was offered and any feedback about the decision results during the four decision sections, but save that information for the final, debriefing class. In addition, very few subjects declined to participate or gave up during the experiment. No change among individuals and groups was allowed, and they remained in the same groups throughout the experiment, so that the evaluation and the measure of teamwork might be effectively taken.

4.5 MEASURES

To generate the team consensus construct, the measure takes the level of agreement among members about budget allocation decisions, consistent with Kellermans et al. (2005), Bourgeois (1980), and Wooldridge and Floyd (1989). Each subject completed and handed in a six-item questionnaire immediately after each decision-making class. The question items relate to the subject's personal level of agreement with each decision made by the group (budget allocation to production, R&D, marketing and quality; and price policing), measured on a seven-point Likert scale (1 = total lack of agreement to 7 = full agreement). The final consensus measure was calculated for each team by adding the average of the individual responses to each question. When non-responses occurred, the individual nonresponse was replaced with a fictitious measure based on the participant's existing response average. The measure thus includes only those students who attended classes and effectively participated in each decision-making process.

The team diversity measure, was borrowed from Hambrick et al.'s (1996: 663) study, which relies on demographic conceptions of team diversity. Existing research uses several measures to assess team diversity, including age, education, firm tenure (length of time with the firm and at the existing position), socioeconomic background, and experience. To test H2, the moderation of team task-related diversity, a measure based on formal university education that assesses the student's general academic record (GPA - Grade Point Average) on a 0–10 scale was adopted. This measure provides an adequate representation of the level of formal knowledge acquired during the student's undergraduate studies and of team diversity, since it represents the amount of accumulated theoretical knowledge acquired by individuals throughout their academic life. The reliance on this measure is owed to the fact that teams which do not have the same level of accumulated knowledge need some level of shared information to balance the information among the group and lead to decision-making. More homogeneous teams would probably need less time to acquire balanced information and possibly less discussion, since the concepts and theoretical issues had previously been well understood and assimilated by those individuals. As such, the standard deviation of each group member's academic records was taken as a measure of the level of diversity. Again, this measure includes only those who participated in the decision-making during the equivalent period; if some team members were absent, we took that difference into account.

For the team/firm performance measure, the present study refers to Kellermans et al. (2005: 725), who state that though "most studies agree on the relevant outcome (organization performance), there is very little consistency in how organizational performance is conceptualized and measured in the literature."

Some research uses objective, financial performance indicators (e.g., return on assets), whereas subjective measures generally compare the organization with its competitors on the basis of a firm executive's perception (subjective evaluation). Because of the ease with which the simulation can generate firm results on the computer, in each simulated period the following measures were used: net profits; ROA (return on assets); and ROS (return on sales).

Finally, three control variables were included in the model to isolate possible interrelationships among the variables: (1) period of decision, coded from 1 (first period) to 4 (fourth period), to control the influence of experience; (2) location, coded as a dummy variable that distinguishes the two universities, to control for contextual interference; and (3) group size, measured as the number of members in each group, which controls the influence of differences on internal group complexity.

4.6 ANALYSIS AND RESULTS

4.6.1 Analysis and Descriptive Results

Four regression models were estimated to test the hypotheses for each measure of team performance (net profit, ROA, and ROS) as the dependent variable. Since the performance measures showed a high correlation (up to 0.9), only the results for ROA are shown in the present study, as the other performance measures resulted very similarly to ROA. The first model includes only the three control variables as independent variables, whereas the second model also adds the consensus measure to test H1. Finally, in the third model, team diversity (task-

related diversity) is incorporated, and in the fourth model, the interaction term between team consensus and team diversity is included to test H2. This analytic procedure follows that suggested by Sharma et al. (1981), Baron and Kenny (1986), and Venkatraman (1989) to analyze moderation.

4.6.2 Hypothesis Results

The descriptive data is shown in Table 4.1 and regression model results for the performance measures to test H1 and H2 are shown in Table 4.2. According to model 2 results, a positive and significant relationship exists between consensus and performance, in support of H1. The low R^2 suggests it results from the few variables in the model to estimate general firm performance. It remains very difficult, if not impossible, to represent a complete model to explain business performance (Capon, Farley and Hoening 1990), even in a simulated environment.

According to the results from models 3 and 4 the variable team diversity moderates the team consensus–performance relationship significantly and positively, in support of H2. The procedure to verify this moderation is based on the analysis of the sign and significance of the interaction term in model 4. The positive sign of the product indicates a positive moderation of team diversity, such that greater team diversity leads to a stronger relationship between team consensus and performance. The coefficient of team diversity is not significant in model 3, which implies that team diversity is a pure moderator that affects the team consensus–performance relationship without directly influencing

performance (Sharma, Durand and Gur-Ari 1981). Additionally, a graph of the slope test of moderation (two way interactions) was plotted according to the procedures described by Aiken and West (1991), in which the effect of moderation can be visualized. According to Figure 4.2, the task-related diversity positively moderates the consensus-performance relationship and offers additional information. Initially, it was thought that consensus must always be positive, with a positive slope on the three curves. Instead, we found that when in presence of low diversity; the effect of consensus is negative, in contrast to the positive effect of consensus on highly diverse teams.

Table 4.1: Means, Standard Deviations, and Correlations[a]

	Mean	s.d.	1	2	3	4	5
1. Period	2.49	1.12	1				
2. Location	0.54	0.50	-0.01	1			
3. Group Size	3.38	0.74	0.02	0.22***	1		
4. ROA	0.13	0.34	-0.06	0.05	-0.11	1	
5. Consensus	6.33	1.60	0.06	-0.15*	-0.053	0.14*	1
6. Task Related Diversity	0.53	0.28	0.03	-0.10	0.12	-0.04	0.14

Obs. [a] n= 138; *** $p \leq 0{,}01$; ** $p \leq 0{,}05$; * $p \leq 0{,}1$

Table 4.2 Multiple Regression Analysis with ROA as Dependable Variable – Task-Related Diversity Moderation

ROA	Model 1	Model 2	Model 3	Model 4
Constant	0.24	-0.49	-0.46	1.24*
Period	-0.03	-0.03	-0.03	-0.03
Location	0.03	0.06	0.05	0.07
Group Size	-0.03	-0.02	-0.02	-0.02
Consensus	-	0.11***	0.11**	-0.16
Task-Related Diversity	-	-	-0.11	-3.60***
Consensus X Diversity	-	-	-	0.55***
R^2	0.02	0.06	0.07	0.13
F	0.62	1.98*	1.82	3.15***

Obs. *** $p \leq 0{,}01$ ** $p \leq 0{,}05$ * $p \leq 0{,}1$

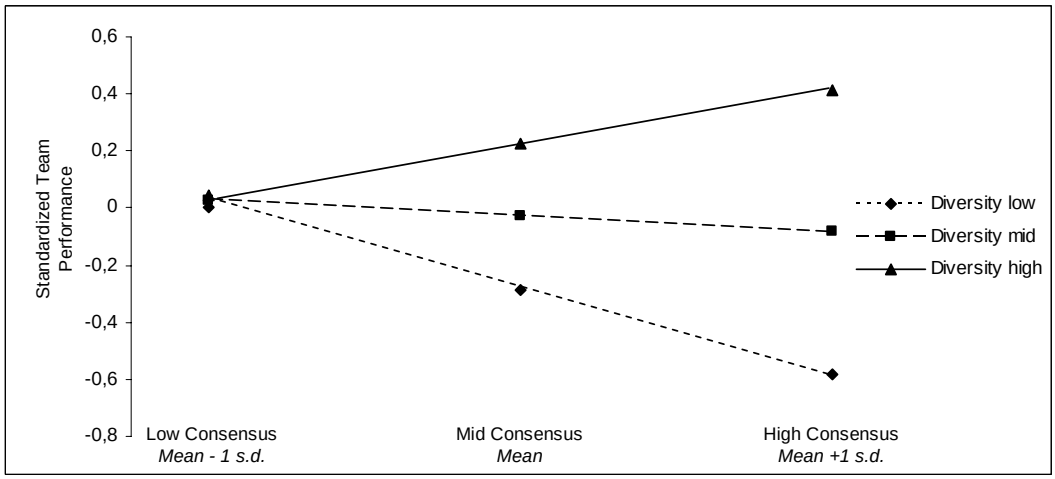

Figure 4.2: Slope Test of Team Diversity Moderation Effect

4.7 DISCUSSION

Early studies of team consensus relate it to team performance and arrive at conflicting and equivocal results. The present study responded to the suggestions made by these previous studies in several ways. First, methodological modifications were introduced into experiment using a more objective and tangible measure, namely, the budget allocation decision. This measure relies on the idea of consensus priorities suggested by Wooldridge and Floyd (1989) instead of aims (objectives) or means (strategy); together with the sequential design of the experiment and the objective team performance measure (as facilitated by the business simulation), this approach enables testing the single relationship between consensus (as an output) and team performance. Second, consensus research advanced by adopting the idea of a "third variable," as suggested by Dess and Priem (1995) and Kellermans et al. (2005) and proposing team diversity as a candidate. In this sense, the arguments presented suggest it serves as a moderator, even though prior work advocates its role as an antecedent of consensus. This shift in point of view derives from previous studies that relate team diversity positively to team performance by analyzing different kinds of conflict in the teamwork process. Thus, in this experiment the empirical results indicates the existence of a positive influence of team diversity on the intensity of the consensus–performance relationship, probably because affective conflict either is not present or becomes irrelevant compared with cognitive conflict.

The results also confirm the positive and significant consensus–performance relationship in bivariate analysis related to consensus about the strategic priority of budget allocations. This result is consistent with the empirical findings of

Bourgeois (1980), who defends the idea that objective measures are more efficient for consensus variables, as well as with the current trend of referring to strategic priorities, rather than other forms of strategy content, when defining and measuring consensus (e.g., Wooldridge and Floyd 1989; Markókzy 2001; Kellermans et al. 2005). Our experiment also adopts a long-term component measuring the consensus over time. As Dess and Origer (1987) state, the consensus–performance relationship might vary over time, so this experiment adopted this kind of approach and thereby attempted to reduce the dependence on the specific circumstances of the particular moment and increase the reliability of this cross-sectional study.

A second important finding pertains to the positive and significant moderating effect of team task-related diversity on the consensus–performance relationship, in support of H2. This kind of diversity appears to play an important role in increasing or intensifying the consensus–performance relationship. In both theoretical (Dess and Priem 1995; Kellermans et al. 2005) and empirical (Knight, Pearce, Smith, Olian, Sims, Smith and Flood 1999) studies of team consensus and performance, team diversity consistently appears as an antecedent, but according to the strong evidence from the present study, it is suggested that it also moderates their relationship.

Despite the possible influence of team task-related diversity on team consensus, diversity also affects the strength of the consensus–performance relationship in the sense that once a high level of consensus is achieved, team diversity could lead to a better decision option. Using the arguments of the team diversity-performance studies, diversity in levels of knowledge (cognitive diversity) in

teams that achieve consensus probably facilitates information sharing among team members. Thus, new or renewed ideas are welcome. Further, Simons (1995), analyzing previous empirical studies, suggested that TMT educational diversity would be advantageous only when the team process allows open debate. For Amason (1996: 124):

> "research on strategic decision quality seems to suggest that although cognitive diversity represents the potential for high-quality decisions, that potential is best realized through critical and investigative interaction processes in which team members identify, extract, and synthesize their perspectives to produce a decision."

Thus, an atmosphere with low affective conflict (i.e., negative personal behavior) and with high cognitive conflict should motivate new and creative considerations of new or renewed variables in team discussions, which in turn should enhance the team outputs, as Hambrick et al. (1996) and Amason (1996) indicate. In order to test the robustness of these research findings, the experiment was replicated using another measure of diversity, related to bio-demographic diversity (age), as a third variable to test the moderation. In previous studies, this diversity did not show statistical significance when related to team performance (Horwitz and Horwitz 2007) and the replicated tests in an attempt to identify a possible moderation effect on the consensus-performance relationship did not show statistical significance either. This result reinforces the arguments about the moderation effect of task-related diversity, and not another kind of diversity, over consensus.

Another remarkable finding of this study was that when a team shows low task-related diversity, the effect of consensus on performance is negative. A possible explanation for this finding could be that when teams are composed of more homogeneous individuals (in terms of knowledge), decisions can be made quickly without much discussion and sharing of information, leading to a low performance decision. The team in this case may fall into the trap of assuming a problem can be solved with ease, therefore making the decision based on a simple, superficial or trivial solution, probably influenced by the team's high level of self-confidence regarding its accumulated knowledge. As Tjosvold and Field (1983: 500) point out, according to Jani's (1972) findings, "members sometimes conform, stifle discussion, and make unreasonable decisions."

Despite these strong results, some precautions must be taken before generalizing these findings or extrapolating them to real firm situations. The experiment took place in a controlled laboratory environment, the business game simulation represents only a simplified representation of a firm environment, and the student subjects have limited management capacity. In spite of the efforts to control these factors, students often display a lack of commitment and free-riding behavior, which may influence the results despite the safeguards. Furthermore, diversity measure is based on the students' formal academic records. Different correlations exist among the various diversity measures available and consensus (Knight et al. 1999; Horwitz and Horwitz 2007). Team diversity based on formal education could be a limited measure, because the different universities do not necessarily evaluate and classify students in the same way. Other measures, such as professional experience and employment tenure, therefore should be taken into account.

Despite the possible limitations of simulations, Schweiger et al. (1989) highlight the importance of laboratory studies as a means to promote future field studies. Schwenk (1982: 224) explicitly states that "the simultaneous use of field and laboratory methodologies is a more fruitful research strategy for many questions in the emerging field of strategic management." Furthermore, various studies rely on a business game simulation environment to test groups in management situations (e.g. Dickinson et al. 2004; Mathieu and Schulze 2006), which could be a tacit indication that laboratory research facilitates findings and insights that are very difficult or even impossible to measure on a day-to-day basis in a real firm environment. The business simulation used in the present research provides a controlled environment in which the teams begin their tasks on an even basis (i.e., same information and financial and operational indicators) and an adequate level of decision-making complexity. As a final remark, laboratory experiments that use business simulations, with a perfectly simulated, controlled environment without external interference, can be an interesting and efficient way to answer questions concerning strategic decision making.

4.8 CONCLUSIONS

Consensus among a TMT appears fundamental for efficient firm performance, and this present study offers some important evidence with regard to this issue. First, a positive relationship between consensus and performance emerges more clearly when the consensus measure is based on tangible, concrete aspects, such as budget allocation, and when data are measured over time to reduce dependence on the specific circumstances of a single moment. This approach

responds to Kellermans et al.'s (2005) claim that many inconsistencies in previous empirical research might be due to methodological differences. Second, this research identifies a moderator that influences the consensus–performance relationship. High team task-related diversity, measured according to the educational level of the group members (accumulated knowledge related to cognitive diversity) working on a sequential decision, seems to lead to a positive effect of team consensus on performance (i.e. a better decision choice). On the other hand, low diversity levels lead to an opposite effect and erode the team consensus-performance relationship. This evidence could at least shed light on the equivocal findings of prior studies about consensus-performance and reaffirm the 'double-edged sword' role played by diversity in the team consensus-performance relationship. Although team diversity often appears as an antecedent of consensus, the present research suggests it also acts as a moderator. Team diversity therefore should join the list of variables, such as firm environmental conditions (Kellermans et al. 2005; Ramos-Garza 2009), that traditionally serve as potential moderators. Earlier theoretical arguments and empirical results from two research lines were used as the foundation for this study reaffirm the results.

Third, team consensus and team diversity remain an empirical challenge. Hambrick and Mason (1984) hinted at and still support (Hambrick 2007) the idea that top managers and their strategic decisions are fundamental determinants of firm success or failure. Assembling and developing a capable TMT with the proper blend of background, experience, values, and personalities will help a firm formulate and implement an effective strategy (West and Schwenk 1996). The present study offers some evidence to practitioners that a TMT which has a high level of diversity could lead to better strategic decision choices, but in contrast,

low diversity leads to poor performance. But the question remains as to what the proper blend of diversity is that leads to outstanding performance. This research offers some contributions in this area, but much more research is required to understand this question fully.

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CHAPTER 5

The Influence of Firm Strategic R&D Orientation on TMT Strategic Consensus – Performance Relationship

5.1 INTRODUCTION

The TMT (Top Management Team) work is always highlighted by practitioners and scholars as vital to firm success. As Schweiger, Sandberg and Rechner (1989: 745) assert, the teamwork developed by the top managers is important since it "address[es] strategic problems because the complexity, dynamism, and ambiguity of such problems overwhelm the knowledge of any person." Much effort has been deployed by researchers in the strategic management field to understand the TMT influence over firm strategic choice. Basically, two broad streams (e.g. Rajapopalan, Rasheed and Datta 1993) were used to identify the link between TMT work and performance, one by looking inside team decision-making, known as team process; and the other by looking outside the team-decision making process, named team outcome/output. Following the latter, the present research will strive to shed light over the relationship between two team outcomes (a) strategic team consensus, and (b) strategic firm orientation towards R&D activities.

Team consensus can be defined by several perspectives. For this study we based the definition on Bourgeois (1980), Wooldridge and Floyd (1989, 1990) and Dooley, Fryxell and Judge (2000): *strategic consensus is the level of agreement*

of a TMT among strategic priorities that the best possible decision making has been made. In sum, strategic consensus, as one issue of the strategic management literature, tries to find a relation between the final consensus of a TMT and the team/firm performance. The consensus is an outcome of TMT process.

In some way it is believed that consensus is a kind of measure of the quality of decision making developed by the TMT (Wooldridge and Floyd 1989, 1990). However, this line of research has been presenting equivocal results (e.g. Dess and Priem 1995; Markóckzy 2001) and several studies have arisen with the aim of providing possible explanations for these results (e.g. Kellermans, Walter, Lechner and Floyd 2005).

According to these studies, one source of problems is found under which conditions the consensus take place, suggesting, among other things, that environmental contingency factors (Dess and Beard 1984) and, more specifically, dimensions such as (a) munificence; (b) complexity; and (c) dynamism, affect the consensus-performance relationship (Dess 1987; Dess and Origer 1987; Dess and Priem 1995, Homburg, Krohmer and Workman 1999; Kellermanns et al. 2005). These authors claim that the consensus-performance relationship could be moderated by firm environmental conditions. We distinctively highlight the theoretical study of Dess and Priem (1995) that presented a model named 'moderating effects model'.

By examining the literature on strategic management and decision-making, we can easily identify the influence that firm environmental contingency factors have over the strategic decision makers. A closer look at these factors reveals munificence, complexity and dynamism as dimensions of the environment, and

the main factors that pervade all these dimensions: *the uncertainty and risk* (Dess and Beard 1984). Concerning contingency factors we highlight the task of TMT access to an environment analysis, a precursor activity to other TMT outputs which includes firm strategic delineation Ginsberg and Venkatraman (1985) and Rajagopalan, Rasheed and Datta (1993).

In this study we build a moderator based on a result of TMT perception of the environment, named *firm strategic orientation*, and test it in a moderating model for the consensus-performance relationship presented by Dess and Priem (1995). In essence this model, primarily considers the correlation of consensus to firm performance, in which consensus is an output of a TMT process reflecting the quality of the entire decision-making (referring to the first model). Secondly, we propose firm strategic orientation as a moderator, by simply considering this choice a reflection of the TMT perception of firm environment (second model), and mainly because this decision takes into account the level of uncertainty and the risk related to strategic priorities choice.

In essence, the aim of this chapter is therefore to analyze the consensus-performance relationship in an attempt to answer the following question: *does the consensus-performance relationship vary in form and strength according to the firm strategic orientation?*

5.2 THEORETICAL BACKGROUND

The following theoretical background considers three main issues. *First* we introduce the concept of strategic consensus, by reporting two important aspects

that could influence the consensus-performance relationship (a) the consensus content; and (b) moderator factors based on environmental contingency variables. *Second* we highlight the TMT role on dealing with environmental uncertainty and making risky decisions such as the strategic orientation choice over R&D activities. This issue has its fundament grounded on the resource based view (the TMT representing a resource and capacity of a firm) and the upper-echelons theory. Using this background we build the fundaments of a moderator by highlighting the uncertainty and risky aspects related to decisions on R&D activities which exist in innovation literature, and linking it to TMT capacity on perceiving and dealing with uncertainty and risky issues. *Third*, we present the expected relations that strategic firm orientation on R&D could present for the consensus-performance relationship, according to the literature on environmental uncertainty.

5.2.1 TMT Consensus

Consensus as a measure of quality of decision making

A major stream in consensus research is based on the idea that a measure of TMT level of consensus taken after decision-making could be a reliable predictor of the team/firm performance. Here we are referring to consensus as an output of team process and not a team process itself. The main argument to use this approach is that it allows us to represent the perceptions of the members of a TMT by a single measure which draws upon cognitive and behavioral aspects present in team discussion. In other words, the consensus measure could simultaneously

aggregate the level of knowledge, experience, conflict, agreement, accordance and other variables that could explain the multiple facets which were present in the debate which includes the climate/atmosphere where the decision-making was involved. Hence, authors like Wooldridge and Floyd (1989, 1990) believe this measure could represent an adequate level of the quality of the decision-making, and so, a reliable measure to forecast the team or firm performance.

The consensus content in consensus-performance relationship

Consensus *content,* besides consensus *scope*, *degree*, and *locus*, is one aspect of strategic consensus construct (Markóczy 2001). Consensus *content* refers to 'about what' a TMT is deciding (Wooldridge and Floyd 1989). Content *Scope* refers to the subjects who participate in the consensus measure (Wooldridge and Floyd 1989); *degree* is about the level of perceived agreement, or acceptance, of each member of a team regarding an object of discussion (Wooldridge and Floyd 1989; Holder 1976); and *locus* of consensus refers to the primary location of the consensus, that is, where the consensus is primarily measured and perceived (Markóczy 2001).

Despite the importance of all these aspects, in the present research we will focus on consensus *content*, basically because this was the most studied issue in consensus literature and that which has generated much controversy concerning the empirical results (Markóczy 2001; Wooldridg and Floyd 1989).

Bourgeois (1980) engendered an empirical study which firstly observed the problem of consensus *content* by measuring the consensus in a firm's means

(strategy) and ends (aims). His findings pointed to both measures being positively linked to firm performance, but the 'means' measure seemed to be more accurate than that of the 'aims'. Bourgeois (1980: 228), evoking economist and management theorist claims about the "existence of multiple (potentially conflicting) goals with different weights attached to them." In other words, members of a TMT could ponder differently each strategic priority. Bourgeois (1980: 243) concluded in his study that "consensus on means always yields higher performance than disagreement on means, while allowing disagreement on less tangible goals tends to be associated with better performance." It seems that less tangible, or complex, dynamic issues or situations, could present a negative correlation between consensus and performance. In general terms we could infer that issues involving high uncertainty, like firm strategic orientation toward R&D, could present an negative effect over consensus-performance relationship. That is, the observed levels of consensus could not be considered a nice predictor of firm performance.

The consensus-performance environment moderators

Kellermanns et al. (2005) summarize one of the major problems of consensus literature: there are few studies which consider the effect of moderators over the consensus-performance relationship. These authors suggest organizational and environmental factors as possible moderators. Dess and Origer (1987) for instance, highlight the influence of the environment on strategic decisions and link it to other attributes like TMT, organizational structure and integrating mechanisms (Lawrence and Lorsch 1967).

The rationale over the use of moderators is based on the idea that the consensus-performance relationship could present different orientations and strengths according to how the TMT deal with the firm's internal and external environment and align the strategic choices with their personal goals and interests (Simons 1995). As Snow (1976: 249) pointed out (cited by Bourgeois 1985: 551):

> "… firms act upon and respond to an environment that their top managements have perceived and interpreted: That is, management responds only to what it perceives; those environmental conditions that are not noticed do not affect management's decisions and actions. This … means that the same 'objective' environment may appear differently to different organizations, possibly resulting in different strategies" (p. 249).

Some few theoretical studies (see Table 5.1) tried to note the consensus-performance link by considering distinct environmental conditions (contingency factors). Priem (1990); Dess and Priem 1995; and Kellermans et al. (2005) in their theoretical papers argue that a higher level of consensus in stable environments is positively related to firm performance whereas, in dynamic environments, lower levels of consensus will be associated to higher performance. Dess and Origer (1987) assert that the 'complexity of the environment' (or industry) dimension is inversely correlated to consensus, that is, the higher complexity of an environment, the lower the consensus-performance correlation.

Table 5.1: Theoretical Studies that Link Environment Conditions (Contingency Factors) to Consensus-Performance Relationship

Priem (1990)	"High levels of consensus in stable environments will then be considered with the appropriate environment-structure match and, therefore, high performance" (p. 473).
Dess and Priem (1995)	"… this formulation suggests that higher consensus is associated with high performance for firms facing stable environments …"(p. 407)
Kellermans et al. (2005)	"In a highly dynamic context, high levels of strategic consensus are likely to undermine organizational performance." (p. 728)

Source: the author

Some empirical studies (see Table 5.2) provide evidence of the proposition concerning the environment dynamism dimension. Bourgeois (1985), for example, concluded in his experiment that in uncertain environments consensus could be dangerous for performance. Another study, from Homburg, et al. (1999), investigated the consensus-performance relationship taking the TMT strategic consensus on 'differentiation strategy', and testing the moderation of 'market-related dynamism'. The study indicated that consensus on differentiation competitive strategy has a positive impact over firm performance, but the relation is reversed when in the presence of perceived TMT high market-related dynamism.

On the other hand, other empirical studies using proxies of dynamism lack statistical significance on proving these relationships. For example, Iaquinto and Fredrickson (1997) did not proved the moderation effect in two distinct industries (forest products - highly unstable; and paint and coating - highly stable) over the consensus-performance relationship. In a similar fashion, West and Schwenk (1996) did not find statistical significance on the industry influence (machine

tools as stable industry; and electronic components as the dynamic one) on moderating the consensus-performance relationship.

Finally, another dimension of environment – complexity – was identified by Ramos-Garza (2009). In her empirical study, she hypothesized on a negative impact of the environmental complexity over the consensus-performance relationship but the empirical results demonstrated a positive moderation effect.

Table 5.2: Empirical Studies that Links Environment Conditions (Contingency Factors) to Consensus-Performance Relationship

Bourgeois (1985)	for example, concluded in his "for rational beings and managers in constantly changing environments, attempts to avoid uncertainty and to gather complete agreement [*consensus*] on perceptions [*environmental*] and goals may be more deleterious than helpful and actually impede performance" (p. 571).
Homburg et al. (1999)	"… we were able to show that the consensus-performance link is stronger in situations of low market-related dynamism" (p. 351).
Iaquinto, and Fredrickson (1997)	"… our results (with control variables) indicate that although industry/environment is strongly related to performance, it does not appear to moderate the relationship between agreement and performance" (p. 72).
West, and Schwenk (1996)	"… it was argued that these relationships [*consensus-performance*] would be stronger in a stable industry than in a dynamic one. The moderated hierarchical regression technique described above failed to provide support for these hypotheses…" (p. 72)
Ramos-Garza (2009)	"… environmental complexity moderates the relationship between TMT strategic consensus and performance (ROI)" (p. 5).

Source: the author

From the literature above, we identify the main factors that affect the munificence, complexity and dynamism of the environmental contingency

variables: *uncertainty and risk* (Dess and Beard 1984). We therefore conclude from the environmental literature that some environments present high levels of uncertainty that is, there is a lack of information to provide a clear judgment. Thus, this kind of environment is implicated in so much controversy and consequently, risky decisions.

This apparent equivocal result instigates us to propose 'firm strategic orientations' as variables to be tested as moderators over the consensus-performance relationship. Using the arguments on environmental uncertainty and risk, we propose a firm strategic orientation toward R&D activities as a possible moderator.

5.2.2 Firm Strategic Orientation toward R&D activities

Firm Strategic Orientation

From strategic management literature we highlight that strategic orientation is a result of a TMT work, that is, the response to how they perceive environmental uncertainty. We likewise highlight that each particular TMT could present distinct perceptions and consequently ways to choose an adequate strategy that ought to be followed by the firm. This is particularly in congruence with Snow (1976), referred to by Bourgeois (1985: 551) "… different top management teams can perceive the same objective environment differently, which would explain why firms facing ostensibly similar conditions pursue different strategies and, by implication, achieve different performance levels." From this statement, we are able to infer that the role played by TMT consists of synthesizing their

perceptions of the firm's environment into opportunities and/or threats according to their individual cognitive capacities and to other individual and collective values and abilities. This inference resonates arguments within the resource based theory that a TMT is a resource/capacity of a firm (Eisenhardt and Martin 2000). Furthermore, the inference also resonates bounded rationality theory advocated by Cyert and March (1963) and a more recent theories derived from the latter, such as the upper-echelons perspective (Hambrick and Mason 1984; Hambrick 2007). The latter by and large sustains that TMT characteristics influence firm strategy and final performance.

Regarding the fundaments and arguments presented above, we are obliged to conclude that TMT perceptions about the environment and other TMT characteristics could be reflected in the firm's strategic orientation. This could justify, at least in part, why some firms in a same industry could possess distinct strategic orientations. We believe this orientation could be a moderator of the consensus-performance relationship, since it presents levels of uncertainty and risk involved in this kind of decision choice. In our study, we propose and expected that the consensus-performance relationship could present a distinct strength and direction in firms with a clear orientation toward R&D activities. In the literature, the decision regarding R&D is considered an uncertain and risky one if compared to more traditional strategic orientations like marketing and quality. Smith and Zahrly (1993: 48) exemplify the uncertainty surrounding R&D over marketing activities by stating that:

> "High technology research and development activities focus on product development, design, and innovation; such activities will go

> largely unrewarded if the resulting products cannot be successfully introduced to the market. In the extreme case of new product development, judging customer interest in a nonexistent product is typically mode difficult and risky than measuring consumer reactions to design changes of existing products."

In what follows, we shall be dealing with R&D activities and the related uncertainty in order to fundament the moderator.

Innovation, R&D activities, and TMT strategic decision

Dosi (1988, p. 1120) states that:

> "In the most general terms, private profit-seeking agents will plausible allocate resources to the exploration and development of new products and new techniques of production if they know, or believe in, the existence of some sort of yet unexploited scientific and technical opportunities; if they expect that there will be a market for their new products and processes; and, finally, if they expect some economic benefit, net of the incurred costs, deriving from the innovations."

The reference to Dosi (1988) could summarize for us several important issues related to innovation and we highlight some of them: (a) the role played by the economic agents (firms) as profit-seeking; (b) the role played by the science and the technology as 'unexplored' opportunities to be embedded in product and

process; (c) the firm investment/resource allocation effort in R&D activities to achieve new products and explore new markets; and (d) the economic cost-benefit analysis regarding the firm's innovative activity.

As observed by Dosi (1988: 1121), innovation is a result of certain outputs generated by the synergy exerted between internal (firm) and external (industry and other actors) capabilities. By this statement, we can infer several external and internal factors that, in sum, affect the firm innovation like (a) the general macroeconomic conditions of the economy; (b) the level of the competition in the industry; (c) the level of embedded knowledge in the product (i.e. high tech, low tech, etc.); (d) the government financial and fiscal stimuli; (e) the firm internal capacity in R&D; (e) the strategic partnerships with other firms, R&D centers, etc; (f) the firm investment capacity; and so on (Dosi, 1988).

The resource-based view of the firm (Barney 1991; Eisenhardt and Martin 2000; Helfat and Peteraf 2003) could set the tone of the previous discussion. They simply state that a firm is a sum of valuable, rare, unique, and irreplaceable resources and capacities that must be exploited in order to guarantee the firm's competitiveness. However, according to Ray, Barney and Muhanna (2003) the resources and capacities must be effectively used. Their mere existence is no guarantee that a firm will achieve the desirable competitiveness. In this stream, we highlight the role played by the TMT, also considered a firm's resource and capacity by authors like Eisenhardt and Martin (2000). According to this view, the TMT is the responsible for creating a firm with "innovation behavior" (Tang 2006: 68). In sum, we were able to understand that the strategic option for innovation is a TMT strategic decision, as stated by Bantel and Jackson (1989:

108) “presumably, decisions to invest resources in either technical or administrative innovations are made by top management (Wilson 1966; Hage and Dewar 1973).”

Among other decisions, we can identify the resource allocation to R&D activities as one way - an important one - in which a firm could develop the ‘innovation behavior’. In accordance to the Frascati Manual (OECD 2002: 30) research and experimental development (R&D) comprise “creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications.” In other words, the R&D activities could lead to knowledge accumulation and the consequences could be new, or significantly modified, products or processes that once introduced into market or firm procedures lead to a firm innovation (OECD Oslo-Manual 2005).

The OECD Oslo-Manual (2005: 38) also recognizes the importance of the innovation in firm strategy, constituting an element that participates (or should have to) in firm resource allocation or investment. This link between innovation, firm strategy, and budget allocation is also identified in the recent literature about R&D and innovation (e.g. Jong and Marsili 2006; Grinstein and Goldman 2006). In sum, R&D investment could be considered one of the signals of a firm’s innovative orientation, in which it is relevant strategic decision-making undergone by the TMT.

Several frames intend to explain why firms invest more or less in R&D activities. One frame uses the resource based view (e.g. Barney 1991) and the competitiveness within the industry (e.g. Porter 1980, 1985). In the former, the

differences among firms could be explained, for example, on occasions where some internal firm climate and culture favors the existence of R&D activities. The latter focuses on external competitive factors (competitive pressure, e.g. Porter 1980) like rivalry, and industry opportunities and threat analysis. In the prior frame we can see TMT identifying an uncertain environment (a) threats and opportunities (external factors), and (b) strengths and weaknesses (internal factors); and consequently deciding the amount of resources to be used in R&D activities and coordinating other external and internal efforts, in order to achieve a proposed strategy.

The other frame is presented by Miller and Friesen (1982) who had used two 'innovation models', based on TMT 'level of entrepreneurship', to develop their so called 'conservative and entrepreneurial' study. In the first 'model' - the conservative - a firm could be characterized as innovative because of a TMT response to an environmental threat. In the second, the entrepreneurial model, a firm has innovation intrinsically related to firm strategy, that is, it is a priority embedded into firm strategy or, as described by Miller and Friesen (1982: 15) "innovation is a natural state of affairs."

According to frames above, we are able to infer that a TMT has the choice of leading a firm to a more or less aggressive pursuit of innovative behavior and, thus, it will be reflected in the level of R&D investments (Damanpour 1991).

The uncertainty surrounding the decision about R&D activities

As observed by Carpenter and Fredrickson (2001: 536):

> "uncertainty is a consequence of environmental factors that generally result in a lack of the information needed to assess means-ends relationships, make decisions, and confidently assign probabilities to their outcomes … According to that theory, decisions made under great uncertainty are likely to be 'the outcome of behavioral factors rather than a mechanical quest for economic optimization' (Hambrick and Mason 1984: 194)."

R&D activities are normally shrouded by a cloud of uncertainty, since the consequences of this innovative process depend on equilibrium between 'what's possible' and 'what's plausible'. Rosemberg (1994) highlights the climate of uncertainty that permeates the decision-making about R&D activities. The experimentation of new and untested ideas is a risky activity. Some could produce unwelcome results, or could be costly; others could be desirable and less costly. As observed by Dosi (1988: 1134), "it involves not only lack of knowledge of the precise cost and outcomes of different alternatives, but often also lack of knowledge of what the alternatives are."

This trade-off is certainly taken into account by the TMT at the moment of designing firm strategic orientation and consequently allocating resources to broad functional areas like marketing, quality, manufacturing, or R&D activities. Dosi (1988) again states that commitment of resources must be a consequence of a TMT perception of opportunities and financial (as well as other) incentives. According to some authors, the R&D resource allocation resides at the level of uncertainty of the expected innovation outcomes (Kay 1979; Pakes and Schankerman 1984; Dosi 1988; Greve 2003). Others present the idea that R&D

investment could be dealt with general budgeting distribution, applying rules like R&D investment as a percentile of the sales or net incomes (Kay 1979). This issue is particularly important in innovation literature. It is in fact an active research line that attempts in general terms to identify the best options to select in R&D projects, and to define resource allocation priorities.

2.3 Consensus-performance and R&D strategic orientation

In sum, we believe that firm orientation toward R&D activities could be a reflection of the TMT perception on firm environment (Damanpour 1991) and their risk tolerance concerning an R&D activity, irrespective of whether the TMT identify an environmental threat, or one that has a propensity to be entrepreneurial. According to these differences, we propose that strategic decision firm orientation toward R&D activity will be involved with an appropriate level of uncertainty leading to a risky decision. The consequences would be a negative influence over the consensus-performance relationship. In this kind of strategic orientation, the high level of consensus could not serve as a reliable predictor of firm performance. The rationale for this statement is based on: *firms oriented toward R&D activities present TMT dealing with right uncertain issues and risky decisions, which in essence could affect the quality of the whole decision making*.

5.3 RESEARCH MODEL AND HYPOTHESIS

In this research we develop a moderator based on strategic orientation, as a TMT response of a perceived firm environment and test it on the 'moderating effects model' for consensus-performance relationship proposed by Dess and Priem (1995).

In the 'moderating effects model', the consensus will represent the quality of the whole decision-making (a measure of TMT process outcome, see Figure 5.1). The TMT chose a desired strategic firm orientation toward marketing, quality, R&D, or manufacturing. Thus, this decision is a consequence of the TMT perception around environmental settings. In general terms, the bivariate consensus-performance relationship could present a positive relationship, without considering other factors. Despite this fact, we suggest that in the presence of a certain strategic firm orientation, this relationship could be modified in form and strength. That is, following the consensus literature on third variables, we propose that a firm strategic orientation act as a moderator of the consensus-performance relationship. More specifically, we build the fundaments for the R&D strategic orientation as a moderator factor and test on the 'moderating effects model' (Figure 5.1).

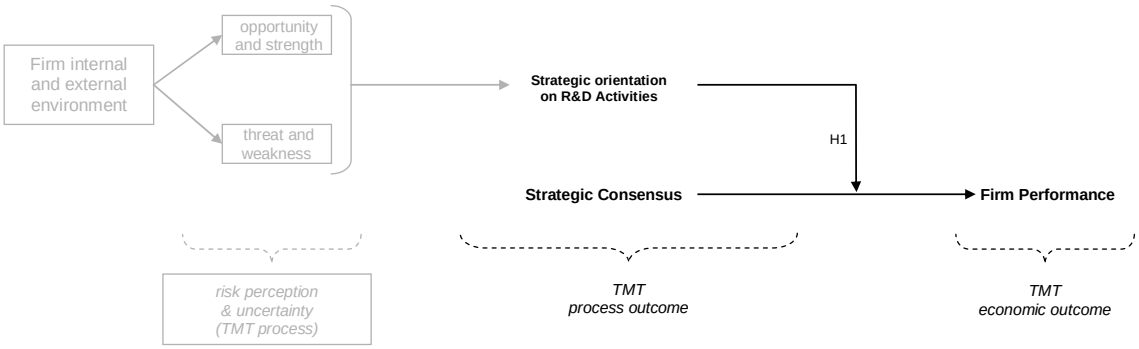

Figure 5.1: Integrative Model of Consensus-Performance with Firm Strategic Orientations

It is expected that the strategic orientation toward R&D activities could play a similar role played by environment TMT perception, by simply lending the tone of uncertainty and risky conditions previously developed by the literature concerning contingent factors (environment uncertainty).

According to this expectation, the TMT which decides on an R&D strategic orientation opt for a risky investment, in which this decision is a response of their perception on the level of uncertainty referred to by the environment, and additionally the level of uncertainty intrinsically related to the R&D issue. Taking this account, it is irrelevant whether the response came from identifying an environmental threat (conservative model of Miller, and Friesen 1982) or from the TMT propensity to make risky investments (entrepreneur model of Miller, and Friesen 1982). Given the uncertain and consequently risky decisions that are involved in R&D activities, the main aspect here is if this decision could affect other decisions on strategic issues like pricing policy, quality, marketing, etc.

From the literature on environmental circumstances and consensus we find theoretical arguments (Priem 1990; Dess and Priem 1995; Kellermans et al. 2005) and empirical evidence (Bourgeois 1985; Hamburg et al. 1999) that the dynamism of the environment (and industry) shall negatively affect the consensus-performance relationship. On environment complexity, some theoretical arguments (Dess and Origer 1989) indicate that higher complexity leads to negative consensus-performance relationships. From these previous studies we could highlight the negative moderating effect that uncertain environments could present over the consensus-performance relationship. From these same studies, the cited authors argue that the level of uncertainty leads to a kind of TMT process in which the discussion must be extensive and deep, and also encouraging the members to strongly explore the issue in order to reduce the level of this uncertainty.

Resorting to innovation literature, we can easily identify uncertainty intrinsically related to strategic orientation toward R&D issues (Dosi 1988; Rosemberg 1994). We conclude that R&D issues hold similarities with the perception of uncertainty in the environment (Kay 1979; Pakes and Schankerman 1984; Dosi 1988; Greve 2003). Relying on these conclusions, we state that firm's R&D oriented could negatively influence (moderate) the consensus-performance relationship.

The main argument used to justify this proposition is that the TMT time and effort consumed to define the R&D strategic orientation (consequently the adequate level of investment) could be excessive and probably wear down the whole quality of strategic decision. In such conditions, other strategic decision discussions, like investments on marketing, quality and manufacturing, and price

definitions may be underestimated, underappreciated, and time constrained. The consequences could be suboptimal decision-making, with low equilibrium over decisions, and with a lack of firm threat/opportunity adequate environmental response. The relation between time and consensus can be appreciated in Schweiger et al. (1989: 751) where, citing Mason and Mitroff (1981: 203), they state that according to the complexity of the case (case study used in their experiment) and its relation to importance: "large, complex problems … generally take a fair amount of commitment and time" (p. 203). We subsequently argue that consensus over more complex and/or uncertain issues like R&D firm strategic orientation could lead to the TMT spending a lot of time and effort on controversial issues in detriment of a desirable balance of attention to be deployed in each issue. The consequence for the excessive focus on R&D issues is the sacrifice of the quality of the entire strategic decision despite an eventual high level of consensus observed over the whole decision-making. This eventual high level of consensus could represent a 'trap' not reflecting the high quality of the whole decisions. These decisions may be characterized by being quick and poorly debated, as those that 'keep the same levels of investment of other periods' or 'use a fix percentile of the incomes'. Thus, we propose the following hypothesis:

H1. The orientation for R&D activity will moderate negatively the relationship between consensus and performance.

5.4 METHOD AND MEASURES

Method

This experiment used the same method and data base generated by the first empirical research of the present thesis described in the Chapter 4.

Measures

Three measures were used on this experiment to access information in order to provide data to test the hypothesis: (a) team consensus; (b) firm strategic orientation, and (c) firm performance.

(a) Consensus

Most studies that use environmental and strategy variables to explain firm performance resort to TMT individual perceptions to achieve a measure based on these proxies of the real firm situations (Kellermans et al. 2005). In our experiment we adapted the measure of consensus from Bourgeois (1980) using suggestions of Kellermans et al. (2005) and Wooldridge and Floyd (1989, 1990). The measure takes the level of agreement among members regarding budget allocation decisions, immediately after each decision-making class. The items employed relate to the subject's personal level of agreement (on a seven-point Likert scale 1 = total lack of agreement to 7 = full agreement) according to each decision made by the group, that is, expenditures on production, plant expansion, R&D, marketing, quality; and pricing policy. The final consensus measure was calculated for each team by adding the average of the individual responses to each question. When nonresponses occurred, the individual nonresponse was

replaced with a fictitious measure based on the person's existing response average. The measure thus includes only those students who attended classes and effectively participated in each decision-making process.

(b) Firm Strategic Orientation

For the firm strategic orientation variable we relied on the direct observation of investment made by each team to the R&D activity. Measures of R&D investment (also referred to in the innovation literature as R&D intensity) are frequently used as a proxy in order to achieve the level of innovativeness of a firm (e.g. Greve 2003). As established in the literature, R&D is an important activity for a firm to achieve innovation. Several other activities and managerial decisions like external acquisition, joint development and so on, could be added to the list. The same could be said to concerning measures of strategic orientation like quality and marketing. In our study we opt for simplification by designing the business simulation to consider these investments as the only way a firm could achieve a desirable strategic orientation. For example, the simulation model considers that an investment in R&D has a direct impact over the demand, calculating it by considering the individual level of investment of a firm relatively to others firms.

(c) Firm Financial Outcome

The team performance output measure used was the Net Benefit, a common financial measure. The choice was based on (a) previous experiments related to consensus (Kellermans et al. 2005); (b) their objectiveness and direct measure without subjective or eventual unreal measures based on questionnaires; and (c)

the advantage provided by the business game in generating a measure based on the same software program source of all the participants and, additionally, avoiding eventual differences among industries (the firms are competing by accomplishing some limits and in a same industry characteristics) like those that are intensive in capital; (d) the possibility of evaluating another performance measure rather than the ROA used in the first experiment (i.e. the empirical experiment described on Chapter 3).

Control Variables

Additionally, three control variables were included in the model to isolate possible interrelationships among the variables: (a) period of decision, coded from 1 (first period) to 4 (fourth period), to control the influence of experience; (b) location, coded as a dummy variable that distinguishes the two universities, to control for contextual interferences; and (c) group size, measured as the number of members in each group, which controls the influence of differences on internal group complexity.

5.5 ANALYSIS AND RESULTS

Table 5.3 presents the descriptive of variables used in the regressions. Four regression models were estimated to test the hypothesis, the results of which are displayed in table 5.4.

The first regression model includes only the three control variables as independent variables, whereas the second model also adds the consensus measure. In the third model, the R&D expenditure is incorporated, and in the

fourth model, the interaction term between R&D and team consensus is included to test H1. This analytic procedure follows that suggested by Sharma, Durant and Gur-Arie (1981), Baron and Kenny (1986), and Venkatraman (1989) to analyze moderation.

The model 2 indicates the positive and significant relationship between consensus and performance using Net Profit as a measure of performance. This result confirms the result found on the Chapter 4 which used ROA as the performance measure.

Model 4 reveals that the variable R&D expenditure moderates negatively the team consensus–performance relationship, in support of H1. The procedure to verify this moderation is based on the analysis of the sign and significance of the interaction term in model 4. The negative sign of the interaction indicates a negative moderation of firm orientation toward R&D activities, thus inverting the positive relationship between team consensus and performance found in the single related model 2. That is, the more consensus, the less performance in R&D oriented firms.

Table 5.3: Means, Standard Deviations, and Correlations[a]

Variables	Mean	s.d.	1	2	3	4	5
1. Period	2.493	1.122	1				
2. Location	1.536	0.500	-0.010	1			
3. Group Size	3.384	0.738	-0.001	0.229***	1		
4. Net Benefit	2.96†	1.12†	-0.1336	0.043	-0.076	1	
5. Consensus	6.327	1.594	0.074	-0.202**	0.065	0.197**	1
6. R&D expenditures	4.49†	1.89†	-0.067	0.002	-0.151*	0.011	0.149**

Obs. [a] n= 138; † value in millions; *** $p \leq 0.01$; ** $p \leq 0.05$; * $p \leq 0.1$

Table 5.4: Multiple Regressions Analysis for Net Benefit as Dependable Variable

Net Benefit	Model 1	Model 2	Model 3	Model 4
Constant	9,14†	-18.2†	-19.6†	-65.6† ***
Period	-1,41†	-1.59† *	-1.52† *	-1.45† *
Location	1,48†	2.53†	2.41†	3.13†
Group Size	-1,46†	-1.39†	-1.19†	-0.9†
Consensus	-	4.09† ***	3.88† **	10.9† ***
R&D Expenditure	-	-	0.478	10.5 **
Consensus X R&D	-	-	-	-1.59 **
R^2	0.027	0.075	0.081	0.115
F	1.26	2.70**	2.32**	2.84**

Obs. † value in millions; *** $p \leq 0.01$ ** $p \leq 0.05$ * $p \leq 0.1$

The coefficient of R&D expenditure is not significant in model 3, which implies that firm orientation toward R&D activities is a pure moderator that affects the team consensus–performance relationship without directly influencing performance (Sharma et al. 1981).

The general low R^2 suggests it results from the few variables in the model to estimate general firm performance. We argue it remains very difficult, if not impossible, to represent a complete model to explain business performance (Capon, Farley and Hoening 1990), even in a simulated environment.

Additionally, a slope test graph of moderation (two way interactions) was plotted according to the procedures described by Aiken and West (1991), in which the effect of moderation can be visualized. According to Figure 5.2, a firm's increased orientation towards R&D negatively moderates the consensus-performance relationship and offers additional information. We observe in the graph that when R&D is high, the relationship between consensus and team

performance is negative. When the R&D orientation is medium the relation is slightly positive, and in low R&D orientation the relation is clearly positive. In general we conclude that the high consensus could be beneficial given that medium and low level of R&D indicates a clear positive influence over performance, overcoming the negative effect of high R&D. Despite this, the higher orientation toward R&D activities is clearly negative for the consensus-performance relationship. Therefore, we conclude that a high strategic orientation in R&D lead us to a negative moderation.

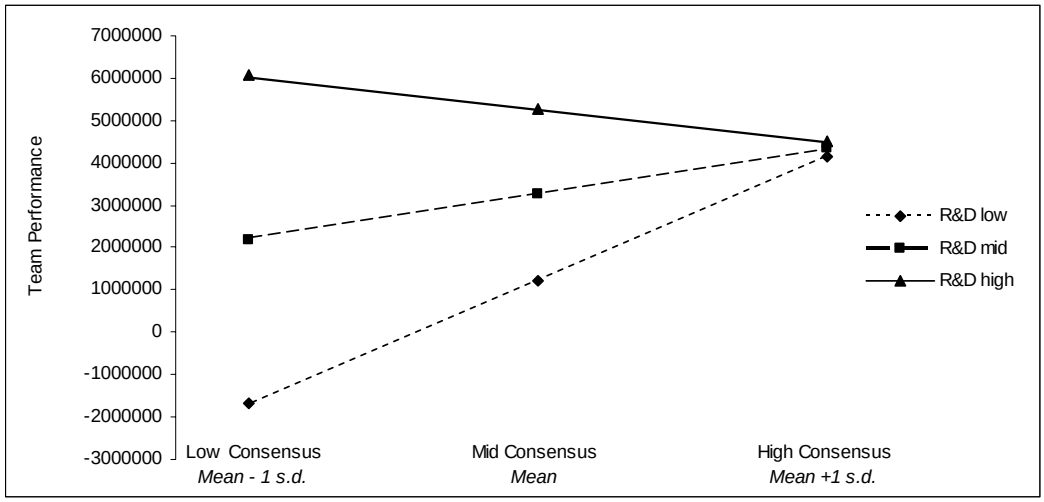

Figure 5.2: Moderation Slope Test R&D Orientation Moderation over Consensus-Performance Relationship

In an exploratory manner, and bearing in mind the testing of the robustness of the findings, we performed two additional tests with other two strategic orientations, quality and marketing. In the first test we verified the level of uncertainty and risk that may exist - and were perceived by the game players - over the R&D, quality and marketing issues (orientations), by comparing the level of the final

consensus of each issue. The second test we performed moderated regressions in quality and marketing orientations over the consensus-performance relationship.

In the first test we compared the means and standard deviations of measures of consensus on R&D, quality and marketing (Table 5.5). In order to verify the independence of the measures we used Wilcoxon signed-rank (on table 5.5, columns 1a and 2a) and Friedman non-parametric test (Table 5.5, columns 1b and 2b), and both tests indicated that the measures could be considered independent, at a minimum of 10% of significance level.

Table 5.5: Means and Standard Deviations of Consensus Measures

	Mean	s.d.	Min	Max	1a[1]	2a[1]	1b[2]	2b[2]
1. Consensus on R&D	6.3597	0.7305	3.50	7	-	-	-	-
2. Consensus on Quality	6.4007	0.6859	3.75	7	* (0.089)	-	* (0.100)	-
3. Consensus on Marketing	6.4271	0.6799	3.33	7	* (0.053)	n.s. (0.152)	* (0.085)	* (0.090)

Obs. [a] n= 138; * $p \leq 0.1$; between parenthesis is displayed the significance; n.s. - no statistical significance; [1] Wilcoxon signed-rank test between consensus on R&D, and consensus Quality and Marketing (1a); and between consensus on Quality and Marketing (2a); [2] Friedman non-parametric test between consensus on R&D, and consensus Quality and Marketing (1b); and between consensus on Quality and Marketing (2b).

According to these results, consensus on R&D expenditures was more difficult to be achieved. In other words, it was an intricate issue to be discussed within the teams, given its low mean and the higher standard deviation in comparison to other issues. The more uncertain and risky nature of R&D over quality and marketing issues must have influenced the achievement of consensus. Moreover, consensus over marketing decisions could be considered less problematic, that is, a less uncertain and risky issue if compared to decisions on quality.

For the second test, we applied the same moderating regression procedure used to test R&D strategic orientation, and added four extra models (5 to 8). The descriptive and regressions are shown in tables 5.6 and 5.7.

Table 5.6: Means, Standard Deviations, and Correlations[a]

	Mean	s.d.	1	2	3	4	5	6
1. Period	2.493	1.122	1					
2. Location	1.536	0.500	-0.010	1				
3. Group Size	3.384	0.738	-0.001	0.229***	1			
4. Net Benefit	2.962†	1.19†	-0.098	0.033	-0.045	1		
5. Consensus	6.327	1.594	0.074	-0.202**	0.065	0.197**	1	
6. Quality expenditures	4.53†	1.83†	-0.043	0.119	-0.116	0.176**	0.143*	1
7. Marketing expenditures	5.41†	1.99†	0.163*	0.150*	0.021	0.134	0.028	0.608***

Obs. [a] n= 138; † value in millions; *** $p \leq 0{,}01$; ** $p \leq 0{,}05$; * $p \leq 0{,}1$

According to the results from models 5 and 6, the variable quality expenditure did not directly influence and nor did it moderate (present lack of significance) the team consensus–performance relationship.

The result from model 7 indicates that investment in marketing did not present a direct effect over the consensus-performance relationship. However, model 8 indicates the variable marketing expenditure positively moderating the team consensus–performance relationship. The positive sign of the product indicates a positive moderation of marketing orientation which leads to strengthen the positive relationship between team consensus and performance. In other words, the higher the consensus, the higher the performance in marketing oriented firms. As the coefficient for marketing expenditure was not significant in model 7, it

implies that marketing expenditure (marketing oriented firm) is a pure moderator that affects the team consensus–performance relationship (Sharma, Durand and Gur-Arie 1981).

Table 5.7: Multiple Regressions Analysis for Net Benefit as Dependable Variable

Net Benefit	Model 5	Model 6	Model 7	Model 8
Constant	-18.3† *	-55.5† *	-15.7†	30.0†
Period	-1.58† *	-1.56† *	-1.34†	-1.38†
Location	2.49†	2.91†	3.11†	2.71†
Group Size	-1.37†	-1.21†	-1.42†	-1.18†
Consensus	4.07† **	9.72† **	4.22† ***	-2.99†
Quality Expenditure	0.058	8.09	-	-
Consensus X Quality	-	-1.254	-	-
Marketing Expenditure	-	-	-0.872	-9.84*
Consensus X Marketing	-	-	-	1.41*
R^2	0.075	0.089	0.095	0.114
F	2.15*	2.16*	2.78**	2.81***

Obs. † value in millions;*** $p \leq 0,01$ ** $p \leq 0,05$ * $p \leq 0,1$

According to Figure 5.3 (a slope graph of the moderation), the firm marketing orientation positively moderates the consensus-performance relationship in high levels of marketing orientation. The graph also indicates that firms with mid and low levels of marketing also achieve better performance with high consensus.

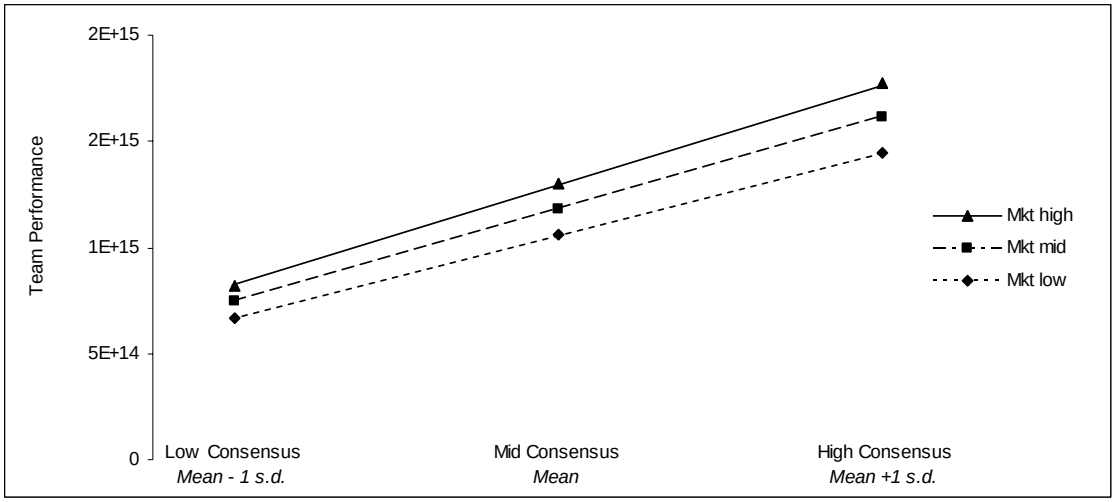

Figure 5.3: Moderation Slope Test for Marketing Moderation over Consensus-Performance Relationship

5.6 DISCUSSION

Furthering the discussion, we argue the existence of a trade-off between the achievement of consensus, and decisions concerning R&D that could explain the expected negative effect of moderating over the consensus-performance relationship. The trade-off is related to the amount of effort dedicated by a TMT to R&D issues in contrast to other important strategic issues like marketing, quality, manufacturing and others. We deal with this trade-off below, as this proposition is the main contribution of our work to the literature on consensus.

In the consensus literature we identify a basic content in which environments with high levels of uncertainty demand rapid and risky decisions. Dess and Origer (1987: 327) share this idea by stating that "… a complex and dynamic environment tends to be associated with less consensus on the firm's strategic direction." The consequences of a consensus seeking behavior within a TMT

could be a lack of appropriate exploration of the environmental opportunities. In an environment with high levels of uncertainty, it is straightforward to think that a TMT will experiment a vast disparity of opinions among the team members. To illustrate this we refer to Carter (1971) who asserts that the level of uncertainty is directly related to the options on the number of goals. In a similar fashion, Homburg et al. (1999: 345) sustain that "in environments with higher dynamism, organizational routines are less established and the criteria by which to evaluate alternate courses of action are not as clear."

Considering the arguments above, it is unproblematic to expect that firms oriented toward R&D activities must demand a great deal of effort and dedication of TMT in defining the optimal level of R&D investment. The clearly uncertain nature of the R&D activity leads to the understanding that decisions over this issue are very difficult and consequently time-demanding in order to reduce this uncertainty. Considering situations like this "building consensus takes time … (Mintzberg 1979)" (Bourgeois and Eisenhardt 1988: 818).

This may consequently cause a polarization over TMT discussion around R&D issues in detriment of other similarly important strategic issues. In this kind of context, achieving higher consensus concerning controversial issues like R&D could counterbalance the advantage in achieving consensus over a whole strategic decision. In other words, an extreme effort deployed to achieve consensus on R&D is deleterious when compared to the benefits of a TMT general level of consensus over decision-making. In essence, the benefits of achieving consensus on R&D issues, do not compensate the costs of achieving the respective level of high consensus. As observed by Hombourg et al. (1999:

347) "… as it takes time and managerial effort to build consensus, this investment in obtaining consensus on strategy may not be worth the cost when there is rapid change in the market."

The consequence of this time polarization on the R&D issue is a low quality of the general strategic decision (decision here comprehended as resource allocation to functional areas) and finally leading to poor firm performance. In our case, we stated that a TMT which opts for R&D strategic orientation will deploy much effort (mainly time) to find the ideal level of investment on R&D activities, and consequently will not spend enough effort in defining the adequate pricing policy and the level of investments for other functional areas like marketing, quality and plant capacity.

Taking situations like this into account, it is expected that the TMT which opted for R&D strategic orientation eventually could present a desirable level of consensus on R&D investment, and eventually a general consensus (among all strategic priorities/areas), but the quality of this second consensus could not be considered appropriate. That is, under these conditions the consensus could be a result of poor general discussion among the TMT. In other words, relegating other decisions to a secondary level of importance, not awarding sufficient attention to other strategic decisions, and possibly defining rules like: 'using a percentile of the total sales revenue for marketing activities' or 'following the historical investment level on quality investments' (as Kay 1979, suggested for R&D budgeting).

From the results of the exploratory tests, we conclude that a firm orientation toward marketing presented a positive effect on the consensus-performance

relationship. This could be interpreted as follows: despite the fact a firm marketing orientation could be involved in a cover for uncertainty and risk, the decision about investment on marketing activities could be considered less uncertain, and less risky than R&D investments. In a general sense, the investments on marketing and the influence of these activities could be defined as positive and influential over consumers, rather than the less uncertain and risky R&D outputs. For instance, by exposing a firm product, brand, or institutional mark to consumer minds could be less costly and the decision less risky than developing and selling new or significantly modified products. The chances of any given innovative or a significantly modified product getting accepted or rejected by the market could be significantly more risky than an unsuccessful marketing campaign. This could particularly be seen as an evidence to what Smith and Zahrly (1993) stated about differences on strategic priorities between 'innovative' firms and 'traditional' ones. Taking this into account, the TMT could better define marketing decisions without restricting time and effort, as the whole decision would be better discussed and the time would be well coordinated and distributed among the contents of all strategic decisions.

5.7 CONCLUSIONS

This empirical study addresses important conclusions regarding the literature on consensus: (a) first, a strategic orientation moderates the consensus-performance relationship; (b) second, the correlation is negatively moderated in presence of firms oriented over uncertain and risk activities like R&D; (c) third, the consensus content, that is, the object of TMT discussion, could play an important

role over the same relationship; (d) fourth, inside a same industry, distinct signs and strengths of the consensus-performance relationship could be identified but, in general, the consensus-performance could be considered a reliable predictor of the firm performance; and (e) finally, exploratory tests indicate that marketing orientation, a more classical firm strategic orientation, present a positive moderation over the consensus-performance relationship.

Theoretical Implications

Using the uncertainty and risk theoretical arguments from the environment contingency factors (Dess and Beard 1984), we correlate the firm strategic orientation decision toward R&D, an activity intrinsically related to high uncertainty and consequently risk decisions (Dosi 1988; Rosemberg 1994) to consensus-performance relationship. The results are in consonance with results found in Hombourg et al. (1999) and Bourgeois (1985), which demonstrated that high uncertainty moderates negatively a prior single bivariate positive correlation between consensus-performance.

The results reinforce prior theoretical arguments that affirm consensus-performance could vary, according to: (a) more or less tangible consensus contents (Bourgeois 1980); (b) the industry, and even inside the same industry (West and Schwenk 1996); (c) contingency factors like environmental uncertainty (Dess and Origer 1989; Priem 1990; Dess and Priem 1995; Kellermans et al. 2005).

However, in general terms, the main conclusion of this work is that consensus could be a good indicator of the quality of TMT decision. Despite this conclusion, some precautions must be taken. For example, when dealing with uncertain and risky firm situations like strategic orientation toward R&D activities, an elevated final TMT consensus could be deleterious to firm performance. This is congruent with Bourgeois (1985) who argues that some kind of level of 'dissensus' or 'disagreement' needs to be visualized in the final decision-making in order to reduce uncertainty and achieve better firm results. The rationale over this assertion is based on the idea that issues characterized by high levels of uncertainty could demand significant efforts from the TMT to minimize the lack of information and diminish the risk of decision-making. In essence, the pursuit of a final decision-making with high consensus over an uncertain and risky issue could be deleterious to firm performance, given the lack of sufficient time to be dedicated to all strategic decisions.

On the other hand, issues related with low uncertainty and low risk decision like marketing investments (a traditional firm strategic orientation) seem to reinforce a positive consensus-performance relationship. In other words, a firm with a clear marketing orientation seems to reinforce the correlation between consensus and performance. The same conclusion could be applied for firms with medium and low levels of R&D investments, a common condition on firms with 'traditional strategic orientation', in which the investment on R&D exists but it is less aggressive than those on firms R&D driven. Firms like this indicate an opposite moderation over consensus-performance, that is, the more consensus the better performance. This findings are congruent with Smith and Zahrly (1993: 48): "strategic management decisions about allocation of limited financial resources

among competing organizational demands may also differ between high technology organizations and traditional manufacturing firms."

Methodological Implications

From a scholarly viewpoint, we believe that the present research advances on the empirical methodology. *First*, the use of business simulators provided desirable conditions for the experiment, in order to favor some conclusions. These desirable conditions facilitated the test of moderations, by avoiding eventual environmental biases that exists in the 'real world'. *Second*, other important methodological contribution lies in the fact that we used objective measures to identify a firm's orientation toward R&D and consensus.

Previous studies use subjective measures to achieve the strategic information data (level of uncertainty perceived by TMT), and according to Wooldridge and Floyd (1990: 239) "self-reported measures may not truly reflect the phenomena of interest. Personal bias and misperceptions may influence responses." This kind of measurement is welcome in situations where the TMT perceptions are needed in order to achieve the subjectivism of the issue studied. R&D investment is a clear and objective measure, distinct from TMT perception on a firm strategic orientation. We highlight here a special methodological contribution related to the consensus measurement, an aggregated measure partitioned in strategic priorities, which obtains the general perception of individuals involved in the decision-making process, surveyed just after the team-decision process. According to Smith, Mitchell and Summer (1985) on Wooldridge and Floyd

(1990: 235) “the strategic priorities reflect what is important to decision-makers and can be observed by focusing on how managers pay attention to, weigh, and actually use certain types of information when making decisions.” This is particularly important since the priorities do not necessarily depend directly on a sequence emanated from the strategic ends and means, and are related to the how a TMT ponders objective strategic issues like budgeting and price definition.

Managerial Implications

For practitioners, the research reveals some important questions. *First* of all, consensus as an output of TMT strategic decisions seems to be beneficial to firm general performance. However, for firms highly oriented toward R&D activities seeking consensus could be questionable advice. *Second*, the consensus over different issues discussed in strategic decision-making could be more difficult to be achieved than others. Given the competitive nature of firms, it is easy to think that time is a precious resource of a TMT.

The excessive time dedicated to discuss uncertain issues could deny the other strategic issues/priorities to the adequate time to be appreciated, and consequently the quality of general strategic decision negatively affected.

We conclude that higher levels of TMT consensus could be a beneficial state in general terms. However, the TMT time to discuss the whole strategic decision-making must be well distributed in order to provide an adequate effort for the analysis of the TMT regarding all strategic issues. Avoiding spending excessive time in considering uncertain issues (like R&D activities) is a desirable condition.

This is a kind of a guarantee that appropriate decision-making was undertaken, avoiding dangerous rules like 'percentile of the net income' or 'historical investment'. In sum, the excessive time dedicated to discussing uncertain issues could deny the other strategic issues/priorities for adequate time to be appreciated, and consequently the quality of general strategic decision negatively affected.

A suggestion that could be provided from this study for those implicated with managerial decisions is: *access to an advantageous consensus but discussing all strategic decisions with adequate equilibrium*.

Strengths and Weaknesses of the Study

This research is open to charges and criticisms. The consensus streamline is a highly complex issue that merges subjective and objective measures, since it deals with human beings – the TMT. The simplifications used to access empirical experiments limits the extrapolation of findings in a broader way. Other problems that could be added are: (a) the use of students, with limited management capabilities; (b) the origin of these students – Brazil – a country in which the business environment is far from being recognized as R&D driven in a general terms, and which presents multi-cultural aspects that may could bias the results; (c) the control over the experiment that could eventually have introduced biases (such as researcher ones) as unpredicted, missed and/or uncontrollable variable; (d) the consensus measure based on means instead of standard deviations; (e) the

simplistic way by which the firm strategic orientation was characterized in the experiment, by simply using the investment to functional area.

On the other hand, some positive aspects of the experiment could be highlighted: (a) the environment control exerted by the simulation in our study could be utilized to reduce biases, among others, on the variety of industry studies melted in the samples found in previous studies (e.g. Ramos-Gaza 2008; Dess 1987) and which represent distinct strategy orientations as a result of a industry specific behavior (e.g. Bantel and Jackson 1989; Bourgeois and Eisenhardt 1988); (b) the simulated experiment facilitated the control over information provided to the subjects; (c) the experiment also provided a reliable measure of the TMT outputs based on a computational model, that is, the firm's performance depends only on the TMT decision and from a common math model emulated from the management game software; (d) the firms initiated with the same information and same financial and operational statements which facilitates team comparisons (related to experiment control); (e) the use of consensus content measures based on strategic priorities facilitated some analysis by simply being measured over the same limits; (f) the measures were obtained shortly after the decision-making, thus avoiding biases related to the 'reflections after experience'; (g) the simulator limited low and high levels of investments which facilitate comparative analyses concerning R&D; quality and marketing investments; (h) the R&D, quality and marketing investment presented the same industry elasticity over demand, that is, an eventual strategic orientation over one of this issues will not be biased by the computational model in favor of one or the other investment.

Suggestions for Future Studies

Finally, we suggest that new studies should further the discussion on marketing and quality strategic orientation, and additionally consider other orientations like production. We also suggest future multivariante empirical studies addressing TMT characteristics ('upper echelons theory' – Hambrick and Mason 1984; Hambrick 2007), and other aspects derived from uncertainty and risk issues in order to clarify whether these aspects affect the firm orientation and the consensus-performance relationship. Furthermore, future studies must consider more complex models, with more variables and in real conditions, with real TMT and in real firm situations, in order to identify new variables (moderators and mediators) related to firm situations and environments that could influence the relationship.

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THESIS CONCLUSION

On Management Games

From our viewpoint, management games are not a fully comprehended issue among management scientists. We believe that until now management games were not exploited in their full potentiality in research addressing strategic management issues. Notably management games have being used with educational purposes. This kind of use may probably have misled the potential of these games as laboratory experiments in the management research agenda. We believe this research provides theoretical arguments and empirical evidence to seriously consider management games an empirical research instrument.

Several reasons emerge in the literature in order to reject the use of management games. The main one relies on the fact that management games do not represent a real firm environment, that is, the validity of the experiment that uses this kind of method could be seriously contested. We counterbalance this statement by arguing that any laboratory research in any scientific area does not represent a phenomenon in its totality. Pilot plants or prototypes in chemistry, biology, physics, and engineering and so on are always needed in order to contrast the laboratory findings. One aim of laboratory research in these sciences is to reduce the risks of failure and the related costs of implementing and operating expensive scale plants. In other words, in the laboratory experiments researchers try to reduce the uncertain results regarding a proposed technical challenge or designed applied knowledge that will be tested in the field.

In laboratory experiments it is possible to explore how variables behave in a certain controlled environment. On the one hand, the controlled environment provides strengths for the experiment because it allows the testing of several combinations among variables before testing them in a field experiment. On the other hand, it constrains the possibility of measuring other unobserved effects that influence the variable and study their correlation with others variables.

As advocated by some authors, laboratory research can be used to test and generate theories, as a complement to field research. Laboratory research could function in accessing both exploratory and/or validate/confirmatory tests. In an exploratory way, it serves to study variables previously tested in field research and eventually experiment with other formerly untested variables. In this kind of environment it is possible to verify the interaction of several variables with easy access, low cost and from a large sample database. Additionally, in a controlled environment, we could isolate eventual biases or disturbances from the 'real world', thus constituting the main arguments in favor of this kind of research instrument. In confirmatory tests, variables could be tested to reaffirm the findings and eventually provoke theories with critiques concerning the findings. The latter kind of experiment enables the study, for example, of the impact of the inclusion of other variables previously unobserved or ignored in previous field research.

Conversely, the weaknesses of this kind of methodology are: (a) the subjects used in this kind of research are mainly undergraduate students with limited management capacity and MBA students; and (b) the lack of reality (or excess of artificiality) of a management game given the limits in mathematically and

computationally representing the 'complex real world'. Despite these pros and cons, accessing data from the 'real world' –from the TMT in our case – is still a very difficult or perhaps impossible mission.

This research further develops theory by proposing that management games are a valid instrument to access databases for empirical research purposes. The complexity of developing a management game could be partially observed in the second chapter of this research. Mathematically representing a firm functioning and simulating it computationally is challenging for anyone given the complexity of the issue. Concomitantly, adjusting the game for experimental or educational purposes represents another challenge. The definition of the number of variables and their interrelations in the game; the level of information provided to players about the game functioning; the available time for the experiment and class; the issue of research or study; and so on; are some examples of the kind of problems a game designer and the researcher will find. To define an acceptable middle term among all these parameters is the challenge in this discipline.

On Strategic Consensus

We follow this thesis' conclusions presenting the results of two empirical studies related to strategic consensus. These experiments were designed to use a management game primarily developed for this laboratory experiment. As a strategic management research streamline, strategic consensus tries to access the general theoretical suggestion that consensus, as an output of the TMT strategic decision-making, is an efficient predictor of a TMT/firm performance. In other

words, the level of final consensus measured as a level of agreement around strategic decisions represents that the best decision-making were taken, constituting as reliable predictor of firm performance. With the support of management games and following suggestions in the literature, methodological improvements were included in the empirical research. Basically two improvements were used: (a) the sequential measurement (in distinct period of time) of consensus and performance over decision-making made by groups of individuals, in order to test the stability of consensus-performance construct over time; and (b) the use of consensus content measure regarding strategic priorities, that is, resource allocation and firm price policing (definition), of which these measures were considered a more direct and objective issue for discussion for TMT, thus avoiding subjective measures like firm aims (objectives) and ends (strategy). The results empirically indicate that consensus is a stable construct, that is, in general, high TMT consensus around strategic priorities lead to better firm performance.

Following the suggestions in the literature, this thesis presents two other contributions to the consensus issue, the effect of two moderator variables over the relationship consensus-performance: (a) team task-related diversity; and (b) firm strategic orientation toward R&D activities. Both variables were built taking the background of upper-echelons and the resource-based theories into account.

From the first variable, empirical tests reveal that TMT diversity could positively moderate the relationship, that is, the consensus-performance relation is reinforced in the presence of high team task-related diversity. In other words, the

derived high diversity from the necessary knowledge manipulated by the TMT to accomplish a task positively strengthens the consensus-performance relation.

The other moderator variable was built around R&D activities, of which the foundation of this proposition was the uncertain and risky nature of the activity. The results indicate that when in the presence of uncertain issues like R&D activities and their outputs, the effect of consensus-performance could be inverted. That is, the uncertain nature of the issue may corrode the consensus-performance relationship, where the high level of consensus is an unreliable predictor for firms highly oriented toward R&D activities.

General Conclusions

We conclude from this experience that management games are an important empirical research instrument that ought to be at least seriously considered in strategic management research streamline. The challenges to design a game consider the specificities of the research necessities and involves a complex task related to math and computational modeling. We share the ideas of authors who advocate that the combination of field research and laboratory experiments could be an efficient manner to improve theoretical findings, mainly if we consider the natural complexity of business and management phenomena.

Hence, we present two points to reflection:

- *"Why sacrifice Rigour for Relevance?" [1]*

- *"When no simple experiment with all-but-one variable held constant will provide the answers we seek, it will be profitable to simulate the organization."[2]*

[1] p. 213 - Schwenk, C. (1982) "Why Sacrifice Rigour for Relevance? A Proposal for Combining Laboratory and Field Research in Strategic Management". Strategic Management Journal, Vol. 3, Nº 3, pp. 213-225.

[2] p. 547 - Bass, B.M. (1964) "Business Gaming for Organizational Research". Management Science, Vol. 10, Nº 3, pp. 545-556.

APPENDICES

Theses appendices were written in electronic format in the following Compact Disc.

[1] International Multidivisional Industry Simulation – IMIS V1 - Player Manual in Portuguese version.

[2] IMIS V1 – Demo Portuguese version for Microsoft Excel 2002.