Fourth edition

COOPERATION IN COMPLEXITY

Cooplexity, a model for collaboration in complexity in times of uncertainty and change.

RICARDO ZAMORA ENCISO

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To María,

without whose company this journey would be meaningless.

Dear reader,

You are holding the result of ten years' research and five years of gathering data about management behaviour in interdependent environments. By observing the behaviour of managers who have achieved extraordinary results in complex, highly interdependent situations, a proposed model for collaboration has been created: it is called Cooplexity, which relates to cooperation and collaboration in uncertainty and complexity. The model is aimed at developing collaborative teams to maximise the benefit of synergy and thus improve overall performance.

The need for Cooplexity stems from uncertainty, from crisis, from unfamiliarity, and grows along with the complexity of strongly interconnected and interdependent relationships. It adopts a systems and global approach by considering a particular group as a whole, with its own characteristics that are differentiated from the sum of the parts. It pays particular attention to the creation and cohesion of the necessary conditions for the natural and spontaneous appearance of collaboration. However, this is not collaboration understood as surrender and magnanimity, but rather it is collaboration that finds the balance between individual and common benefits, thanks to the generation of new options.

Better teamwork and distributed leadership are direct consequences of the model, which is strongly supported by rigorous research and has used the Synergy business simulator as the main tool. I am in no doubt that, even if you have participated in any of the business simulator courses, you will find this book to be a useful tool for application in your organisation.

I would be delighted to receive any comments or personal experiences that the model evokes, as well as any observations about it being put into practice.

Ricardo Zamora Enciso
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Prologue

This work is motivated by an interest in exploring the concept of teamwork; it has the particular aim of discovering its unique appropriateness in complex situations.

With the increase of globalisation, complexity in managing current organisations has also increased. This has enhanced the need for collaboration between individuals to complement each other and improve their collective results. If isolated individuals are unable to manage a complex environment adequately, such as those which exist now, it will be necessary to find other ways of addressing those situations.

Throughout my professional career, I have had the opportunity of seeing how the necessity for collaboration has been increasing in step with the predisposal and capacity for teamwork within organisations. My first interest, then, stems from the necessity to verify the relationship between complexity and teamwork.

To carry out this study I analysed, over the five years from 2002 to 2007, a series of observations made on the behaviour of 52 groups of managers, from global multinationals and large, internally complex national companies, exhibited while completing the same training course.

The training courses in question revolved around a simulator with numerical results reflecting the actions of each group; this allowed a comparison of behaviours with results.

Given the richness of that data, the second goal of this work was to identify the existence of team evolution phases and check if they could be validated empirically. Initially, I defined an evolution model as a starting point to synthesise the phases through which the groups passed in undertaking the courses. Ultimately this model was adjusted and replaced by the one hereafter called Cooplexity.

The simulator which provided the spine of the training course is called Synergy - a clear allusion to its goal of developing teamwork. I started to develop it in 1997 and finished in 1999 after one and a half years of research, design, and programming. It is important to highlight that initially special interest was placed in the simulator, as well as the training course itself, to reflect an incipient reality - the increase of departmental cross-collaboration and the necessity to have multitasked teams. Therefore, the course and the simulator were specifically designed to reflect reality more faithfully rather than base themselves on previous theory. While I did not know it at the time, that greater faithfulness would be a fundamental part of the success of the course, the origin of the research and the conclusions reflected herein.

Acknowledgements

Firstly, I would like to thank the Dannon Company and especially Alberto Izaguirre for the confidence placed in my capacity for the development of the Synergy simulator which, in later years, would become a fundamental part of this text. Even now, when I review the proposal and the original documents, I am still surprised. Pages and pages describing an idea, through abstract concepts, formulae, and constant references to the Theory of Systems. Even more so when we are talking of 1996 and two further years of development, demonstrating a level of patience that would be unthinkable nowadays, where short-termism imposes itself all too frequently.

With the same sincerity, I would like to thank Dr Alberto Gimeno Sandig[1] for his conceptual contribution about the Theory of Systems and the Theory of Complexity, among others. Without such a contribution, I have no doubt that Synergy would have become just a mere simulator - albeit a magnificent simulator. However, undoubtedly it would have been far from not only the scope of academic reflection it could reach but also the capacity of understanding the reality that can now be inferred and the business projection possibilities of the suggested model.

I would also like to thank the people that participated in the design of Synergy by helping me in interminable weekly meetings for more than a year, and especially Josep Closas Compte from Equus Interactiva, without whose special capacity for landing abstract ideas it would have been impossible to program a tool of such complexity as the Synergy simulator.

Additionally, I would like to thank all those multinational companies that have placed their confidence in the quality of the 'Teamwork in Complex and Uncertain Environments' course given by Training Games. All of them have contributed to its development and evolution. However, for setting the bar so high and stimulating me to make some very significant qualitative jumps, I would like to pay a special tribute (in chronological order) to Agustín Carrasco Eguino from Red Eléctrica de España, Antonio Mateo Navarro from Lafarge Cementos, and David Payeras Bailly from Arbora y Ausonia. Also Miguel Angel García Torrente and Mabel Carabias Costa from the Banco de Santander for the encouragement that made me start writing this text.

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Next, I would like to pay tribute to Joan Manel Batista, Director of the Survey Research Centre of ESADE, for his invaluable assistance with handling statistical data with the necessary rigour and approach to establish a robust final model. In addition, to Manel

[1] Dr Gimeno is professor of Business Policy at ESADE Business School

Peiró Posadas, Academic Vice-Dean of ESADE, who from the beginning has guided me in the approach, structure, and contents of the present work.

Note for the third edition:

I would also like to thank Menno Wielhouwer from Santander Consumer Bank, one of my students at the High-Performance Team Programme, for his generous contribution in revising the text. This valuable and patient work has produced clearer sentences that are more enjoyable to read.

CHAPTER 1.

INTRODUCTION AND GOALS

1.1 Genesis

Everyone knows about the communication, cooperation and coordination problems that can arise in departments with different and apparently contrary goals, such as manufacturing and logistics or marketing and sales, to mention some classic examples. In 1996 Alberto Izaguirre, at that time training director of Dannon España, was looking for a different way to improve collaboration. His goal was to develop an interactive dynamic to achieve better cross-cooperation within the company.

Given its specialisation in creating games and simulators for use in training, the consultancy company Training Games was then invited to present an offer for assistance. It was the motive for the Synergy project which, after one year of design and programming, was proudly presented in November 1997. Six months were necessary to adjust the dynamics generated by the simulation to the training goals. The software was tested, and the contents were developed. In June 1998, a pilot course was carried out, starting a series of 35 training sessions delivered during 1999 and 2000.

The course became a two-day residential seminar during which participants were required to manage projects, make decisions, and invest scarce resources. These projects, sometimes interrelated, generated a dynamic in the group in which the participants interrelated and made decisions together.

After consolidating the course, in 2001, some behaviours were detected as standard in most sessions. Consequently, a process of identifying and standardising those repeated behaviours commenced. A database was designed to gather information, and in January 2002, the observations started to be registered systematically. Five years later, in January 2007, the data collection period closed, with 52 equivalent courses included in the sample. In September 2008, 12 years after the Dannon initiative and ten after the first pilot course, the results of the statistical analysis were provided. One year later, the first edition of the Cooplexity book was published covering all the research and its outcomes.

In 2010, the Cooplexity Institute was established in Oxford (UK) focusing on promoting and disseminating know-how about the Cooplexity model. It also widened the cooperation complexity model to manage interrelations and interdependences under uncertainty and changing environments.

During all these years, modifications have been introduced to both the simulator and the course that shares the Synergy name. Most of them were requested from clients that saw the potential of the training sessions and wanted to explore further the model's operation and analysis.

Along the way Synergy has been conducted in the Spanish, English, Italian and Chinese languages; in American countries, Europe, and Asia; in private and public companies, multinationals; and some business schools.

Currently, it is still a very powerful tool for training and assessment; it is aimed at either large and complex companies or for integration into Business School programmes.

1.2 Objective

The present work has the objective of proposing a model that allows developing teams from a functional (efficiency) and emotional (affiliation) point of view. To accomplish this objective, I will use as a basis the observations taken, over five years, at a training course for managers aimed at developing teamwork in organisations. Through game dynamics based on a simulator called Synergy, the participants make decisions in an initially uncertain and increasingly complex environment. From observing the mentioned actions of the participants, a behaviour pattern is identified.

In Synergy, participants are divided into four groups. Throughout the game, they must interrelate to achieve the proposed objectives. The only way to be successful in an interdependent world is by provoking synergies, thus saving resources that can be used in other projects. This way, the entire group becomes a team that must make decisions together. They must manage many small projects needing simple decisions - but are all are highly inter-related. At the beginning of the simulation, the participants do not even know the most basic rules of the game. Therefore, at the beginning, they are likely to make uncertain decisions that allow the analysis of decision-making and teamwork process from a highly realistic platform.

In a revision of the research carried out in the last ten years, about the effectiveness of teams, the main conclusion is precisely the necessity of accepting complexity in modern organisations and defining the process of team development, interpersonal relationships, structures, leadership and dynamics (Mathieu, Maynard, Rapp, & Gilson, 2008).

In this context, the objectives that this book seeks to achieve are to:

1. Decide up to what point there is a relationship between complexity and teamwork.

2. Identify the existence of phases through which the birth of a team passes.

1.3 Context

Although, later on, I will go deep into certain aspects of the Synergy training course dynamics, its simulator, and the identified observations, I consider it important to have an initial overview that frames the context of the research.

Synergy is a special course. It starts by impeding participants' access to information. If any person is invited by the company to participate, he or she receives only the course objectives, basic information, and logistics. Significantly, at the end of the course, they are asked to sign a confidentiality agreement to protect its content for future participants. This approach maintains the creation of uncertainty regarding events, contents, and the programme. It must be said that the feeling of vulnerability this creates is not to the liking of many participants. In China, there was an attempt to condition participation in the course by eliminating the initial conditions; for a high-level director to face a situation with the absence of control creates an anxiety that is not always acceptable.

Between 12 and 16 persons are invited and, on entering the classroom, they find a game board on a table in front of a computer. Participants are distributed such that their immediate companions are not their usual collaborators; the presentations then start. The course begins around a game board but quickly moves on to interaction with the business simulator.

The entire group is divided into four subgroups. If they all belong to the same company, each subgroup takes the part of a department, area, or affiliate. Each department is identified as a game unit, akin to a player—that way, each 'player' really represents a department formed by 3 or 4 participants. Later, when I refer to individual gameplay, I will be referring to a department as an agent with an independent capacity for making decisions.

For two days, the participants combine playing and reflection in a cyclical manner to improve their knowledge and evolve their relationships. Indeed, the group training activity is divided into cycles, each one of them with a different objective.

Because of the unknown situation, the first cycle analyses the management of uncertainty. Exploration and experimenting provide knowledge in this first phase. The second phase moves on to interrelation; the intensity of those processes - such as communication, cooperation, and coordination - increase as the game cycles progress. At the end, the level of complexity is at its highest, and all participants become interdependent in order to reach the proposed objective.

Acting as an engine, the simulator simply reflects the decisions that the participants make in investing in a group of initiatives or projects that involve sharing scarce resources to obtain a given benefit. The resulting benefit is not necessarily considered as economic

but rather, in a wider sense, the results of decisions are quantified numerically, and thus participants can modify their strategy in the light of the results that they obtain.

As the course evolves, patterns of behaviour appear; even though there are variations between groups, a common denominator is maintained. Thanks to that behaviour, indicators can be identified that (following an observation protocol) have led to the database on which the study has been carried out.

It is especially relevant to note that this database reflects the interactions of approximately 600 directors grouped into the 52 training courses that were subject to the same experience over five years.

The study shows empirically that teamwork as a collaboration activity has significant relevance over obtaining improved results when interdependencies exist. Notwithstanding the use of measurement instruments in qualitative research, observation and the conclusions derived from it are also important.

CHAPTER 2.

TEAMWORK

2.1 Introduction

Preindustrial society was based on skills. A skilled worker became specialised in a production process, covering it from start to finish. They accumulated all the information, gained all the knowledge, and understood all the processes. With this level of ability and experience, they were capable, with time, of reaching higher levels of development. Nevertheless, that level of knowledge and ability was personal and costly to transfer. As a result, the production process was slow and individualised.

Adam Smith ('The Wealth of Nations, 1776') started a process for transforming a society that was characterised by the division of work. Henry Ford refined the Smith concept of dividing work into small repetitive tasks and created the mobile assembly line or the *production line*. He took work to the worker. By dividing it, Ford made work much easier but complicated the process of coordinating people and combining the results to obtain a perfect car. Much later, Alfred Sloan created the prototype of the administrative system. He took control of GM and improved Ford's system by establishing a more global approach, identifying it as *mass production*. Sloan applied the Adam Smith principle of dividing work to include administration. The executives did not need either engineering or manufacturing knowledge; there were specialists to supervise those areas. They needed financial expertise. The new marketing specialists and financial managers added value to the work of the company engineers. Now a person did not do anything more than a portion of the process. Their knowledge was easily obtained, their function was more easily replaced, and the production process was faster and on a greater scale.

Today, in the information and knowledge era, although technology is universally easily obtainable, it is not what makes the difference. The product has little margin because competition has squeezed the production processes so much that solutions have also become common. Mergers, acquisitions, globalisation, and outsourcing have been adequate answers up to now as part of the optimisation process. We have gone from mass products to universal products. In addition, it is that same universality that is now drowning current consumers in their fight for differentiation looking for design, an emotional connection, service, and personal attention. Customers have gained a conscience, become aware of themselves, of their power and the effect of their collective behaviour; companies need to think about how they respond.

This situation stimulates a variety of further processes. Companies focus on their core business, outsourcing all activities that are not part of their primary expertise. Manufacturing, logistics, legal advice, data processing, even human resources, are externalised. The result is what we could call 'the extended company'. The boundaries of companies are blurred and include parts of their suppliers that are now called partners. These partners are really like specialised units of the company that optimise that specialisation with different clients. The bottom line is that this organisation in clusters is the natural consequence of the super-specialisation caused by competition. The truth is that organisation in clusters is also internally reproduced. The difference is that externally it is functional, internally it is project-led.

However, in turn, clusters serve to increase the interrelations of economic agents, complexity, knowledge sharing and universality.

Therefore, if the internal organisation is structured by project and the difference between organisations depends on their capacity to add value for the end-user beyond the product itself, we rapidly turn to a dependence on human teams to achieve results. When machines and standardised processes are no longer capable of adding value to the company offer, the limelight is passed to the people that form it. In fact, we are entering an era where dependence on teams and not on individuals is more and more pronounced. Only multi-disciplined, trained, tightly knit, motivated and coordinated teams can manage the interrelations and complexity that affect the different areas of organisations.

Therefore, it is very important and a top priority to focus attention on the consideration of collaboration (internal and external) as a fundamental part of business success. At this point, it is necessary to develop a model for teams with the qualities necessary to meet today's challenges.

2.2 Teamwork

2.2.1 Groups and teams

The first issue we find is the indistinct use of the terms 'group' and 'team'. In literature, we find this indistinct use on numerous occasions as both terms are used to refer to the same concept. The difference resides more in the origin of the use than in the meaning that each author gives it. Thus, the use of the term 'group' is more widely used among researchers and academics in the context of 'group cohesion', 'group dynamics' or 'group development'. On the other hand, 'team' is used more by those authors linked to organisational behaviour and management in general, when they refer to 'teamwork', 'team-building', 'team effectiveness' or 'high-performance teams'.

2.2.2 Definition of team

When an author wants to differentiate between the simple, general notion of group-like association, as opposed to a more concrete team, they usually refer to the degree of cohesion between its members. Carron and Hausenblas define their study groups as 'two or more individuals with a common identity, with common objectives and goals, that share the same destiny, that show structured interaction patterns and ways of communication. They have common perceptions about the structure of the group, they are personal and instrumentally interdependent, they have reciprocal interpersonal attraction, and they consider themselves as a group' (Carron & Hausenblas, 1998). Therefore, in addition to cohesion, a second important factor appears: the common objective. In his analysis of groups, while referring to the common objective, one of the most relevant figures of the Tavistock Institute, Wilfred Ruprecht Bion, coined the concept of 'Work Group' especially identifying the objective pursued by the group when carrying out specific tasks (Bion, 1991).

The second definition of a team is that offered by Jon Katzenbach who describes it as 'a small number of people with complementary skills, who are committed to a common purpose, performance goals, and approach for which they hold themselves mutually accountable.' (Katzenbach & Smith, 1992). In this case, the common purpose inherent to any group has another added dimension: the shared responsibility.

For this text, I propose the following definition, which has clear contact points with those mentioned previously:

'A team is a small number of interdependent persons who are spontaneously and naturally coordinated, with the motive of a common project, thanks to a feeling of membership resulting from a determined level of cohesion and making decisions based on shared knowledge.'

2.2.3 Origins of the teamwork concept

David Buchanan[2] tells us about the origins of the teamwork concept (Buchanan, 2000). The benefits of an organised collective action had been evident for anybody throughout history, but it was not until the 20th century that teamwork came to the fore as a management technique. The benefits of teamwork were identified in the 1920s by

[2] Related to the subject of teamwork and under the name of David Buchanan we can find several authors. In this case, I refer to the Professor of Organizational Behaviour in the De Montfort University (DMU) Business School in Leicester (http://www.dmu.ac.uk). Do not be confused with David Buchanan, also Professor of Organizational Behaviour but in the Cranfield University School of Management and co-author with Andrzej Huczynski of Organizational Behaviour: an Introductory Text. Neither should he be confused with David Buchanan, Professor of Human Resources Management at Loughborough University Business School, and co-author with Diane Preston of Life in the Cell: Supervision and Teamwork in a Manufacturing Systems Engineering Environment.

investigators from the Industrial Fatigue Research Board to reduce boredom and increase results. The effects of work on morale and productivity are key elements in the findings of the Hawthorne studies (Whitehead, 1938) (Roethlisberger & Dickson, 1939). Frederick W. Taylor was the true father of the model with his 'scientific management'.

Despite the foregoing, the contemporary concept of teamwork appears in the 1950s following the work of assessors from the Tavistock Institute of Human Relations in London. More recently their work has been 'rediscovered' by a number of modern authors, some of whom related to a movement called 'Quality of Working Life (QWL)' in the 1960s and 1970s while in the 1980s another, Richard E. Walton, described the difference between 'control strategy' and 'commitment strategy'. The first, oriented towards control, appears at the beginning of the 20th century in response to the division of work in small fixed tasks. The objective of this traditional model is the establishment of order and exercising a level of control that assures efficiency. The commitment strategy appears towards 1980 in the hands of companies like General Motors, General Foods, and Procter & Gamble, demonstrating the success of trade union cooperation policies. With the commitment strategy, job descriptions are designed to be more comprehensive, combining planning and implementation not only to maintain operations but also improve them. Individual responsibilities change in response to new demands from the job. At that point, the team, rather than the individual, becomes responsible for results. With relatively flat hierarchical structures, minimising differences in status, coordination and control depend on shared objectives, and it is experience and knowledge, more than the formal position held, that determines influence.

Under the commitment strategy, performance expectations are high and serve not to define minimum standards but to provide 'stretch objectives', emphasise continuous improvement, and reflect the requirements of the marketplace. Accordingly, compensation policies reflect less the old formulae of job evaluation than the heightened importance of group achievement, the expanded scope of individual contribution, and the growing concern for such questions of 'equity' such as gain sharing, stock ownership, and profit-sharing (Walton, 1985).

2.2.4 Teamwork characteristics

The students that participated in the courses defined teamwork as the result of a series of qualities or capacities. I summarise their opinions as follows:

Teamwork is:

- Emotional implication
- Linked initiatives
- Shared leadership
- Participated in planning
- Common objective
- Shared information
- Unselfish cooperation
- Coordinated actions

Teamwork is not:

- Pooling
- Sum of interests
- Superficial coordination
- Interchanged or granted information

Teamwork involves:

- Common objective
- Common strategy
- Coordination
- Communication
- Cooperation/willingness to share functions
- Implication
- Balance between common and individual objectives
- Taking advantage of synergies
- Finding synergies
- Diversity
- Wider vision

Teamwork contains:

- Organisation
- Good atmosphere
- Discipline
- Planning
- Confidence
- Communication
- Collaboration
- Cooperation
- Responsibility
- Honesty
- Solidarity
- Self-criticism
- Listening
- Empathy
- Understanding
- Learning
- Interdependence
- Delegation
- Illusion

2.2.5 Teamwork as a competence

The definition of a team starts to become tangible the moment that teamwork is identified as competence and parameters are established for its measurement. The model of competences has its origin in checking that pure intelligence is not a factor that is correlated to good performance in work and success in life. Quite the opposite, the relevant performance should be measured through such competences (McClelland, 1973). Competence at work is defined as 'a subjacent characteristic in a person that is causally related to the effective or higher development in a job' (Boyatzis, 1982). Subjacent characteristic means that competence is profound and permanently associated with the personality and allows predicting behaviours in a wide range of situations and professional tasks. Causally related means that competence causes or predicts behaviour or action.

Competences, as their meaning implies, do not have a universal application. In other words, managing a competence is only relevant to the performance of a specific function in a particular company and environment. That way, therefore, although a series of general competences needed by a waiter can be identified, these are modified and blended according to the environment or the company where the waiter works: the competences needed by a successful waiter in a five-star hotel are not identical to those needed by a typical waiter on a summer terrace at the coast.

Inspired by the works of David C. McClelland and George O. Klemp Jr. and thanks to the efforts of numerous professionals belonging to the staff of the McBer Company, over the years, the methodology called Job Competence Assessment has become the defining basis for human resources management. Identifying the results obtained in different research carried out with the BEI[3] method, Boyatzis found that a series of defining competences for professional success existed independently of the organisational structure; he called them general competences. Based on Boyatzis' success, years later, research was carried out aimed at determining the key competences in employment success. It took the form of a dictionary of competences (Spencer & Spencer, 1993). By including behavioural indicators, each competence ended up being structured around training levels, normally three to six. Each level progressively describes each work competence.

This way, the concept of competence is redefined 'as an underlying characteristic of an individual that is causally related to criterion-referenced effective or superior performance in a job or situation'. Criterion-referenced means that the competence predicts who will do something well or poorly, as measured on a specific criterion or standard (Spencer & Spencer, 1993).

[3] The BEI (Behavioural Event Interview) is a series of interviews carried out on a group of persons that make up the representative sample of 'superstars'.

2.2.6 The teamwork competence

In the dictionary of public competences published by Spencer & Spencer (1993), 'teamwork' is identified as one of the general competences and defined as a 'genuine intention to work cooperatively with others, to be part of a team, to work together as opposed to working separately or competitively' (p 61). The scale of measurement is based on the extent to which an individual promotes teamwork. It is as follows:

A.-1. Uncooperative. Disruptive. Causes trouble.

A.0. Neutral, passive, does not-participate or is not a member of any team.

A.1. Cooperates. Participates willingly, supports team decisions, is a 'good team player', does his or her share of the work.

A.2. Shares information. Keeps people informed and up-to-date about the group's processes, shares all relevant or useful information.

A.3. Expresses positive expectations. Has positive hopes of others. Speaks of team members in positive terms. Shows respect for others' intelligence by appealing to reason.

A.4. Solicits inputs. Genuinely values others' input and expertise, is willing to learn from others (especially subordinates). Solicits ideas and opinions to help form specific decisions or plans. Invites all members of a group to contribute to a process.

A.5. Empowers others. Publicly credits others who have performed well. Encourages and empowers others, makes them feel strong or important.

A.6. Builds the team. Acts to promote a friendly climate, good morale, and cooperation (holds parties and get-togethers, creates symbols of group identity). Protects and promotes group reputation with outsiders.

A.7. Resolves Conflicts. Brings conflict within the team into the open and encourages or facilitates a beneficial conflict resolution (must involve action to resolve the conflict, not to hide or avoid the issue).

Throughout my professional career, I have had the opportunity to access dictionaries from large and multinational companies with diverse definitions of the teamwork competence. A representative example could be that supplied by Red Eléctrica de España in 2003:

Teamwork and Cooperation involve the intention to cooperate and collaborate with others, being a part of a group, working together, as opposed to going it alone or competitively. For this competence to be effective, the intention should be genuine. It can always be considered that the occupant of the position is a member of a group that

functions as a team. 'Team' is widely defined as a group of persons that work with shared processes, tasks, or objectives.

This person:

1. **Cooperates.** Willingly participates in the group, supporting the decisions of the same, being a good 'team player', carrying out its corresponding work. As a member of a team, they keep the other members informed and updated on the matters that affect them (processes, individual actions, or events). Shares all the important or useful information with them.
2. **Expresses positive expectations of the team.** Speaks well about other team members, setting positive expectations regarding their abilities, contributions. Shows respect for the intelligence of others by reasoning with them.
3. **Requests opinions from the rest of the group.** Sincerely values ideas and experience of others, keeping an open mind to learning from others (including their colleagues and people under their responsibility). Requests opinions and ideas from others when making specific decisions or plans. Promotes cooperation in the team.
4. **Encourages and motivates others.** Publicly recognises the merit of group members who have worked well. Encourages and trains others by making them feel strong and important.
5. **Develops team spirit.** Acts to develop a friendly work atmosphere and a good cooperative spirit (holds meetings and creates identity symbols in the group). Resolves conflicts that may arise within the team. Defends the identity and good reputation of the group before third parties.

The key question is whether the person acts to facilitate the performance of the group to which they belong. The behaviour indicators, in this case, will be:

a. Involving others in the questions that could affect them.
b. Assuring that members of the group contribute to a process.
c. Requesting collaboration from those affected by planned activities.
d. Recognising the merit of those who have contributed to the success of a project.
e. Showing interest in treating people correctly and equally.
f. Acting for the development of a teamwork climate and cooperation.
g. Creating identity symbols in the group.
h. Using group meetings or conversations to create group pride or to inspire others.
i. Identifying and promoting solutions that benefit everyone.
j. Working to resolve conflicts or differences of opinion.

Currently, the management of competences is widely practised - not only in the private sector but also in public bodies. Two especially significant, high-quality examples are that published by the Department of the Environment of the Canadian Government[4], or that produced by the National Centre for Evaluation of Higher Education, A.C. de Mexico[5] as a guide for the evaluation test services that it offers to schools, universities, businesses, educational authorities, national professional organisations and other private and government enterprises. These examples are reproduced below.

[4] More information in Environment Canada http://www.on.ec.gc.ca/core-competencies/resourceguide-e.html (consulted in June 2009)

[5] See details in CENEVAL, National Centre of Evaluation for Higher Education http://www.ceneval.edu.mx (consulted in October of 2008).

Department of the Environment of the Canadian Government

Teamwork Competences

Degree	Behaviours
1	**Understanding the Value of Teamwork.** Is able to explain the value of working collaboratively with others. Can articulate own role and role of others in the team, and the contributions to be made. Values the benefits and synergies of communicating and working cooperatively. Supports team decisions. Does fair share of work.
2	**Participating as a Team Member.** Operates as a team member. Participates fully, sharing knowledge and expertise. Willingly takes on additional responsibilities to achieve team objectives. Makes appropriate contact to acquire the right information. Values input of others. Keeps other team members informed and up-to-date. Is willing to learn from others.
3	**Bringing Others Together.** Brings key individuals together as a team, with strengths to achieve objectives or solve problems. Takes initiative in leadership role in area of expertise. Capitalises on individual strengths of team members. Defines for others how the team objectives fit in with the Organisation vision and goals. Acknowledges diverse opinions amongst team members. Works towards consensual solutions. Finds ways to collaborate and exchange ideas. Helps to work through group conflicts.
4	**Enhancing Team Effectiveness.** Encourages members of a team to contribute to a process. Enhances the cohesion of the team. Recognises individuals and teams who have performed well. Protects and promotes the team's reputation. Identifies strengths and weaknesses the in team and makes necessary adjustments. Shares responsibility for achievement of team objectives. Creates an environment that builds diversity and supports multiple perspectives.
5	**Ensuring Alignment.** Promotes alignment of team objectives and priorities to the Organisation's and Department's mission, goals, and values. Is supportive of the wider organisation. Secures commitment of others on the team to objectives to be achieved. Ensures appropriate linkage/partnerships are established and maintained.

Table 1 Teamwork Competences - Canadian Government

National Centre for Evaluation of Higher Education, A.C. de Mexico

Teamwork Competences

Area	Behaviours
1. Helping third parties.	1. Actively participating in achieving team goals. 2. Respectfully listening to their colleague's points of view. 3. Helping other team members that ask for assistance.
2. Interchanging information.	1. Keeping other team members updated about information relevant to their work. 2. Contributing and requesting suggestions from fellow team members about how to resolve problems, achieve the objectives and improve results. 3. Informing their team companions about situations that could potentially affect them.
3. Becoming integrated with achieving objectives.	1. Effectively forming part of teams from different areas and disciplines. 2. Acts considering the impact of their participation in achieving the group objectives.
4. Promoting team collaboration.	1. Promotes cooperation between the members of their team. 2. Urging others to express their opinions and viewpoints to other members of the team. 3. Becoming involved with one or more teams, being influential due to their knowledge, criteria and/or experience.
5. Maintaining harmony within the team.	1. Openly and honestly facing disagreements and conflicts, looking for solutions and consensus that strengthens their team. 2. Facilitating the relationship with other teams resolving conflicts in a beneficial way.
6. Cohesion and team spirit.	1. Generating identity symbols and other actions to favour team cohesion. 2. Establishing criteria and rules that facilitate self-directing of the teams. 3. Even at critical times, with the right attitude and words of encouragement, motivating the members of the team. 4. Building a solid sense of identity, membership of and pride among the members of the team.

Table 2 Teamwork Competences - A.C. de Mexico

Note the commonality in the behaviours identified as essential for the development of teamwork over the years. This fact should not surprise us as it was precisely the basis of the study carried out by Boyatzis and Spencer, and that led to the appearance of general competences.

2.3 Summary

In literature, we very frequently find the terms ‘group’ and ‘team’ being used interchangeably. Nevertheless, when we want to define each term, we describe a group as merely a number of individuals, whereas we see a team as a unit that is conscious of itself. As such, a team will be conscious of itself as an entity as opposed to a sum of its parts.

In line with this concept are those who directly associate the team with cohesion, commitment, involvement, and many other characteristics that make them participants in a common reality.

Teamwork, as a management technique, started to attract attention at the beginning of the 20th century to reduce boredom and increase productivity. However, despite the results of pioneering studies in this field, it was not until the end of the century that large corporations started to implement real policies on teamwork and collaboration.

In 1973, David McClelland introduced the concept of competence that Boyatzis and Spencer & Spencer end up defining as ‘an underlying characteristic of an individual that is causally related to criterion-referenced effective and/or superior performance in a job or situation’. ‘Criterion-referenced’ means that the competence predicts who will do something well or poorly, as measured against specific criteria or a given standard (Spencer & Spencer, 1993).

It was from then on that increasing the value of teamwork and cooperation by identifying a series of general competences, and corresponding scales became widely recognised as one of the key elements of good management practice. Together with others, these competences have been compiled into a dictionary that has been used by thousands of organisations ever since.

CHAPTER 3.

REVIEW OF CURRENT MODELS

3.1 Introduction

Throughout the years, many investigators have centred their studies on both the training dynamics of teams and the characteristics of their members.

In this chapter, I will refer to team development or building models as the same thing. I will aim to identify the level to which they adapt to complexity, thus revealing their degree of proximity to my own research.

Within the current theories of team dynamics, the different development models can be classified according to their approach.

1. Role models.

   These are based on the personal characteristics of team members. See Margerison-McCann (1990) and Meredith Belbin (Belbin, 1981).

2. Phase Models.

   Models based on a sequential succession of different phases of development. See Drexler-Sibbet (Drexler, Sibbet, & Forrester, 1988), Tuckman (1965), (1977), Bennis (Bennis & Shepard, 1956) and Schein (2004).

3. State models.

   The group adopts different states. See the Bion model (Bion, 1991).

For a quick initial analysis of the impact these authors have had on the academic and business world, it would suffice to review the results of a Google Academic[6] search on them. I use this source as a search engine for academic documents due to the relative lack of awareness of some of these models, to amplify the origins or sources of quoted material

The models are organised chronologically, in the table below, based on the date of publication, and not by the frequency with which they are quoted. As an exception, the

[6] Google Academic allows searching a specialized bibliography. It is possible to search many sources including studies revised by specialists, theses, books, summaries and articles from sources such as academic editorials, professional associations, preliminary print deposits and universities.

Schein model has not been included in the table, but it has been analysed; this is because the Schein study theme is on organisational structure and not teamwork. Quotes from it will thus refer to the first theme, the true objective of his study, and not the one in which we are interested.

Author	Work and date of original publication	# quotes
Margerison, C.-McCann, D.	*Team Management: Practical New Approaches*, 1990	31
Drexler, A.B.-Sibbet, D.	*The Team Performance Model*, 1988	19
Belbin, R.M.	*Management Teams. Why They Succeed or Fail*, 1981	699
	Team Roles at Work, 1993	428
Tuckman, B.W.	*Developmental Sequences in Small Groups*, 1965	1,219
	Stages of Small Group Development Revisited, 1977	551
Bion W. R.	*Experiences in Groups*, 1961	608
Bennis W.G.	*A Theory of Group Development*, 1956	355

Table 3 Group Development Models

The Tuckman model has had more impact in the academic world and, by extension, in business. As we can see, though, it is one of the oldest. It will, therefore, be necessary to give it special attention and careful analysis to confirm its validity.

At first glance, it seems reasonable to assume that perhaps the teamwork theme has not received as much attention as other topic areas. But again, a quick look at Google provides clear confirmation: teamwork has 19,500,000 results while leadership has 172,000,000 references. [7]

Significantly, 'up to now, there does not seem to be any theory that handles the theme of team development in sufficient depth as to be useful to those who are interested in creating efficient groups and in actions and beliefs that underlie the appearance of these important cooperation and collaboration processes among the members of a group' (Cannon-Bowers, Tannenbaum, Salas, & Volpe, 1995).

Based on the above, and from an academic point of view, finding an empirically validated, soundly based teamwork model becomes an enormously stimulating challenge.

[7] Consulted in June 2009

3.2 The Margerison-McCann model (1990)

In 1990 Charles Margerison and Dick McCann developed a model called the Team Management Wheel (due to its wheel shape); they classified it as social-psychological (Margerison & McCann, 1990), thereby differentiating it from sociological models, such as those produced by Belbin (1981) and (1993), and from psychological models based on individual differences, as in the Myers-Briggs[8] personality test which is based on theories such as Psychological Types put forward by Carl Gustav Jung (Jung, 1994)[9].

After highlighting the importance and necessity of teamwork in today's increasingly complex organisations, they identify nine basic functions of teamwork that balance those considered as better teams.

- Advising - which relates to obtaining and disseminating information.
- Innovating - the creation of new ideas or new ways of approaching old problems.
- Promoting - persuading others to search new opportunities.
- Developing - once ideas are 'sold' internally.
- Organising - generating a structure so that products, services, or plans can function.
- Producing - as in addressing all the necessary details behind, for example, a manufacturing process.
- Inspecting - to check that relevant details have been handled correctly.
- Maintaining a common working standard.
- Linking - a series of coordinated actions by all team members to ensure maximum cooperation and interchange of ideas, reports, and experiences.

In the initial design, the first eight functions rotate around a circle that contains the ninth (linking). Later we will see how this is a special function.

Having identified basic teamwork functions, the model centres on preferences by asking four key questions:

1. How do people prefer to relate to each other?
2. How do people prefer to obtain and use information?
3. How do people prefer to make decisions?
4. How do people prefer to organise themselves and others?

[8] Isabel Myers and her mother Katharine Cook Bridges formalised the ideas of Carl Jung in a personality test, the Myers-Briggs Type Indicator, capable of combining individual types of personality. There are four dichotomies defined as Extrovert-Introvert, Sensorial-Intuitive, Rational-Emotional and Qualifier-Perceptive in their model that give place to sixteen combinations or categories of different personalities. See Myers-Briggs Foundation at http://www.myersbriggs.org/

[9] Date of original publication: 1921

The influence of Jungian personality dimensions can be seen here by considering opposing preferences in the following four key management areas:

1. Relationships (with a variation between introversion and extroversion).
2. Information management (with a variation between creative and practical).
3. Decision-making (with a variation between belief-based and analytical).
4. Organisation (with a variation between flexible and structured).

Figures 1 to 3 (below) show how these opposing preferences in the four categories build-up to make up the basis of the model, as shown in Figure 4 (below).

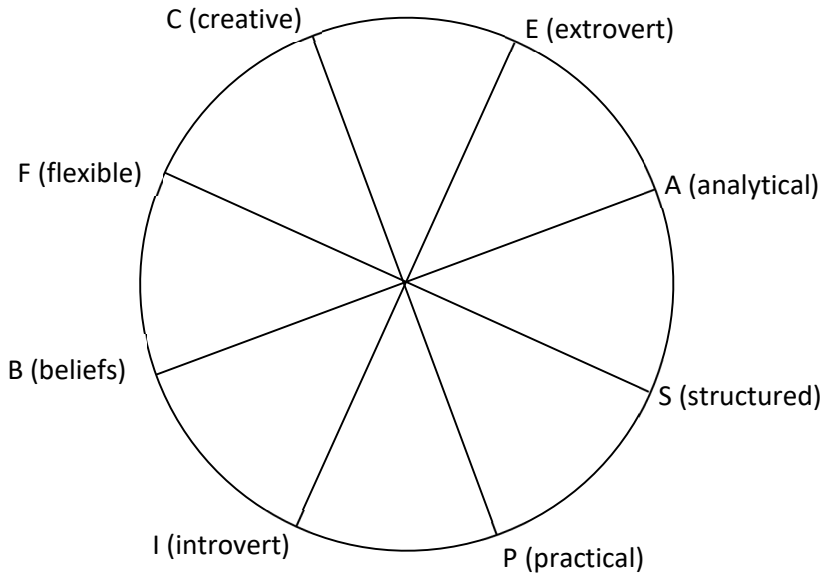

Figure 1 Basis of Margerison-McCann Model

The model builds to include pairs of combinations that define each role in the wheel along with the basic work functions, leaving the Linker function in the centre (Figure 2).

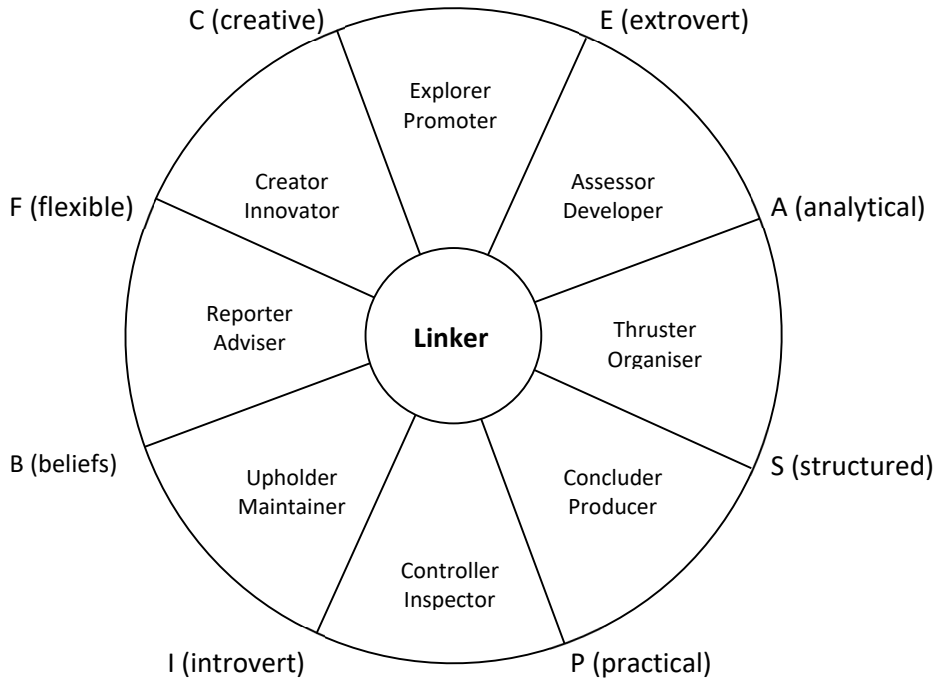

Figure 2 Wheel of Margerison-McCann Model

As a result, we can identify four major activities (Figure 3):

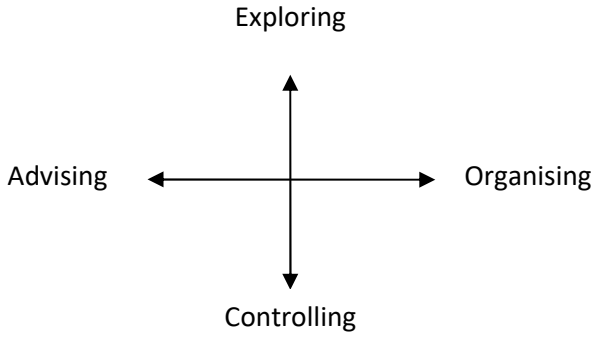

Figure 3 Activities of Margerison-McCann Model

In producing their final model, Margerison and McCann brought together team functions, personal preferences, and work activities, as shown in Figure 4.

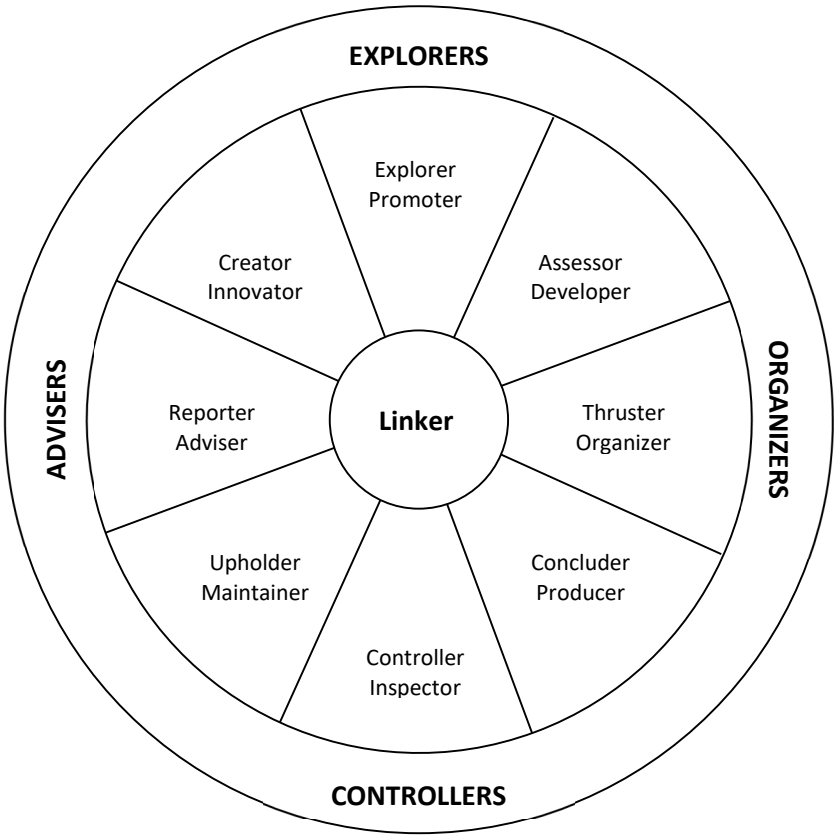

Figure 4 Margerison-McCann Model

The Linker function requires a special mention because of its importance for the group. Connecting is the central function of the model; it should not be considered as a preference but a skill to achieve high-performance teams. Among its duties, we can distinguish between internal, external, and informal connections. The first two refer to the formal roles of the team leader. The internal is the coordination itself while the external would be in the line of group representation. The informal connection, on the other hand, would be the function carried out by group members rather than the leader. These contribute to establishing informal connections between them and to the development of external connections.

From their studies, Margerison and McCann identified 11 key linking skills that encompass internal linking, external linking, and informal linking. These11 skills are:

'Linkers':

1. Listen before deciding.
2. Keep team members up-to-date regularly.
3. Are available and responsive to people's problems.
4. Develop a balanced team.
5. Allocate work to people based on their capabilities.
6. Encourage respect, understanding and trust among team members.
7. Delegate work that is not essential.
8. Set an example and agree on high-quality standards with the team.
9. Set achievable targets for the team but always press them for improved performance.
10. Coordinate and represent team members.
11. Involve team members in the problem-solving of key issues.

It is interesting to see the parallels that exist between some of these skills and the definitions that we have seen of the teamwork competence.

3.3 The Drexler-Sibbet model (1988)

Allan B. Drexler and David Sibbet developed a model which they called the Team Performance Model™ (TPM)[10]. It was based on research by Jack R. Gibb and the theories of the cosmologist Arthur Young. Later, with the help of Russel H. Forrester, they developed a diagnostic instrument based on the Team Performance Model, the Team Performance Inventory. It consisted of a 70-item questionnaire using an agree-disagree format (Drexler, Sibbet, & Forrester, 1988).

Firstly, they defined the characteristics of the group being studied. It is a group that shares common objectives and has members with different educational backgrounds who face an ambiguous situation where different values can conflict. The group needs to choose between different ways of achieving the same objectives, carry out a complex task with a high degree of interdependence and cooperation, and will need high-performance levels to achieve its objectives.

Gibb identified four basic themes relating to social interactions in the development of groups: 'acceptance', relating to creating confidence; 'data flow' relating to the flow of

[10] The Team Performance Model should not be confused with another model developed later by David Sibbet in collaboration with Maryem Le Saget called Stages of Organization (SOO Model). The coincidence of one of the authors and the graphic similarities between models can induce error. The SOO arises from the application of knowledge acquired in the definition of the Team Performance Model, along with influences from other models but this time applied to stages in the evolution of organisations. This model is promoted by the David Sibbet consultancy, The Grove Consultants International, and has been renamed as Sustainable Organizations™ Model and can be found at http://www.grove.com/site/method_pm_som.html (accessed in June 2009).

feelings and perceptions between the individual and the group; 'objective creation' relating to the intrinsic motivation of an individual or the group, thus affecting problem-solving and decision-making processes; and 'control', relating to interpersonal and intrapersonal control and the regulatory mechanisms that have organisational consequences. Gibb discovered that the creation of confidence and acceptance, agreeing on objectives, procedures and timing, and the interchange of information are necessary elements in a group (Gibb, 1964).

Development stages	**Derived mode**	**Symptoms of its non-resolution**	**Symptoms of its resolution**
Acceptance	Association	Fear, distrust	Acceptance, trust
Data flow	Decisions	Caution, false front policy	Spontaneity, feedback process
Goal Formation	Productivity	Apathy, competition between members	Creative work
Control	Organisation	Dependence, counter-dependence	Interdependency, role distribution

Table 4 Main Group Development Stages According to Gibb

In the Team Performance Model, Gibb's work integrates with Young's vision that all the formative processes of all groups move from freedom to constraint, and the evolutionary process is regaining freedom by mastering constraint. As a result, seven states are created (see Table 5 below). Although apparently chronological, the authors warn that they are not; they can all be 'in play' at the same time. Nevertheless, dependence progresses generally through the stages, in such a way that the resolution of themes in one stage allows concentration on those in the next. That said, this dependence is not absolute, and any team can be successful without resolving any of the stages. However, generally speaking, to be successful at one stage increases the probability of succeeding at the next.

A summary of the seven stages is as follows:

Stage	Key question	If resolved	If not resolved
1. Orientation	Why am I here? Do I belong here? Do I want to be here?	Orientation Acceptance Association	Disorientation Anxiety
2. Trust Building	Who are you? What do you expect of me? Can I trust you?	Group trust Spontaneity Information flow	Distrust Caution Front
3. Goal Clarification	What are we doing?	Calls for action Appearance of options Task identification	Apathy Irrelevant competition
4. Decision-making	What to do?	Differentiation of roles Decision-making Commence work	Dependence Distrust
5. Implementation	How can we do it? Who does what, when and where?	Clear sequence Creativity, productive results Disciplined processes	Conflict/confusion Non-alignment Non-fulfilled periods
6. High performance	Wow! [11]	Synergy in action Flows Intuitive communications	Overload Disinterest
7. Renewal	Why continue? Is it worth it?	Renewed commitment Congruence between vision, one's self and the team	Boredom Disconnection

Table 5 Team Performance Model™

[11] State 6 differs from the previous ones in that it does not have an associated theme because (according to the authors) no solution allows achieving the state of true synergy. Its effects, and when they occur, can be felt but are not very predictable.

Although Drexler-Sibbet warn that their stages are not necessarily chronological, the numbering and the graphic sequence they present suggest that they are. In my research, there is a time sequence for the appearance of behaviours.

Drexler-Sibbet State	Observations found
1. Orientation	The group suffers an initial moment of crisis and disorientation accompanied by feelings of vulnerability and anxiety. A process commences for searching out information that gives sense to its activity.
2. Trust Building	The group goes through a very clearly defined moment in which integration and trust-building processes are released. It reaches a level of cohesion that later allows it to obtain significantly better results.
3. Goal Clarification	Once the group has bonded, it establishes action and decision-making criteria allowing members to independently self-coordinate. Nevertheless, it is very important that coordination is decentralised. Definition of objectives, making decisions and implementation are not sufficient; there should also be autonomy of action. To the contrary, in the complex environment reproduced in Synergy, the person or subgroup responsible for the centralised coordination will be overwhelmed, lose vision and centre on the process; this means a bottleneck and slows down the activity of others, condemning them to dependence.
4. Decision-making	
5. Implementation	
6. High Performance	The appearance of team conscience after reaching high cohesion levels is the nearest to this state that, according to the authors, cannot be provoked but can be recognised.
7. Renewal	Does not appear.

Table 6 Comparison of Synergy and the Team Performance Model™

3.4 The Schein model (1985)

In his analysis of organisational culture and leadership, Edgar Schein reflects on group formation. He identifies four stages: Group Formation, Group Building, Group Work and Group Maturity (Schein, 2004). As his analysis is only part of the organisational culture theme that interests him, I will only include a summary here:

Stage	Dominant assumption	Social-economic approach
Group Formation	Dependence: the leader knows what to do.	Self-orientation: emotional approach to inclusion of themes, power and influence, acceptance, intimacy, identity, and role.
Group Building	Fusion: we are a group, we like each other.	Idealisation of the group: emotional approach to harmony, conformity, and search for intimacy. Differences are not valued.
Group Work	Work: we can be effective because we know and accept each other.	Group mission and tasks: Emotional approach to group work, maintaining the group in a well-functioning order. Differences are valued.
Group Maturity	Maturity: we know who we are, what we want and how to obtain it. We should be right because we have been successful.	Group survival and comfort: emotional approach to group preservation and its culture. The differences and creativity of the members are seen as threats.

Table 7 Summary of the Schein Model Stages

3.5 The Belbin model (1981)

3.5.1 Description of the model

Belbin's team role model is based on the balance between the different roles that can exist. Therefore, it is an approximation centred on each member's personal characteristics.

Although this model is the second most important from an academic and business point of view (after that of Tuckman), it addresses a completely different field of investigation to that which is the focus of this work. A deeper consideration of personality opens its own line of research – one that I will not handle here. Nevertheless, given its importance, I should summarise the model.

The R. Meredith Belbin role model arose, to some extent, as a consequence of an accumulation of circumstances that link the Henley Management-Training Programme[12] with the Belbin Business Training and Research Centre in Cambridge and with two games: the Executive Management Exercise, originally, developed by Ben Aston, and its later evolution, Teamopoly. These games act as a repeated observation platform of the workgroup's activity. The relationship existing between different behaviours and the success of the teams at play has been studied for years. The crossing of stereotypes identified by the Cattell Personality Questionnaire, better known as 16PF,[13] allowed relating personal characteristics and team roles. In this way, Belbin initially identifies eight team roles (Belbin, 1981) that in a later revision, he extended to nine (Belbin, 1993).

Belbin distinguishes three types of team roles:

- **Mental roles:**
    - Plant. Creative, imaginative, unorthodox. Resolves difficult problems.
    - Monitor-Evaluator. Serious, non-emotional, perspicacious, strategist. Receives all options. Plays with exactness. Prudent, discreet.
    - Specialist. Is only interested in one thing at a time. Contributes specific knowledge. Dedicated. Acquires knowledge for their own interest.

[12] Henley Business School (http://www.henley.reading.ac.uk/) (consulted in June 2009).

[13] The fifth edition of the 16PF continues measuring the same sixteen primary personality factors identified by Cattell in the 40s although the denomination of the factors adapts more to the contents of the items that make-up the factor. The questionnaire has 185 elements, with three answer alternatives and can be applied to teenagers and adults.

- **Social roles:**
    - Resources Investigator. Extrovert, enthusiast, curious, communicative. Looks for few opportunities. Develops contacts. Capacity for responding to challenges.
    - Coordinator. Mature, confident, self-assured. Promotes decision-making, clarifying the goals to achieve, and is a good delegator. Strong sense of achievement. Is a good director with capacity to treat and accept on their merits all those that have the potential to contribute.
    - Team Worker. Cooperative, peaceful, affable, sensitive, perceptive, diplomatic. Listens and impedes confrontations. Capacity to respond to all people and situations and to promote team spirit.
- **Action Roles:**
    - Shaper. Dynamic, challenges people and works well under pressure. Has the necessary push and courage to overcome obstacles. Willing to question the status quo, inefficiency, complacency, or self-deception fooling.
    - Worker. Disciplined, loyal, conservative, and efficient. Transforms ideas into actions. Organisational capacity, common sense, practical, worker, self-disciplined.
    - Finisher. Meticulous, orderly, painstaking, conscientious, eager. Looks for errors and omissions. Does work in the established time. Perfectionist.

The extent to which a role orients towards the performance of tasks (action roles), the world of ideas (mental roles) or relationships with people (social roles), will obtain a more extreme or less defined positioning. That way, the Plant (ideas), the Completer-Finisher (tasks) and the Team Worker (social) will be extremes while the Coordinator will be more central.

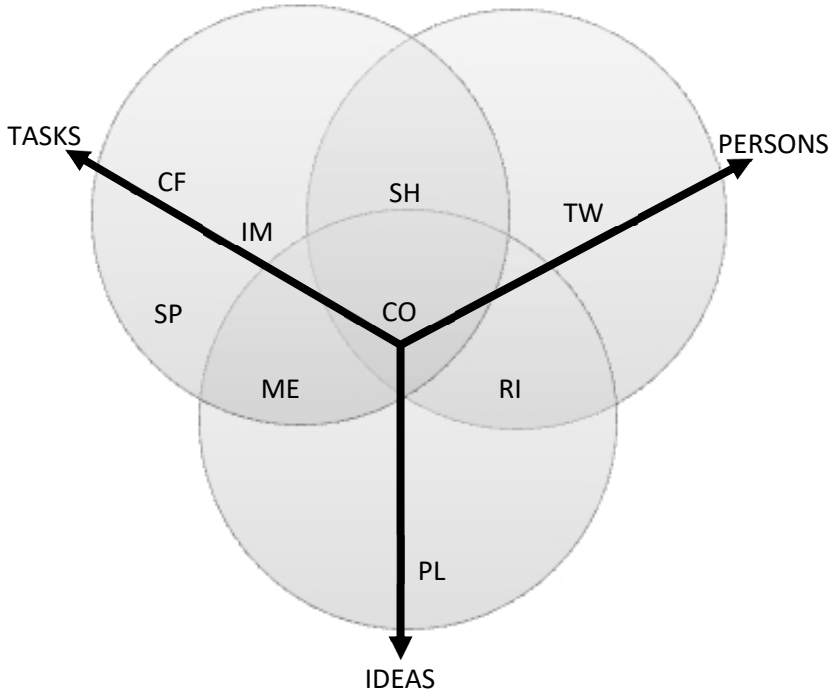

Figure 5 Positioning of the Belbin Roles

Belbin also developed an inventory of self-perception to help identify the role more easily. The following table summarises the characteristics of the different final roles.

3.5.2 Characteristics and functions of team roles

Name	Type or symbol	Characteristics and qualities	Allowed weaknesses	Unallowed weaknesses
Plant	Mental PL	Creative, imaginative, unorthodox. Resolves difficult problems.	Too much interest in ideas leaves functionality to one side and ignores details. Communication difficulties.	Strong 'sense of property' of ideas. Difficulty in cooperation.
Resource Investigator	Social RI	Extrovert, enthusiast, curious, communicative. Looks for new opportunities. Develops contacts. Capacity for responding to challenges.	Prone to losing interest when the initial fascination disappears.	Defrauds the trust of the clients by not following-up agreements.
Coordinator (Originally: President)	Social CO	Mature, confident, self-assured. Promotes decision-making, clarifying the goals to achieve, and is a good delegator. Strong sense of achievement Is a good director with capacity to treat and receive all those that can potentially contribute on their merits and prejudices.	Can be considered as a manipulator. Tendency to offload personal work if they can find someone else to do it.	Assumes all the credit for the team's effort.
Shaper	Action SH	Dynamic, challenges people and works well under pressure. Has the necessary push and courage to overcome obstacles. Willing to question the inertia, the inefficiency, the complacency, or self-fooling.	Tends to provoke and is impatient. Prone to frustration and irritation. Can offend other people's feelings.	Incapable of recovering a situation in good humour or apologising.

Name	Type or symbol	Characteristics and qualities	Allowed weaknesses	Unallowed weaknesses
Monitor-Evaluator	Mental ME	Serious, non-emotional, perspicacious, strategist. Receives all options. Plays with exactness. Prudent, discreet.	Logical scepticism. Does not have the initiative and ability to inspire others.	Illogically cynical.
Team Worker	Social TW	Cooperative, peaceful, affable, sensitive, perceptive, diplomatic. Listens and impedes confrontations. Capacity to respond to all people and situations and to promote team spirit.	Undecided in important situations or moments of crisis.	Avoids situations that can subject him to certain pressure.
Implementer (Originally: Company worker)	Action IM	Disciplined, loyal, conservative, and efficient. Transforms ideas into actions. Organisational capacity, common sense, practical, worker, self-disciplined.	Lacks flexibility, indifferent to untested ideas.	Obstructs the way.
Completer-Finisher	Action CF	Meticulous, orderly, painstaking, conscientious, eager. Looks for errors and omissions. Does the work in the allotted time. Perfectionist.	Tendency to worry excessively about small things, details. Unlikely to delegate.	Obsessive behaviour.
Specialist[14]	Mental SP	Is only interested in one thing at a time. Contributes specific knowledge. Dedicated. Acquires knowledge for their own interest.	Only contribute when it is a subject they know well. They expound on technicalities.	Ignores factors outside of their own field of interest.

Table 8 The Nine Team Roles

[14] New role added in the 1993 revision.

Finally, the fundamental concept of how a person adapts to a team resides in the balance and compensated composition of the roles. Thus, a team with a representation of each role would function better than one with some of them lacking. Nevertheless, it admits that the roles are not absolute, but, rather, there can be mixed manifestations with dominant roles and secondary roles. A manager with poor self-awareness complicates the model because the classification process is based on self-perception. If an individual profile is compared with that of an external observer, we can find ourselves either in a coherent situation (where there is a coincidental agreement between the self-perception and external observation), a discordant situation (non-coincidental) or a confusing situation (where profiles are difficult to classify by both the participant and the observer).

3.6 The Tuckman model (1965)

3.6.1 Description of the model

Without doubt, the model that Bruce Wayne Tuckman (1965) published in an article about the stages of team development[15] is a key reference for the majority of students. Based on his systematic revision of empirical studies, he identified four fundamental phases which, even with some limitations, adequately summarised the relevant process. At all times, studies are related to the interpersonal field and that of the task. Phases are described as:

Forming. From the team development viewpoint, the author defines the first phase as *testing and dependence*. Members discover which behaviours are accepted in the group based on the reactions of a therapist[16] or trainer. They find out, through testing, which are the frontiers of the situation. From the activity development viewpoint, labelled as *orientation to task,* members of the group will try to identify the task in terms of its most relevant parameters and in such a way that the group experience will be used to complement it. The group should decide which type of information it will need and how to obtain it.

Storming. The second phase in the development of the group structure is called *intragroup conflict*. The members of the group become hostile either with each other or towards the trainer or the therapist as an expression of their individuality and resistance to forming the group. The lack of unity is the most outstanding characteristic of this

[15] This article was reprinted in Group Facilitation: A Research and Applications Journal n° 3, 2001 and is available as a Word document at:
http://dennislearningcenter.osu.edu/references/GROUP%20DEV%20ARTICLE.doc (consulted in June 2009).

[16] Tuckman reviewed studies from the therapeutic practice environment, from training to natural groups and laboratory groups. In the first, the objective was to help individuals with their personal problems; in the second, the objective was training; the third existed to carry out some social or professional function and the last were groups especially convened to study a specific phenomenon.

phase. From the task viewpoint, this is labelled as the *emotional response to task demands*. The group has an emotional answer to the task demands and disagrees about the orientation to cover such demands.

Norming. This third phase is called the *development of group cohesion*; the members accept themselves as a group as well as the different idiosyncrasies of its members.

The desire to maintain and perpetuate the group appears, and regulations are established to assure the existence of the group. Harmony acquires maximum importance, and conflicts are avoided to assure it. From the task point of view, this phase is defined as the *open exchange of relevant interpretations*. It takes the shape of a discussion between one's self and the other members of the group.

Performing. The fourth development phase of the group is called *functional role relatedness*. The group has become established as an entity in the previous phase and can now become an instrument for resolving problems. The relationship among members is now consolidated, and they can now accept a role that improves the activities of the group toward the task. From the task point of view, this phase is called the *emergence of solutions*. Here we can see constructive attempts to contribute to the success of the task.

There is an essential link in all the phases between the group structure and the task field. In both areas, the emphasis falls on constructive action, and both go together in such a way that all the energy previously invested in the relational structure later reverts to resolving the task.

Tuckman himself, nevertheless, warns that this classification is conceptual and suggested by analysed studies in such a way that it is subject to posterior confirmation. He expressly cites limitations from the literature that this cannot be considered as completely representative of the development of small groups. He admits that an over-representation of the therapeutic groups and the T-groups was seen in detriment of the natural and laboratory groups.

He also suggests the necessity of working in a more rigorously methodological way, beyond unique observations, to manipulate the independent variables systematically.

Stage	Group Structure	Task Activity
Forming	Tests Dependence Definition of group limits	Orientation to the task Identification of relevant Information Definition of the way of obtaining information
Storming	Conflict Hostility Resistance to forming the group. Disunion	Emotional answer to the task Demands Discrepancies about the direction to be taken
Norming	Common acceptance Appearance of rules Desire to perpetuate the group Harmony	Open discussion
Performing	Definition of functional role	Emergence of solutions

Table 9 The Tuckman Model

Years later, together with Mary Ann Conover Jensen, Tuckman revised his subsequent studies trying to verify his hypothesis, to which he finally added a fifth phase (Tuckman & Jensen, 1977).

The analysed studies (except one) were not trying to prove any previous theoretical model but rather reflecting empirical research. Some of them coincided with the phases of the Tuckman model while others merged some of them, added other new ones or eliminated some. Once again, they were slowed down by the research methodology used, but it seemed reasonable to add later a final phase which was repeatedly documented in many of them. This phase referred to the termination of the group and to the uneasiness produced by its disappearance, having previously developed strong interpersonal feelings. He called this phase **Adjourning**. Once again, he warns about the limitations of adding and the necessity of posterior confirmations.

Tuckman model	Observations found
Forming	At the very beginning of the session, the dependence on the trainer is absolute, given that the group lacks the necessary knowledge to operate. Through questions and experimenting, they will find out the necessary knowledge to start and obtain minimum results.
Storming	Intragroup conflict does not happen in Synergy in a generalised way or as a phase of individual expression. On the contrary, groups that identify the interdependence of their situation easily accept the need to explore ways of collaborating. It is also true that when part of the group advances in this way and another part refuses to maintain their individuality, conflicts of will and interest appear.
Norming	Parallels with the Tuckman phases of regulation in the development process of the cohesion are absolutely clear in Synergy. Participants create rules to identify themselves as a group. The rules and the cohesion are a consequence that emerges from the necessity of uniting efforts. Achieving a common project causes the group to coalesce.
Performing	At the end of the evolving process of the group and when it feels tight-knit, it is normal to see a common search for solutions. Participants spontaneously interchange information; they commonly warn of risks and opportunities and dynamically coordinate themselves.

Table 10 Similarities with the Tuckman model

3.6.2 Developments following the Tuckman model

Based on the Tuckman model, consulting models have been developed that aim to boost the development of groups, fundamentally to make them evolve sequentially towards the last phase. Such models enrich the analysis of each of the phases, incorporating aspects that were not contemplated in the original model. In the same way, they add an optimal way of working both for group members and the leader, according to the development phase. Therefore, they assume the model and all its consequences, including its limitations and, on occasions, obviating that Tuckman's initial intention was that of helping to understand the development of small groups, warning of the necessity for posterior confirmation by means of studies to that effect.

3.6.3 Criticism of the model

Stephen Robbins' (1999) analysis of the model's limitations can be summarised as follows:

> **This is a sequential model.** Many interpreters of the five-phase model have assumed that the group becomes more efficient as it progresses through the first four phases. Although this general premise could be true, what causes a group to become efficient is more complex than the model admits. In certain conditions, high levels of conflict lead to the high-performance of the group. Thus, we could

expect to find situations where groups of the second phase overtake those in phases three or four.

The categorisation of the phases is diffuse. Similarly, groups do not always proceed with clarity from one phase to the next. Sometimes, in fact, several phases coexist at the same time, such as when groups are storming or performing at the same time.

It is a linear model. Groups occasionally, return to previous phases. Therefore, even the most active defenders of this model do not assume that all groups follow the five phases with precision or that phase four is always the preferred one.

It is a decontextualised model. Another problem with the five-phase model, in terms of understanding group behaviour, is that it ignores the organisational context. The contexts supply rules, task definitions, information, and necessary resources to develop the group task. They do not need to develop, plan, assign roles, determine, and distribute resources, resolve conflicts, or establish rules in the way that the five-phase model predicts.

Lastly, it would be fair to question the names that Tuckman used for each one of the phases. Without undermining his success - after all, his model has survived until now - we could charge him with over-simplification. When considering his phase definitions, we see that they are centred on concrete aspects, leaving aside other possible abstract concepts that can be considered in each of them.

Nevertheless, it is only right to credit Tuckman's model properly and the enormous qualitative jump it made towards understanding teams at work.

3.7 The Bion model (1961)

The group behaviour theory of Wilfred Ruprecht Bion, the British psychoanalyst who pioneered work on group dynamics, and his collaborators (H. Bridger, G. Higgin, E. Jaques, E. Miller, A. K. Rice, E. L. Trist and P. M. Turquet) was produced in the Tavistock Institute of Human Relations[17] in London, England, from where it gets its name - the Tavistock method; this method is used in organisational analysis and assessment. Bion's theory originated in observations of groups during and after the Second World War, but the basis of the method also recompiled ideas from psychoanalysis and the Theory of Systems. It started to become known in 1961 when his book *Experiences in Groups* was published.

The method is based on the roles that individuals assume in workgroups, depending on the dynamics generated as a result of authority and leadership relationships. There are three basic assumptions: Dependence, Matching and Fight or Flight (Bion, 1991)[18]. Later, Pierre M. Turquet added a fourth basic assumption: Fusion (Turquet, 1974).

The basic assumptions are unconscious states of the group that can be useful (as they are energisers or de-energisers of the approach to the task). It appears as an unconscious defence against the anxieties generated by the task in question.

Basic Assumption of Dependence. The essential objective of a group is to obtain security and protection from an individual - either the previous leader or whoever takes on that role. The group behaves as if it were stupid, incompetent, or psychotic, in the hope that it will be rescued by a powerful leader that will instruct and direct the group towards achieving its objectives. When the leader fails to achieve these impossible demands, the group expresses its distaste with hostility. The dependence function frequently demands the appearance of a charismatic leader.

The fantasy or false belief contained in the basic supposition of dependence is that it assumes that the leader is more capable than is the case in reality and that followers are more incompetent than they really are. Group members, under the influence of this false

[17] When consulting the Tavistock Institute, one has to distinguish between the Tavistock Clinic, a royal institution of the 20s with an address in Tavistock Square in London, and the private network of professionals that was formed in 1946 with the help of a subsidy from the Rockefeller Foundation. The Tavistock Institute of Human Relations, as it is called, was founded by some of the psychiatrists, psychologists and anthropologists who had worked in the clinic; from there they called it the Tavistock Group. At present, its online headquarters are at http://www.tavinstitute.org/. Bion was commissioned to apply his technique in therapeutic groups from the Professional Committee of the Tavistock Clinic in 1948; he started to publish his experiences from the June 1948 issue of Human Relations, the official publication of the Tavistock Institute (consulted in June 2009).

[18] Date of original publication: 1961

belief, try to avoid the concept of personal authority and refuse to carry out their individual responsibilities. Consequently, the group's task is neglected.

Bion compares this behaviour with religion in which people create or designate a 'God' to guide and lead them. In the basic supposition of dependence, the 'cement' that unites one to another is formed of guilt and depression.

Basic Assumption of Pairing. Under this supposition, two or more members of the group have bonded, are co-aligned and, in searching for support, are distinguished from the rest of the group. This pairing implies that the group unites to save itself from its irrational feelings through the union of two people, groups, or subgroups.

Their behaviour implies that the leader is not fulfilling their task. The group hopes that the pairing believes that something or someone will guide them in a new and better direction. Nevertheless, the most important product of this union is not a capable leader but the hope of salvation that is always pending. Bion called this 'messianic hope' in the sense that the hope only lasts as long as it remains a possibility. As such, the pairing, the leader does not in fact exist; it has not been born. In this case, the messianic hope is the 'cement' that binds them.

Basic Assumption of Fight-Flight. Under this third supposition members of the group appear to be united in fighting for something or in fleeing from something; they behave as if their survival depends on attack (active aggression, physical attack) or on flight (passivity, abandon, routine).

Anyone that mobilises the aggressive or evasive forces of the group is given the leadership of it. However, attempts at being the leader do not last long because the group tends to hesitate between fighting and fleeing, and the different nature of each tendency requires a different leader for each activity.

In flight, members of the group behave as if they were at their working to keep themselves free from change and anxiety. It is a defence against development precisely because progress implies anxiety and change. Leadership in this case usually falls on whoever minimises the importance of the task and allows the group to stay far from the here and now.

In fight and flight, the 'cement' that binds the group is dislike and hate.

Basic Assumption of Fusion. This last assumption, created by Turquet, occurs when members abandon passive participation and unite to become an intense, all-powerful, and animated force that participates actively. They all feel the same, with the same problems, emotions, and limits. They all act as if they agreed what to do and how to do it. The generation of conflict is discarded because conflict is denied. Clearly, this position is unrealistic and unproductive. Leaders that have a philosophical approach to life or offer a high level of integrity become attractive to the group.

Basic assumptions	Overcoming the assumptions
Dependence Hope that the initiative and solutions come from others.	Autonomy The members of the group become responsible for its acts and objectives.
Pairing Forming of pairs or subgroups that have strongly defended the same position or have consistently shown their agreement on something against the rest of the team.	Team spirit The group is tight-knit, and all its members support and motivate each other.
Fight Action or comment against another member of the group or the group itself.	Collaboration Tries to overcome a point jointly.
Flight Refrains from what the group is doing.	Commitment The members of the group accept the interest of the group as their own.
Fusion The group avoids conflict even at the cost of not being productive.	Critical analysis The group accepts constructive criticism.

Table 11 Overcoming the Basic Assumptions of the Tavistock Method

I see large similarities with Schein (see Table 3-5). The basic assumption of dependence in Bion is identical to the dominant assumption of dependence in the first stage of Schein. What Bion called 'pairing' will also be common at Schein's group building stage, 'since the need for love and intimacy that is operating can easily be projected onto those members who display such feelings overtly' (Schein, 2004). Finally, the group work in the third stage of Schein is also common to Bion's definition.

A team that is functioning goes from one supposition to the other in any order according to the circumstances. If the team overcomes these situations, it can become centred on the task and obtain results. For Bion, these states can even invade organisations, being omnipresent although at a more unconscious level than conscious. Some classic examples are the army that feeds on the basic supposition of fight and flight; the religion that is based on dependence (everyone should love, as love resolves all) or the aristocracy and the political system that is founded on pairing (where clusters, lobbies or political parties defend their positions in front of others).

The basic supposition does not have to be destroyed as it gives strength and energy, but neither should it be left to spread until it limits the progress of the organisation (what Bion calls 'invasion of the basic supposition').

Basic assumptions of Bion	Observations found
Dependence	As in the Tuckman model, the basic supposition of dependence that Bion observes is reflected in the first observations of Synergy. The group, uneasy due to uncertainty, searches for security and protection from the trainer.
Pairing	Shortly after beginning the session, proactive behaviours that lead the activity appear. These participants give security to the team, inasmuch that they allow them to feel active and give them the sensation of progress. It is common to see a few people 'pairing' to form an active front that leads the others.
Fight or Flight	This supposition only occurs when the group is not getting results. The group does not admit the evident failure of its action and looks for a responsible person, usually found in the trainer, against whom they become aggressive. If the course is advanced and it is already patent that responsibility for failure is not of the trainer, then the situation becomes similar to the supposition of flight. The group abandons the task and simply lets time pass, waiting for the activity to end. They become irritated with anybody that wants to redirect the situation (including the trainer), and it is impossible to convince them of their responsibility for results.
Fusion	Like in the regulation phase of Tuckman, fusion clearly appears in the cohesion process of the group. They participate, vibrate, and have a strong sense of unity.

Table 12 Similarities in the Basic Assumptions of Bion

3.8 The Bennis model (1956)

Warren Bennis and Herbert Shepard founded this theory based on observations made during a five-year study of a group of students of group dynamics. The main objective of their seminar, which was the context for their research, was the improvement of internal group communication (Bennis & Shepard, 1956).

Firstly, they observed that people could resolve their internal conflicts, mobilise their resources and take intelligent action only if anxiety does not interfere with the use of their experience. Their seminar proposed a state of internal uncertainty that should be resolved in order to evolve. Consequently, they identified two large areas of internal uncertainty: Dependence (relationships with authority) and Interdependence (personal relationships). They called these areas Phase I and Phase II, where each phase has subphases with specific characteristics.

The main body of their theory of group development resided mainly in Phase I or Dependence area, which holds the main obstacles for the development of valid communication (always related to authority).

They also identified a close relationship between group personality and development. People who liked rules and the procedures were called 'dependent' while those to the contrary were called 'counter-dependents'. Similarly, those members that were not happy until having built a certain degree of contact with other members were called 'over-personal', while the opposites were called 'counter-personal'. The very dependent or very over-personal individuals were called 'conflicted'. On the other hand, the non-discrepant or independent persons had a more intermediate situation which was less polarised. These were responsible for most of the advances towards communication.

Each one of the phases, which were linear, has simultaneous subphases with specific characteristics. In the following tables, there is a description of the two phases and subphases in the process of improving group internal communication systems. The tables should be read in order as they are linear, where each column summarises the subphases according to seven common characteristics.

PHASE I DEPENDENCE OF POWER RELATIONS	Subphase I Dependence – submission	Subphase II Counter-dependence	Subphase III Resolution
Emotional Modality	Dependence-Flight.	Counter-dependence - Flight. Off-target fighting among members. Distrust of staff member. Ambivalence.	Pairing. Intense involvement in group tasks.
Content Themes	Discussion of interpersonal problems external to training groups.	Discussion of group organisation, i.e., what degree of structuring device is needed for 'effective' group behaviour?	Discussion and definition of the trainer role.
Dominant Roles (Central Persons)	Assertive, aggressive members with rich previous organisational or social science experience.	Most assertive counter-dependent and dependent members. Withdrawal of less assertive independents and dependents.	Assertive independents.
Group Structure	Organised mainly into multi-subgroups based on members' past experiences.	Two tight sub-cliques consisting of leaders and members, of counter-dependents and dependents.	Group unifies in pursuit of goal and develops internal authority systems.
Group Activity	Self-oriented behaviour reminiscent of their most new social gatherings.	Search for consensus mechanisms: Voting, setting up chairs, search for 'valid' content subjects.	Group members take over leadership roles formerly perceived as held by trainer.
Group Movement Facilitated By:	Staff member abnegation of traditional role of structuring situation, setting up rules of fair play, regulation of participation.	Disenthrallment with staff member coupled with absorption of uncertainty by most assertive counter-dependent and dependent individuals. Subgroups form to ward off anxiety.	Revolt by assertive independents (catalysts) who fuse subgroups into unity by initiating and engineering trainer exit (barometric event).
Main Defences	Projection. Denigration of authority.		Group moves into Phase II.

PHASE II INTERDEPENDENCE PERSONAL RELATIONS	Subphase IV Enchantment	Subphase V Disenchantment	Subphase VI Consensual validation
Emotional Modality	Pairing- Flight. Group becomes a respected icon beyond further analysis.	Fight-Flight. Anxiety Reactions. Distrust and suspicion of various group members.	Pairing, understanding and acceptance.
Content Themes	Discussion of 'group history' and generally salutary aspects of course, group and membership.	Revival of content themes used in Subphase I: What is a group? What are we doing here? What are the goals of the group? What do I have to give up - personally - to belong to this group? (How much intimacy and affection are required?) Invasion of privacy versus the 'group giving'. Setting up proper codes of social behaviour.	Course grading system. Discussion and assessment of member roles.
Dominant Roles (Central Persons)	General distribution of participation for first time. Over-personals have salience.	Most assertive counter-personal and over-personal individuals, with counter-personals especially salient.	Assertive independents.
Group Structure	Solidarity, fusion. High degree of camaraderie and suggestibility. The description of 'group mind' made by Gustave Le Bon applies here[19].	Restructuring of membership into two competing predominant subgroups made up of individuals who share similar attitudes concerning degree of intimacy required in social interaction, i.e. the counter-personal and over-personal groups. The	Diminishing of ties based on personal orientation. Group structure now presumably appropriate to needs of situation based on predominantly substantive rather than emotional orientations.

[19] Charles-Marie-Gustave Le Bon (7 May 1841 – 13 December 1931), was a French sociologist, whose main contribution was the development of the mass behaviour theory. Le Bon explains how the collective mind and the group mind are a species of collective character or spirit that determine its cultural evolution. The collective mind would emerge from the masses, influencing its behaviour in such an unpredictable manner by studying the simple sum of individuals. The behaviour of the masses is based more on emotions than on intellect. The Le Bon theses were used by media investigators to develop propaganda and publicity techniques that would affect the public at large. They were also used by Adolf Hitler to mobilize the masses, based on the manipulation of their emotions and fears.

PHASE II INTERDEPENDENCE PERSONAL RELATIONS	Subphase IV Enchantment	Subphase V Disenchantment	Subphase VI Consensual validation
		personal individuals remain uncommitted but act according to the needs of situation.	Consensus significantly easier on important issues.
Group Activity	Laughter, joking, humour. Planning out-of-class activities such as parties. The institutionalisation of happiness to be accomplished by 'fun' activities. High rate of interaction and participation.	Disparagement of group in a variety of ways: high rate of absenteeism, tardiness, balkiness in initiating total group interaction, frequent statement concerning worthlessness of group, denial of importance of group. Occasional member asking for individuals help finally rejected by the group.	Communication to others of self- system of interpersonal relationships i.e. making conscious to self, and others aware of, conceptual system one uses to predict consequences of personal behaviour. Acceptance of group on reality terms.
Group movement facilitated by:	Independence and achievement attained by trainer-rejection and its concomitant, deriving consensually some effective means for authority and controls (Subphase 3 rebellion bridges gap between Subphases 2 and 4).	Disenchantment of group as a result of fantasied expectations of group life. The perceived threat to self-esteem that further group involvement signifies creates schism of group according to amount of affection and intimacy desired. The counter-personal and over-personal assertive individuals alleviate source of anxiety by disparaging of abrogating further group involvement. Subgroups form to ward off anxiety.	The external realities, group termination and the prescribed need for a course grading system, comprise the barometric event. Led by the personal individuals, the group tests reality and reduces autistic convictions concerning group involvement.
Main Defences	Denial, isolation, intellectualisation, and alienation		

Table 13 Summary of the Bennis Model Phases

Bennis Phases	Observations found
Dependence	Unlike the basic Bion assumption of dependence or the Tuckman formalisation, there is a dependence relationship in the Bennis model that nevertheless adds the characteristic of submission. In Synergy, this aspect also becomes very clear when the trainer, searching for proactive initiatives, does not help the participants, does not give them all the information, and does not support their analysis. In most cases, the reaction is the acceptance of the situation as something unavoidable. Trusting that sooner or later, the trainer will act to help the group and that the initial shock is something considered as 'unavoidable' in the learning process.
Interdependence	When the group accumulates sufficient knowledge about making decisions independently and confidently handling the simulator, then what Bennis identifies as enchantment appears. The trainer continues to give instructions, often key information or even clear clues for action but is not listened to. The group politely waits for them to finish before carrying on with their internal discussion.

Table 14 Similarities with the Bennis model

3.9 Summary

Group dynamics and development processes, as well as the relevant characteristics of the members of a team, have been investigated in several studies. The different development models can be classified according to their approach.

1. **Role models.**
   These are based on the personal characteristics of team members. See Margerison-McCann (1990) and Meredith Belbin (Belbin, 1981).
2. **Phase Models.**
   Models based on a sequential succession of different phases of development. See Drexler-Sibbet (Drexler, Sibbet, & Forrester, 1988), Tuckman (1965), (1977), Bennis (Bennis & Shepard, 1956) and Schein (2004).
3. **State models.**
   The group adopts different states. See the Bion model (Bion, 1991).
   Two models have received more academic and business attention: the Tuckman model of phases and the Belbin model of roles.

In 1965 Bruce Wayne Tuckman published an article in which he defined four fundamental phases in the development of groups. Later, in collaboration with Mary Ann Conover Jensen, he added a fifth.

Forming. Members of the group discover which behaviours are acceptable and both discover and test boundaries.

Storming. Members of the group become hostile with each other as an expression of their individuality and resistance to forming the group.

Norming. The members accept each other as a group at the same time as the different idiosyncrasies of its members.

Performing. The group has become established as an entity in the previous phase and can now become an instrument for resolving problems.

Adjourning. The group terminates with an uneasiness produced by its disappearance after developing strong interpersonal feelings. The other significant model is that of R. Meredith Belbin; it is based on the balance of team composition regarding the different roles that can exist. Therefore, it is an approximation centred on members' personal characteristics.

Belbin distinguishes three types of team roles:

- **Mental roles:** Plant (PL), Monitor-Evaluator (ME) and Specialist (SP).
- **Social roles:** Resources Investigator (RI), Coordinator (CO) and Team Worker (TW).
- **Action roles:** Shaper (SH), Implementer (IM) and Completer-Finisher (CF).

The fundamental concept of how a person adapts to a team resides in the balance and compensation of roles. Thus, a team with a representation of each role would function better than one with some of them lacking.

CHAPTER 4.

THE RESEARCH

4.1 Introduction

In this chapter, we will review the methodology of research, its environment, and the Synergy simulator tool.

The research was carried out by observing managers participating in a training course. A situation of increasing complexity was developed during the course where the managers had to reach pre-determined outcomes. To achieve these results, managers were asked to allocate different types of resources to a variety of pre-selected initiatives and projects. The characteristics of the initiatives and projects and the resultant selection and allocation of resources to them are managed using a special simulator.

Simulation, as an empiric research method, allows recreating an environment equivalent to a real decision-making situation for the manager, provided that the accuracy of the simulated environment is such that it is very close to the reality it represents.

The study sample was composed of 600 managers distributed into groups of an average of 12 participants per each two-day classroom training course. That they were managers, with the majority belonging to large and complex companies, confers more significance to the study, the more so considering the difficulty of having such a resource for such a long time. As a result of the approach, observations covered experience, training, approach, capacity, and habits of the collective that take the same decisions in their organisations.

It is also important to highlight that the observation variables were identified from the behaviour detected as recurrent; this means that managers freely reacted to the proposed environment and not by following a pre-determined study pattern.

4.2 The research methodology

4.2.1 Simulation as a method of empiric research

When applied to research, simulators allow for a more precise measure of behaviour than other laboratory research because decisions are taken in an environment much closer to the organisation. These decisions, or similar ones, are answers that are repeated in time - thus allowing a much more adequate study. Causal relationships

between the environment and the organisation can be determined by the investigator in a way that would be impossible in other types of research. Therefore, three desirable dimensions are maximised from the whole research: the ability to generate from an example; control and precision for the evaluation of behaviours; and the realism of the scenario in which the actors behave (Keys & Wolfe, 1990).

The direct observation model used is also especially useful for the objective of the present work in that it does not imply any hassle, obstruction, or interruption of any type. Participants can operate spontaneously without feeling observed or having to interrupt their relationship processes; this means that the situation is equivalent to a real environment of management team decision-making.

It also has a no less important second advantage. The research is only influenced by the simulation, by the construction of an environment of uncertainty and complexity. The action of the group is absolutely not induced by any preventive measure objective. That is to say, it is a free activity and responds to what reality would be like. From that position a series of recurrent observations that, adequately standardised, categorised, and dimensioned, form the basis for recompiling data. In other words, the data recompilation protocols were built on standardised observations after the identification of recurrent behaviours.

The expected results, therefore, would be a non-biased model as in an interrelation training group (T-group). The task consists of helping participants to interact with each other more productively, less defensively and being conscious of the dynamism generated by the described situation (Tuckman, 1965).

Like the Chinese proverb, the trainer pretended to act like a wise man by teaching without words and guiding without interfering[20].

4.2.2 Sample

The information gathered over the five years is enormously rich. Although we must consider that in this case, unlike that which could happen in other empirical studies, the data collected in the observation of the T-group are subjective, this is because they are not referenced to a single study group. However, the sample is sufficiently homogeneous and with an adequate number of cases, so that its conclusions are accurate enough both quantitatively and qualitatively.

It is important to highlight that all the groups that did the course were independent of each other. Each participant belonged to one and only one of them. There was no interaction or previous knowledge of either the dynamism or the contents.

I made most of the observations personally; in the cases where I did not, they were made following a defined recompilation protocol. Even though the observations were gathered

[20] From the book of Taoist thinking, Dào Dé Jing (道德經)

and compiled over five years, all the groups introduced to the analysis followed the same execution criteria, making sure the dynamics, level of demand and data compilation parameters could be compared to one another over the entire span of research.

In sum, the sample is formed by groups of an average of 12 managers each from 52 different courses. The fact that participants were managers is important as the studies with simulators are usually carried out using students.

Business or organisation	Number of courses	Years	Country
Aguas de Barcelona	5	2004, 2005 and 2006	Spain
Arbora y Ausonia	9	2005, 2006 and 2007	Spain
BBVA	1	2003	Spain
Beiersdorf, S.A.	4	2002	Spain
Capcana	1	2005	Dominican Republic
Ciba Vision	1	2002	Spain
Copo Ibérica	1	2002	Spain
Deutsche Bank	1	2003	Spain
ESADE (open course)	1	2002	Spain
Farma-Lepori (Angelini group)	3	2003	Spain
Lafarge Cementos	8	2004, 2005 and 2006	Spain
Mahou	2	2003	Spain
Medichem	2	2005	Spain
Mútua del Carmen	1	2003	Spain
Puleva	3	2002	Spain
Red Eléctrica de España	7	2002, 2004 and 2006	Spain
Universitat Autónoma de Barcelona	1	2005	Spain
University of Texas Dallas	1	2003	USA

Table 15 Companies Participating in the Research

4.2.3 Measuring instrument

A series of variables were identified (see the Behaviour Indicators Annex) for recompiling data; each one of them defined a concrete behaviour in the game. On occasions, the behaviour happened only once and normally did so in the same cycle (the moment of the game equivalent to a match). Sometimes, however, the behaviour was repeated and prolonged throughout different cycles or was manifest with different degrees of intensity. In all cases, each observation was a different variable that nevertheless could reflect a gradation. Therefore, the observations were of the appear/not appear type. A

database was programmed for systematic recompilation where its existence and moment of appearance were registered.

4.2.4 Method of analysis

Once the recompiling of data was done, each course date, company, participant, and other data were identified as well as the series of behaviours that were seen.

As it was not practical to analyse such a wide series of variables, the dimensionality was reduced by grouping those variables that had the same behaviour in different cycles. Using the Statistical Package for the Social Sciences (SPSS), the Main Categorical Components method was applied through optimal scaling; this method was chosen instead of Factor Analysis because the variables were not continuous - that is to say, they reflect the existence of the observation or, at the most, its degree of intensity. The new series of variables included filtering of those that were not significant. As a result, the derived variables that were a line combination of the originals were now continuous.

According to the initial theoretical model that was expected to be confirmed, the identification of relationships by means of Factor Analysis was carried out, giving place to a final combination of six factors. Each factor was considered subjacent to the variables as these were correlated with each other.

According to the obtained model, the six factors were grouped into pairs, explaining three different dimensions that made up the teamwork multidimensional construct.

Finally, I applied line regression techniques to check the relationship between the variables with the final result of each group.

4.3 The research environment

4.3.1 The course

The teamwork course for managers consists of action over two complete days that, by means of real-time group dynamics and using a game interface in a recreational manner, transports the group to an environment of growing complexity. The group acts by following the processes of making decisions and the integrated organisational guidelines which lead them to a situation of incompetence in the new environment to which they should respond. The dynamics provoke a crisis, which forces participants to reconsider their way of working and understand the cause of their difficulties and their poor answers.

By using a simulator, the attitude of the participants is influenced to promote teamwork, collaboration, cohesion, and a sense of belonging. The method also forces confrontation to an uncertain situation that is constantly changing and full of ambiguities. Searching for results, the group interrelates and takes interdependent decisions.

In this way, the keys and benefits of teamwork are understood as well as the fundamental parameters for its gestation.

4.3.2 The course dynamics

The course starts directly with a traditional board game (counters, cards, and dice) and a business simulator. The entire game is divided into cycles, and these become turns of play. Before each cycle, conceptual content is introduced, and each group plans its own strategy. After each game cycle, the results of the match are printed and analysed; methodological and in-depth conclusions are then obtained. Halfway through the game (in the third of six cycles), the group masters the mechanics and knows the concepts being transmitted.

From here on the group advances in 'technological' knowledge but is not able to respond to the demands 'of the environment' and does not achieve the objectives at play. It is not able to achieve them until it realises that it is not sufficient to work as well related groups, but that it is necessary to cooperate and work in a coordinated manner.

4.3.3 The programme

First day	Second day
9:00 Welcome and introduction Course opening Presentation of the facilitator and participants Introduction and communication of course objectives **10:00 Cycle 1: Getting to know the Synergy simulator** Introduction, basic function mechanisms, objectives Preparation (15 min) Play (15 min) Analysis (15 min) **11:00 Break** **11:15 Cycle 2: becoming aware of the real dimension of Synergy** Conceptual base, advanced function mechanisms, objectives Preparation (20 min) Play (20 min) Analysis (60 min) **13:30 Lunch** **15:00 Cycle 3: Learning game techniques** Conceptual base (cont.), dynamic function mechanisms, objectives Preparation (30 min) Play (30 min) Analysis (30 min) **17:00 Break** **17:15 Cycle 4: Communication** Objective Preparation (40 min) Play (40 min) Analysis (20 min) **19:00 Closure**	**9:00 Opening and presentation** Analysis and revision of previous day. Introduction to complexity (30 min) Objective Preparation (60 min) **10:30 Break** **10:45 Cycle 5: Cooperation** Play (30 min) Analysis (60 min) **12:15 Break** **12:30 Cycle 6: Coordination** Objective Preparation (60 min) **13:30 Lunch** **15:00 Cycle 6: Coordination (cont.)** Last preparation (30 min) Play (30 min) Analysis (30 min) **16:30 Break** **17: Model** Search and selection of information Understanding, implication, and initiative Interaction and communication Cohesion and learning Action and response **18:00 Final conclusion and closure**

Table 16 Synergy Programme

It is worth highlighting that the length of the course, two days, is long enough to allow the appearance of behaviours derived from the dynamics of participant interaction. Usually, studies can be found whose experimental laboratory methodology limits the analysis of group activities to periods of 50 minutes average per session. Those studies do not allow observing determined behaviours that only appear after a long interaction process (Arrow, McGrath, & Berdahl, 2000). In this sense, it overcomes one of the main problems of this type of study.

4.3.4 Behaviour analysis

The series of behaviours seen can be divided into two categories: individual and group (see the Annex Behaviour indicators).

- Individual analysis
  - What behaviours have been seen?
  - How have they affected the group?
  - What attitudes have appeared?
  - What perceptions have been had?
  - How has involvement evolved?
  - How were relationships?
  - How was the communication?

- Group analysis
  - What evolution processes did the group follow?
  - How has it matured?
  - How has it united and why?
  - What repercussion has the cohesion had?
  - How was the group coordinated?

4.4 The research tool

4.4.1 Simulation & Gaming as a research methodology

We define simulation as a 'partial representation of reality, that chooses crucial characteristics from a real situation and makes a replica of them within an environment essentially free from risk allowing the participants to develop their strategies to resolve a determined challenge' (Saunders & Powell, 1998).

We define play/simulation as 'an activity that works, entirely or partially, on the basis of the players' decisions. The simulation is an operative model that has the abstraction and the representation of a larger system' (Tsuchiya & Tsuchiya, 1999).

Therefore, we distinguish between simulation as a representation exercise and play/simulation as a human relational activity that takes the mentioned simulation as an instrument. The subtle difference is of special relevance when play/simulation creates a new shared mental model.

When we talk of play/simulations, we can identify three essential components:

1) A base operative model
2) Human activity
3) Representation at reality scale

As a contrast, the pure game has no representation, and pure simulation has no human activity in the operational model.

A fruit of that human activity is the interchange and modification of the mental models of the individuals. In this regard, Professors Tsuchiya & Tsuchiya indicate:

How can the game or simulation change the mental models that govern us and create a shared mental model beyond the different values, interests and visions or the participants' world? The mechanisms are as follows:

- **Voluntary learning** When we are forced, we learn little because we resist accepting anything new in the mental models that govern us. The elements diverted to simulation and the game encourage us to participate in an experiential learning environment, in a simulated world and to learn voluntarily.
- **Creation of Disorder.** The first step in changing attitudes, beliefs and assumptions is allowing participants to doubt of the validity of the mental models that govern them (Festinger, 1962). The conflict and disorder created by the game/simulation provoke doubts in their minds and reduce resistance to change.
- **Big Picture.** The schematics allow participants to share a holistic view of the matter; this counteracts the narrow perspectives that come from specialisation and provides a model to retain details. When it is understood, the individual mental models of the participants grow. Consequently, the compatibility of its mental models increases, and the creation of shared mental models becomes possible.
- **Understanding.** Time and space compression make experiential learning possible and accelerates the learning process. The game/simulation allows participants to gain experience from the results of their decisions and actions in a short period. In real life, we have fewer opportunities to learn from experience, mainly because the results of our decisions and actions are, usually, beyond our learning horizons. Additionally, accelerated learning processes facilitate more solid learning. As individuals, we rarely notice that certain problems can only be corrected by altering the mental models that govern us. Nevertheless, when we find this incorrect pairing, our mental models are affected and altered, although

the change is imperceptibly small. Game/simulation allows participants to experiment many cycles and therefore, the accumulation of these small changes make them visible, resulting in improved training.

- **Risk-free Environment.** Game/simulation allows participants to experiment with new policies, strategies, and learning attitudes without any risk of the irreversible actions that happen in real life. That risk-free environment of game/simulation expands the variety of experiences that make sense to participants.
- **Shared Experience.** Through shared experience in game/simulation, the individual mental models of participants converge and, consequently, the commensurability increases, which is essential for the creation of a shared mental model.
- **Rich Interpretation of History.** Our understanding of past experience, or 'history', through game/simulation allows us to learn from small episodes of real life. These small pieces of experience are used to build a theory of history, from which a variety of unrealised but possible additional scenarios are generated. The rich interpretation of history facilitates experiential learning.
- **Causal Maps.** Uncertainty and ambiguity in the real world hinder experiential learning because they make it difficult to find meanings or explanations. The causal maps developed through participating in game/simulation help participants to interpret and project, thus making sense of the experience.

4.4.2 Using simulators in training

Since Peter Senge wrote 'The Fifth Discipline' (Senge, 1990) and helped the diffusion of the systems concept[21], its application to social systems has become more and more clear and evident. It would be impossible to try to understand and manage a world of increasing complexity that is constantly changing and, each time, becoming more interrelated, with a partial, simple, or uni-disciplinary approach. In 1961 Jay Forrester of the MIT introduced the concept of system dynamics applied to mediation (Forrester, 1961). Computer tools developed since then facilitate the creation of these causal models.

New training disciplines, based on gaming/simulation, are capable of dramatically using the development of explanatory models through Systems Dynamics. They are based on Systems Thinking of social and economic reality, using all the possibilities of new technologies to develop business simulators, capable of being used in higher training dynamics, both at universities as well as in organisations. The result is experiential

[21] A system is a group of interacting, interrelated, or interdependent components that form a complex and unified whole. Nevertheless, a system is more than the sum of its parts; it is the product of its interactions (Kauffman, 1980).

learning that combines cognition with emotion, allowing the participant to understand and integrate complex, dynamic contexts.

Experiential learning that allows gaming/simulation favours the change of necessary mental schemes for learning and organisational evolution.

4.4.3 Simulation & Gaming and systems dynamics

In the conference 'Designing the future' that Jay W. Forrester held in the University of Sevilla on 15 December 1998, he defined systems dynamics simply when he said: 'During the past 30 years I have been developing a field known as systems dynamics. The systems dynamics combines theory, methods and philosophy to analyse the behaviour of systems', 'systems dynamics uses concepts of the field of feedback control to organise information in a computer-based simulation model... the resulting simulation reveals implications of system behaviour represented by the model.'

Therefore, there are three basic concepts for understanding systems dynamics: the contents of the system, the model concept, and the computer-based simulation concept.

Complex systems have a behaviour that can, in many cases, be precisely opposed to that which intuitively could be expected. Forrester denominates this behaviour as counterintuitive.

4.4.4 Simulation & Gaming and complex environments

Game/simulations unite knowledge of scientific disciplines and try to make complex realities understandable. They allow breaking organisational, rigid, rigorously hierarchical social ways to create responsible groups, allowing the development of flexibility, dialogue and creativity, emphasising personal initiative, favouring self-organisation of groups and a communication model based on the competence of systems (Kriz & Rizzi, 1998).

Throughout history, many studies have demonstrated the appropriateness of discipline in games/simulators for understanding systems. In his doctoral dissertation research, Willy Kriz analyses 125 persons using a series of tests to discover, among other things, knowledge, personalities, interests, and interaction style. Some months earlier, some of these persons had participated in a training programme for the competence of systems based on simulation and games. The difference between one and the other was that those who had participated in the earlier session faced the risk and uncertain situations better in their second session. They promoted more sustainable use of resources, created communication structures and more efficient workgroups, and were more interested in the development of the group and the cooperative relationships between its members. They also proposed a discussion, a definition of roles and a more detailed work share. Finally, they developed solutions to improve the entire process (Kriz & Rizzi, 1998).

Game/simulation has the potential of offering a quasi-realism regarding the performance of a system and its dynamic interactions (Arrow, McGrath & Berdahl, 2000). In this sense, the key features of a good simulator for the study of groups such as dynamic systems are that:

- Individuals act within a context that is psychologically very similar to the context of the real-life reference system in which the members will act.
- The context is structured in such a way that particular actions tend to be similar to those that are a consequence of the same actions in real-life reference systems.
- Activities have meaningful consequences for participants.
- Simulation is over a long period, such that the system operates, which means that the dynamic processes develop as if they were in a real-life reference system.

4.4.5 The Synergy simulator

The training course is conducted by a simulation called Synergy. Synergy is a simulator that allows participants, cyclically, first to receive instructions about the use of the simulator, prepare the game cycle in question, play, obtain reports and finally to analyse together with the teacher, the results, dynamics, academic references and their extrapolation to real life.

Here I distinguish between first, second and third-generation game/simulators. The first ones are standard games, complementary to a training action and strengthening concepts. Their structure is simple, and usually, they close a course or make a concrete activity more exciting. Among them, we find many board games that we would buy to spend some time with friends. The second group has its own meaning in that they allow identifying concepts and are used for analysing them after the activity. They mean the central core of a description exercise and conceptual identification. There are games for training in leadership, communication and negotiation that respond to this category. The games in the third category are the centre of an activity that has the objective of integrating knowledge, abilities, or concepts. They imply experience and application in an environment equivalent to real life. Business and behaviour simulators are the clearest references.

Synergy is truly an unusual simulator. We can identify it as a behavioural simulator. Closely linked to business simulations, behavioural simulations emerged in the sixties in the USA. Contrary to business simulators, with their focus on economic theory, this type of game pays special attention to learning about organisational behaviour, organisational design, change, development, and management. They simulate the many aspects of organisational life such as the development of work teams, informal groups, organisational differentiation and integration, leadership, organisational conflict, information processing systems and politics (Klabbers, 2006).

Compared with a traditional system, its difference could be defined superficially as:

	Behavioural simulation	Business simulation
Representativeness	They represent an open manner situation	They represent a real measured or to scale model
Main activity of the participant	Relationships and concepts	Analysis and procedures
Group of possible observations	Open	Closed
Number of decisions	Many	Few
Time available for making decisions	Instantaneous or little	Medium to high
Decision-making speed	High	Low
Individual importance of decisions	Low	High

Table 17 Differences Between a Behavioural and a Business Simulation

Synergy presents a series of interrelated projects that should be managed in an environment of scarce resources. The interdependencies mean that 'how' they are managed becomes more important than 'what' they manage.

In this sense, it would be nearer the concept of micro-world understanding as a learning instrument. One of the pioneers of artificial intelligence, Seymour Papert[22] (who was a scientist, mathematician and educator), related the concept of micro-world with the theories of learning and computers, understanding it as a small portion of reality and, an explorable environment that can be manipulated. Therefore, it is not a simulated world but rather a real-world where learning is completely built through intuitional, formal experiences (Papert, 1987)[23].

[22] Papert was a collaborator of Jean Piaget in the 60s, also cited here, who had influence in his ideas about experiential learning. Piaget was considered as one of the pioneers of constructivism in the learning environment and education. Nevertheless, Papert's model (confusingly called 'constructionist' about self-design and self-construction of the meaning, applicable to learning by games, programs and computer robots), differs from the widely accepted conception of constructionism (Kafai and Resnick cited by Munné, 1999) which is more oriented towards social and political psychology.

[23] A preview is available on-line in Google Books.

Other authors emphasise the importance of relationships when they define a micro-world as 'an atmosphere in which students manipulate and control several parameters to explore their relations. The most complex micro-worlds are expandable, allowing the student creativity to personalise and extend the atmosphere of the micro-world' (Flake, McClintock, & Turner, 1990). In the exploration of a micro-world, participants have the opportunity to experiment, putting their ideas into practice, proposing and testing hypotheses by using a language and teamwork as an opportunity for interaction that enriches the educational experience.

Thus, Synergy alone does not represent any business model, any market, or any company situation. Participants do not dedicate most of their time to calculating the contents of their decisions, but to the implication that the same process has of making the mentioned decisions. The relationships that are built between them, the way they act, the way they communicate, their level of personal implication - in other words, their behaviour -, will be what truly differentiates one team from another.

4.5 Summary

Nearly 600 managers that attended the 52 sessions of the training course called Synergy between 2002 and 2006 were chosen as a sample for a behaviour study. By using a simulator that recreates an increasingly complex environment, activities, interactions and group reflections were analysed.

The use of a simulator in the study allows recreating a quasi-real situation, capable of faithfully reflecting the performance of the reference reality, its dynamics, and its interactions.

Nevertheless, the simulator used in this case is of the so-called behavioural type, whose objective is not analysing a scaled real measured model but learning through organisational behaviour. That way, we would also be distinguishing between simulation as an abstract operative model from a larger system and game/simulation like human activity. By including the game as a human activity of relationships, game/simulation will include the simulator as an instrument of something much more important: the relationship activity. Pure gaming will not have representation, and pure simulation will not have human activity in the operative model.

With the Synergy simulator as an instrument and relational activity of dynamic play, the group interacts showing identifiable behaviours. The conclusions of this work are based on the study of these behaviours.

CHAPTER 5.

KNOWLEDGE

5.1 Introduction

The participants arrive at the course, and they find a table with a board game on it, where there are cards, dice, and pawns. At the end of the table, there is another series of smaller tables forming a 'U' with a trainer in the middle, surrounded by machines, a computer, a printer, a display board (in the original version), a digital clock and papers. We are going to have fun; they exclaim 'this is like Monopoly, great!' After a short while, they receive a series of complete instructions - but these are meaningless to them. 'It seems easy, come on, let's play!'

This would be the most frequent description of what managers find when they attend a teamwork training course with the Synergy simulator. After a short while they will see it is not as simple as it might appear for a game, nor so easy, and neither similar to analogue experiences that they may have had.

The information received is incomplete, not sufficiently clear, and not including the necessary guidance for it to be understood. The game that seemed obvious results in leading them to situations of failure, becoming frustrated and giving an unpleasant experience. They simply do not understand the simulator at all; they know neither how to operate it nor what they should do to control it. Their knowledge about games is not helpful, and precisely those preconceived mental patterns are the ones that block new learning. They have gone from a feeling of control and security to one of anxiety and vulnerability. The uncertainty caused by the new experience results in a crisis situation.

From the very beginning, there is a complete process of learning that tries to resolve the proposed scenario; it starts when they enter and does not finish until they leave. Nevertheless, there is a clearly identifiable period in which participants are trained to address the challenges created by the simulator. From the six subdivisions of cycles in the training course, this period coincides with the first and second; here they allocate the majority of time to obtaining information, making decisions based on it, controlling the evolution of the game, comparing and obtaining feedback from created hypotheses. All these actions, the ultimate aim of which is to provide learning, I categorise as 'proactivity oriented to results.'

Some groups stop here, generating an experience from what they learn. However, others go beyond and try to create a relationship between group members. Remember that

each course has about 12 managers grouped into four departments. Therefore, it is very easy to concentrate on one's own department and not cooperate with others until the course is well advanced and interrelating becomes a necessity. On the other hand, those groups that initiate relationships from the outset are later found to be more capable of developing and consolidating those relations. Indeed, rapid and fruitful progress largely depends on this. I call this relationship 'attitude Proactivity oriented to relationships', and it has three fundamental functions: interest in the task of others; the interchange of information, and the intent of having common experiences.

5.2 Observation variables

The first activity in the groups is always the acquisition of sufficient knowledge to allow them to gain a basic understanding of the environment. In this sense, the observations I make of the participants have two orientations, one toward obtaining results and the other toward building relationships.

1) Obtaining results. This consists of acquiring data by requesting more information and the clarification of that already received in making action decisions and in controlling results. I call this 'variable Proactivity of results'.
2) Building relationships. This consists of an interest in the task of others, the interchange and joint analysis of information and the intent of building relationships and sharing experiences. I call this variable 'Proactivity to relationships'.

The result of this proactive attitude in the atmosphere of uncertainty created at the beginning of the simulation is the acquisition of knowledge. Everything occurs at an individual level where we understand the individual not as a person but rather as an agent with an independent capacity to make decisions. Extrapolating this to reality, an agent could be a person, a department, or an area of the organisation as long as it acts as a sole agent making decisions in a larger system. In fact, the simulation understands the individual as a subdivision of the group. If the group is the 12 participants, the subdivision is the three that form a department, and thus there are four in the group.

5.3 Knowledge and learning

5.3.1 Knowledge

'Where is the Life we have lost in living?
Where is the wisdom we have lost in knowledge?
Where is the knowledge we have lost in information?'
(T.S. Eliot. 'The Rock', Faber & Faber 1934)

With this simple poem, T.S. Eliot could not have anticipated the discussion that later extended his poetic lines to the hierarchy of knowledge. It suggests a relationship, a hierarchy, a chain: information, knowledge, and wisdom. Later, some authors reworked this possible hierarchy, especially in the fields of Knowledge Management and Information Science[24] by adding data at the base of the pyramid. Among them, Russell Ackoff is probably the one who most helps the generalisation of what is already known as the knowledge pyramid.

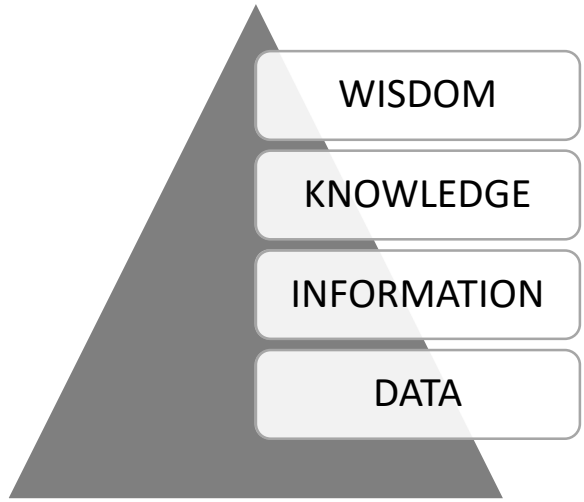

Figure 6 The Knowledge Pyramid (DIKW)

Nevertheless, Ackoff adds another division: understanding. His hierarchy is as follows: Data - Information - Knowledge - Understanding – Wisdom (Ackoff, 1989).

[24] The first reference appears in an article in the Futurist from Harlan Cleveland in 1982 ('Information as Resource', The Futurist, December 1982, pages 34 to 39). Later cited by Milan Zeleny in 1987 ('Management Support Systems: Towards Integrated Knowledge Management', Human System Management, 7, 1987, 1, pages 59 to 70).

Data. This is gross data. It simply exists; it does not mean anything. 07012008 is data that can have many meanings: a birthday, the serial number of an electrical device or a manufacturing lot.

Information. Information is data to which meaning has been given through a relationship. If the number 07012008 appears on the label of some food after the text 'Best Before:', we know it is the expiry date.

Knowledge. Knowledge is the adequate selection of information; it is relevant information. The list of Goth Kings is information; we know what those names mean, but it is not knowledge in that can be considered as useful. The choice of whether to cook food or not, considering its expiry date, is knowledge. Knowledge answers the 'who?', 'what?', 'where?' or 'why?' type questions.

Understanding. Understanding is a cognitive and analytical process through which new knowledge can be obtained based on that already existing. The expiry date on yoghurt does not mean that the product is in bad condition as soon as it is reached. It only means that its organoleptic characteristics vary due to the action of bacteria that remain active in the product, conferring it with beneficial probiotic properties. Its flavour changes, becoming more acid, which means it may be better used in certain recipes. Understanding answers 'why?' type questions.

Wisdom. Wisdom extrapolates; it is a non-deterministic, non-probabilistic process. Different to previous categories it not only works with the past but also orients to the future, incorporating vision and design. Wisdom allows the human being to discern and to judge. It is a state that requires having a certain spirit that a machine could never have. In our example, a great chef can sense the right combination of ingredients to make the best use of their individual characteristics, thus creating something different, which is more than a mere mixture of flavours.

Nevertheless, the strict differentiation between the categories has generated confusion as they have been interpreted differently by different authors. Davenport and Prusak pinpointed 'understanding is not data, nor information despite it being related to both and the differences between these terms is frequently a degree problem' (Davenport & Prusak, 2001). Without pretending to give a rigorous experiential definition, these authors define knowledge as:

> '…a fluid mixture of structured experience, values, contextual information and expert internationalisation that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the mind of the knower. In organisations, frequently it is not only in documents or databases but also in routines, processes, practices and institutional standards.'

With this in mind, Michael Polanyi (1967) classified human knowledge into two categories: tacit and explicit knowledge. Tacit knowledge is that which cannot easily be expressed with any type of language. Explicit knowledge refers to knowledge that can be expressed by words, drawings, or any other type of articulated mechanism.

Others identify understanding not as a category but rather as one of the pivots that, together with the context, allow progressing from data to wisdom.

On 20 March 2007, at the International Risk Assessment & Horizon Scanning Symposium organised by the Centre of Excellence for National Security and held in Singapore's Shangri-La hotel, John Poindexter [25] introduced the technological section. In his presentation, he used an evolution of the DIKW model. I got to know the model in September 2008, during the accreditation course as a Cognitive Edge practitioner. Professor Dave Snowden[26], who had also participated in the symposium, presented it to us in relation to his sense-making studies. Once I understood it, I was able to identify parallels with some of the observations that I had made in Synergy.

The model uses the first three categories of the pyramid: Data, Information and Knowledge. The data are a non-structured mass to which we apply structure and interpretation, putting it into context through analysis; this is something that I detect in my groups and which specifically refers to the 'Obtaining data' variable. Information becomes knowledge by making it meaningful. This process is parallel to the second cycle of the Synergy simulator in which participants learn to handle it; that coincides with passing from the individual level of knowledge to group cohesion. Knowledge opens up a complete set of possibilities, of options. These options are determined using a path-finding process that presents different levels of risk, opportunities, and threats. From the execution of one or more options, we obtain actions that generate new data that iterates the model. There are two interesting factors in this new vision of the DIKW. One is the orientation to action that makes the model a useful instrument and the other, more importantly, is that which defines a learning model through an experiential loop.

[25] John Poindexter was director of the Information Awareness Office (IAO), an official body of the Defence Advanced Research Projects Agency (DARPA), from December 2002 to August 2003. Originally, the name of the department was simply Advanced Research Projects Agency (ARPA), and it was created in 1958 as an answer to the Soviet Union's launch of Sputnik in 1957. One of its key development areas was the processing of information, from which they developed projects like ARPANET, the first information transmission network by packets - the predecessor of the present Internet.

[26] Dave Snowden is particularly known for his Cynefin Framework cited in this work.

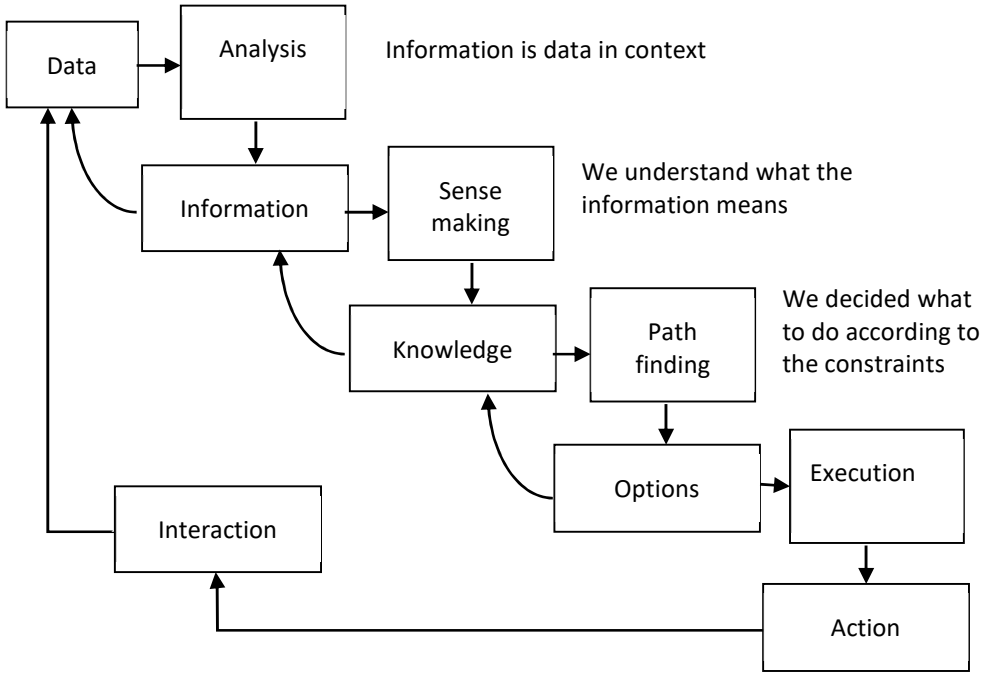

Figure 7 The John Poindexter Model

5.3.2 Learning

In the summer of 1971, Charles Argyris and Donald Schön participated in a programme for helping students to be more effective. Previously they had been centred on themes regarding the effective performance of consultants and building theories that affected the practice (as opposed to the theory); this strengthened their commitment to integrating theory and practice, and they started to consider which skills would be necessary. After a while, the necessary programmes for developing capacities became more and more extensive, and those capacities were only slightly different from what could be intervention strategies. That was how they first started to talk about the theory of intervention, and finally, the theory of action, to replace the terms 'capacities' or 'strategies' (Argyris & Schön, 1974).

We can understand theories of action as those mechanisms we use to link our thoughts with our actions. In their work, they distinguish between espoused theories and theories-in-use. The first theories are used to describe and justify our behaviour, while the second are those we put into practice.

Occasionally the theory that really governs our actions is not congruent with that which we show to explain them. The lack of congruence between both can precipitate the search for a modification of any of them in an attempt to integrate our actions with our beliefs. Nevertheless, the congruence itself is not necessarily positive as it will depend

on the sense it has. Thus, a shown theory which is congruent with an inadequate theory in use is less valid than an adequately shown theory with an inadequate theory in use as this incongruence can discover and supply a stimulus for change. An example to help understand this would be that it is worse to reason and explain a racist decision or act (congruence) than to present one's self as a non-racist racist and later take racist decisions (incongruence). It is possible to learn from this second situation.

A theory I use is effective when it tends to achieve governing variables, which are understood as those variables that we try to keep within an acceptable value range. They can be objectives to meet, beliefs to defend, or values. Argyris & Schön initially speak of governing variables, but Argyris later indistinctively uses the terms governing variable and governing value (Argyris, 1982).

In their analysis of the elements of the Argyris and Schön model Bob Dick and Tim Dalmau propose that it is better to observe them as a mixture of motives, values, beliefs and feelings, depending on the specific mix of the person, the situation and the context. (Dick & Dalmau, 2000). The work of these authors somehow evolved in parallel, around what they described as the information chain that gives sense to relationships and the information necessary to resolve difficulties.

The information chain of a person produces, through their actions, certain consequences, or results that on many occasions awaken strong emotions that can be resolved using specific techniques. Nevertheless, these techniques are frequently only partially effective or only effective in the short-term due to possible hidden intentions that may exist. It is much more effective to act on the opinions and beliefs that each person has about the other (although people are averse to describing them honestly).

However, there are added difficulties. Firstly, we are not good observers of ourselves, of our own behaviour. Secondly, we tend to judge our behaviour by our intentions and that of others by their actions. As a result, the chain has the following key elements:

Actions >> results >> beliefs >> feelings >> intentions >>

The equivalences of both theories would be:

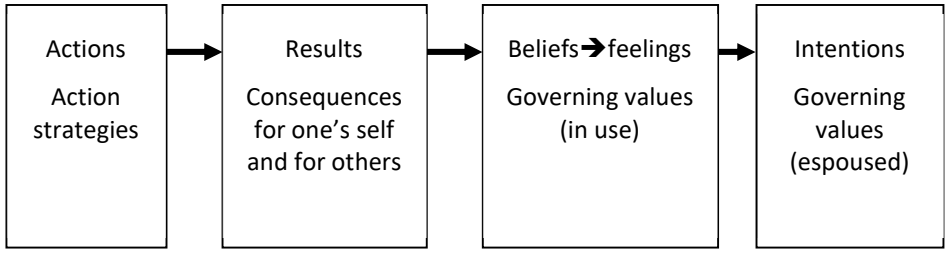

Figure 8 Parallels Between Dick & Dalmau and Argyris & Schön

The actions, their results and the values that motivate them, as well as the level of congruence, are going to have a fundamental influence on the learning process. Therefore, we should first review the two behaviour models or clusters identified by Argyris and Schön.

Model I has been identified as competitive and defensive, while model II is more collaborative. Their main characteristics are in the following tables:

Governing values or variables	**Action strategies**	**Relational consequences**	**Consequences for learning**
Search for own objectives	Environment control	The person is perceived with a defensive attitude	Self-blockage
Maximise benefits and minimise losses	Task control	Defensive relationships	Single-loop learning
Minimise negative feelings	Unilateral self-protection	Defensive rulings	Stop publicly comparing theories
Rationality not emotionality	Unilateral protection in front of possible harm caused by others	Low level of commitment and risk assumption	Single-loop learning

Table 18 Argyris and Schön Model I – Theories-in-use

Governing values or variables	Action strategies	Relational consequences	Consequences for learning
Valid information	Creation of an environment that allows freedom	Minimum defensive attitude	Different points of view are explored, and more risky ideas are expressed
Free and informed option	Joint task control	Non-defensive relationships	Double-loop learning
Internal commitment to the adopted option	Self-protection is a joint task oriented towards growth	Learning oriented rules	Theories are compared in public
Opening	Bilateral protection of others	Commitment	Double-loop learning

Table 19 Argyris and Schön Model II - Theories-in-use

Unfortunately, most social systems are model I systems. Therefore, to evolve from model I to model II, the possible inconsistencies (the existence of contradictions) should be identified, and new models should be explored to reduce the inconsistency and increase affectivity, test new contradictions, confirm them (or not) and, finally, internalise and feel responsible for the new behaviour.

Lastly, we should approach another key contribution from Argyris and Schön: single-loop learning and double-loop learning[27]. People programmed under model I generate new action strategies to maintain existing governing values. Those programmed under model II use double-loop learning according to which they adapt and modify those governing values. In the single-loop, action varies as a function of the analysis that results from our actions. We modify our way of doing things by working on the contents within our governing scheme and reinforcing them. Nevertheless, in the double-loop, it is our way of thinking that is modified, thus changing the way we way do things. For example, in a single-loop, a person learns techniques to suppress the appearance of conflicts, while in a double-loop they would try to resolve the conflict instead of suppressing it.

[27] This contribution of Argyris and Schön is related to the British anthropologist Gregory Bateson's concept of 'deutero-learning'. His ideas about Gestalt learning, or deutero-learning (from the Greek word for second), compared to single learning (or proto-learning), not only influenced Argyris and Schön in the field of organisational behaviour but also other authors cited here like Paul Watzlawick, who found clear parallels in first and second order changes (Watzlawick, Weakland, & Fisch, 1974). For further information about the evolution of the concept consult the work of Max Visser (Visser, 2003) accessible via the Radboud University Nijmegen (Holland) website:

http://www.ru.nl/aspx/download.aspx?File=/contents/pages/24222/visserjhbs.03.pdf (consulted in June 2009)

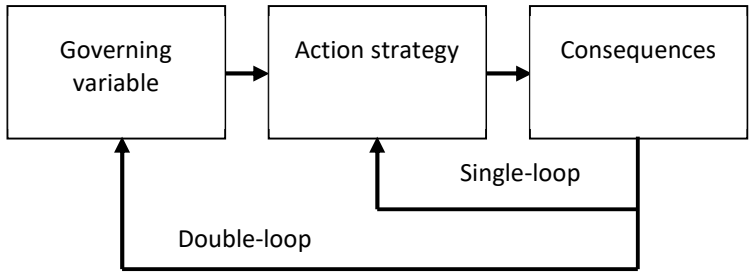

Figure 9 Single-loop and Double-loop Learning

5.3.3 The Argyris and Schön model in Synergy

Dick and Dalmau identified that the style of communication could be a clear possibility for evolving from model I to model II (Dick & Dalmau, 2000). The use of non-defensive open styles promotes high participation and shared responsibility – which are the assumption risks and testing assumptions in double-loop learning.

In Synergy, the defensive model I and single-loop learning are given right from the beginning of the game, between cycles 1 and 2 when the evolution of the group is centred on technical aspects, and there is still the idea that the objectives can be met by improving their method. Frequently, some participants competed with the simulator, trying to find out how it works, its formulation, or the keys that would guide them to immediate success.

Model II, which is more collaborative and involves double-loop learning, will appear in the intermediate and final cycles of the course, when participants have learned that there is no 'formula' for success but, rather, achieving the objective is the result of the entire series of actions and group decisions. Group conscience, shared leadership, treating each other as equals and especially communication, much more than algorithms of the simulator, are 'the' keys to success.

5.4 Experiential learning

5.4.1 Dewey, Lewin, and Piaget

Experiential learning focuses on the idea that it is a particular form of learning distinguished by the central role that experience plays in the process. The concrete experience is transferred to an abstract conceptualisation which is actively tested through new experiences.

In Experiential Learning: Experiences as the Source of Learning and Development (Kolb, 1984), David Kolb perfects the work of other authors by bringing experiential learning to its highest level of influence on adult education. In his book, he quotes John Dewey, Kurt Lewin, and Jean Piaget as precursors.

John Dewey (20 October 1859 – 1 June 1952) wrote 'Experience and Education' in 1938, articulating the principles for experiential programmes in higher education. At that time, there was a growing conflict between traditional education and this new approximation. Traditionally, learning comprised of imposition, discipline and learning based on texts and teachers and was opposed to the expression of individuality, free activity and learning through experience. For Dewey, learning transforms impulses, feelings, and desires from a concrete experience into a new higher-level action with a determined motive.

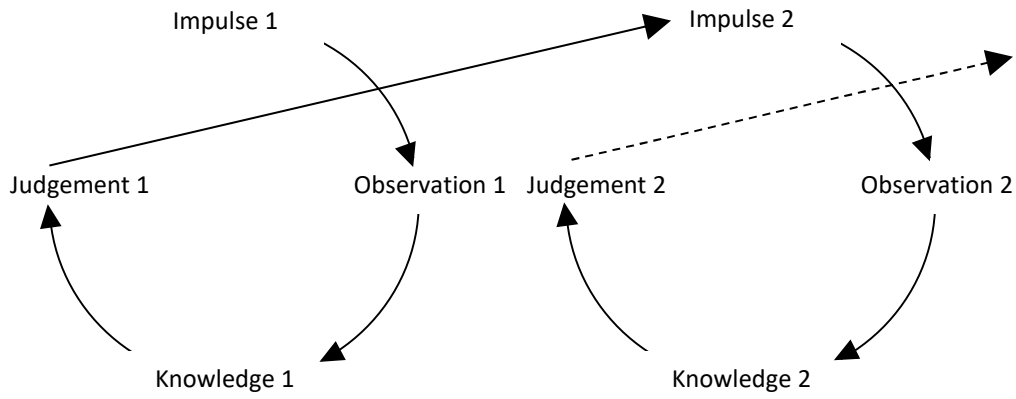

Figure 10 John Dewey Model of Experiential Learning

Kurt Zadek Lewin (9 September 1890 – 12 February 1947) was considered as the father of organisational development following his contribution at the Research Centre for Group Dynamics in the Massachusetts Institute of Technology in Field Theory in Social Sciences, where he described learning as a four-state cycle. Observations are obtained from concrete experience and, using reflection and analysis, allow conceptualisation - which leads to conclusions and hypotheses that can be applied to a new experience that modifies the behaviour of the actor, reinitiating the cycle.

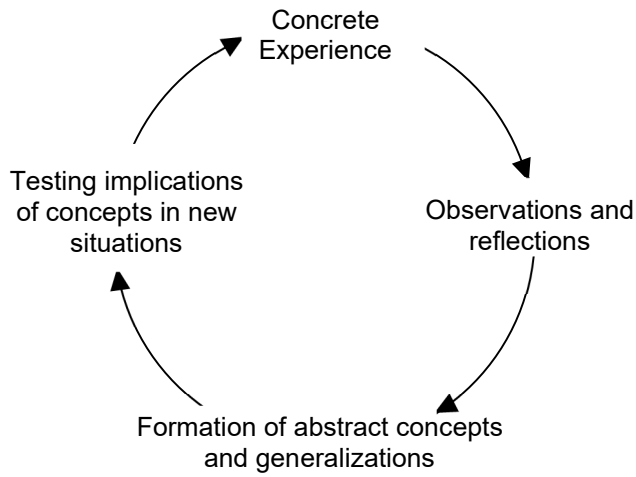

Figure 11 Kurt Lewin Experiential Learning Cycle

Jean Piaget (9 August 1896 – 16 September 1980), the third author cited by Kolb as an ancestor of experiential learning, reflects in his research about the processes of cognitive development, the nature of intelligence and how this is developed. He describes how the function of knowledge in children changes qualitatively in four stages.

From zero to two years, the child is active and concrete in its style of learning; this is called the 'Sensory-motor stage' and is predominantly Enactive Learning through feelings, touching and handling. It has an accommodative position toward the world. Learning is a consequence of the association between stimulus and response. For example, a child is thirsty, can identify a calming object, can recognise that it is water and associate its name.

From two to six years, the child internalises actions converting them into images; this stage is called 'Representational'; learning is Iconic Learning through manipulating observations and images. The development of visual memory seems to be very specific at this stage. Its position towards the world is divergent. The child is captivated by its ability to view the world from different perspectives. The child can imagine that water has different shapes, can visualise it in different contexts and can imagine swimming or creating adventures as a sailor.

From seven to 11 years, the child initiates an intense development of abstract symbolism; this stage is called 'Concrete Operations' and is predominantly Inductive Learning through classes and relationships, gaining independence from concrete experimentation. It has an assimilative position toward the world. It can select

experiences based on its concepts and theories. The child can recognise the consequences of using water and uses logic and reasoning to identify that a plant lacks water and needs watering.

Finally, from 12 to 15 years, the adolescent moves from symbolic processes, based on concrete operations, to the symbolic processes of figurative logic; this stage is called 'Formal Operations' and is Hypothetic-deductive Learning through reasoning. It has a convergent position towards the world. In contrast to the divergent position, here the child organises data, identifying and controlling variables. The child can understand complex concepts and abstract ideas such as the implication of seeing a glass of water as either half-full or half-empty.

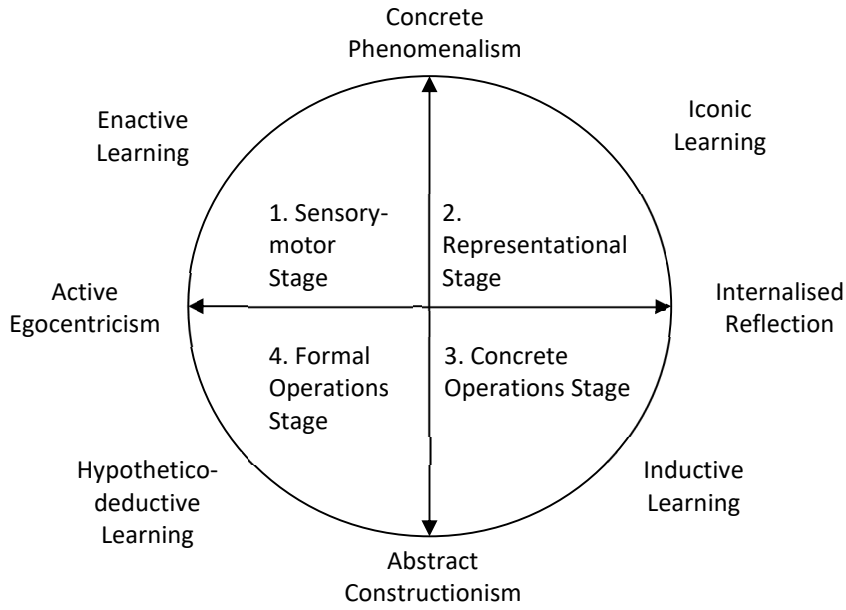

Figure 12 Piaget Cognitive Development and Learning Model

Here I should pause to interpret the Piaget cognitive development and learning model. In the first stage, the Sensory-motor, it is said that learning is 'Enactive'. I have translated this as 'practical' although it could be translated literally as 'adoptable' or 'interpretable'. 'Enacting' is one of the possible forms of organising knowledge and one of the forms of interaction with the world. The first definition of 'enactive' was put forward by the famous cognitive psychologist Jerome Burner in 1966, in association with the other two ways of organising knowledge: 'iconic' and 'symbolic'. The 'enactive' knowledge is that

which is acquired through action and is built on motor skills - like handling objects, riding a bicycle, or participating in sport[28].

It also refers to the Concrete/Phenomenalism that has parallels with the concrete experience of Kurt Lewin and that, later, Kolb identified as CE (Concrete/Experience). According to the dictionary of the Real Academia Española, 'Phenomenalism' is understood as the idealistic theory that started with the German philosopher Immanuel Kant, who affirms that objects can only be known as they appear and not as they really are, which strengthens the link between learning and concrete experience. Learning, therefore, is partial and derived from a specific phenomenon.

In the second stage, the Representational one, learning is iconic in that knowledge is stored as visual images. Commonly, we refer to visual images as diagrams and illustrations that can accompany verbal information.

Reference to Internalised/Reflection is parallel to the observations and reflections of Lewin and that Kolb called RO (Reflective/Observation).

The third and fourth stages are those of Concrete Operations (internalised actions that operate with images of material objects) and Formal Operations (internalised operations that operate with other more basic internalised operations). Learning is symbolic, being differentiated as inductive in the third stage and deductive in the fourth. In a symbolic form of learning, knowledge is kept as words, mathematical symbols, or other symbol systems. It will be inductive when we extract abstract concepts and generalisations from determined observations or particular experiences. It will be deductive when the consequence is obtained from a principle, proposal, or supposition. The deduction is a generality obtained as a logical consequence of reasoning and therefore can be valid or invalid but not true or false.

In this case, the references to Abstract/Constructionism and Active/Egocentrism would be parallel in Lewin to the formation of abstract concepts and generalisations in the first case, and to the tests of implications of concepts in new situations in the second one. In Kolb, we will find AC (Abstract/Conceptualisation) and AE (Active/Experimentation).

Finally, and referring to Constructionism[29], the theories of social construction believe that ideas, concepts, and memories arise from social interchange and are biased by language. Constructionists maintain that all knowledge evolves in the space between

[28] Other authors, like Gregory Bateson, Humberto Maturana and Fráncisco Varela, postulated the so-called 'enactivism', doctrine that emphasises the way the human brain and organs are organised by means of interaction as an environment.

[29] Similar, but differentiated from Constructivism. In Constructivism, from the perspective of behaviour sciences (which consider Piaget to be their ancestor), knowledge is built from individual experiences. All types of experiences are essentially subjective, and although reasons can be found to believe that one person's experience can be similar to that of another, there is no way of knowing if really it is the same.

persons: the 'common and current world' (Hoffman, 1996). Therefore, Constructionism here refers to symbolic knowledge, to that built using language.

5.4.2 Experiential learning: Kolb

David Kolb (1984) identifies that the four modes of adaptive learning (Concrete/Experience or CE, Reflective/Observation or RO, Abstract/Conceptualisation or AC, Active/Experimentation or AE) represent two different dimensions, each one with dialectally opposed orientations.

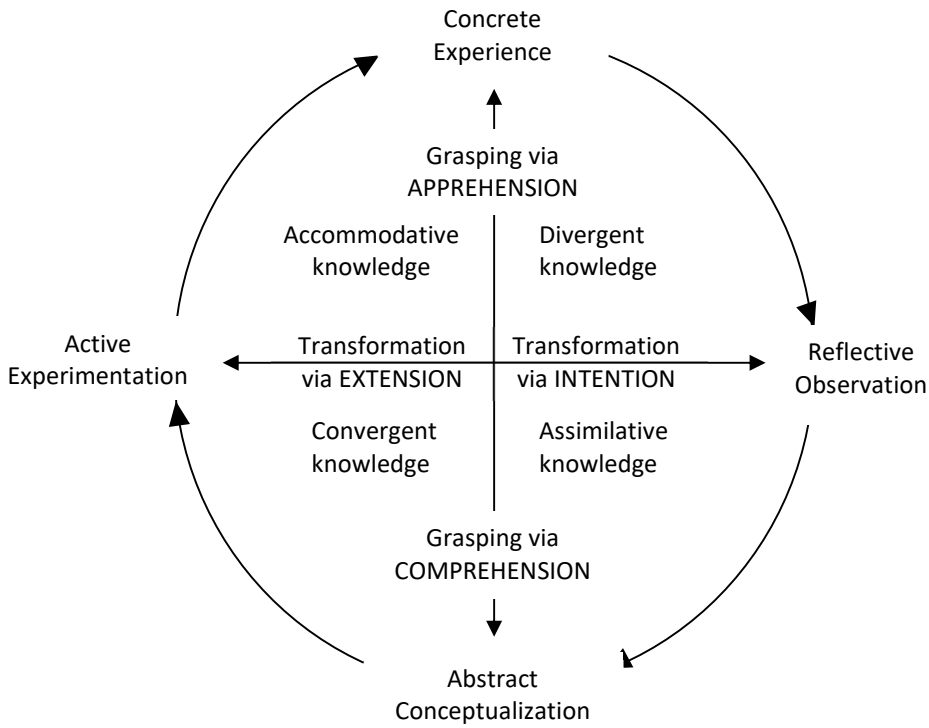

Figure 13 Structural Dimensions of Experiential Learning

As we can see, Concrete-Abstract is represented by two different and opposed processes for capturing experience. One is Apprehension (comprehension and subjective acceptance of contents without affirming or denying them), and the other is Comprehension (or understanding, as a faculty, capacity, or insight for understanding and penetrating things). The first is achieved through that which is tangible via the qualities of immediate experience and the second through conceptual interpretation and symbolic representation.

The second combination, Active-Reflective, relates to the transformation of that which has been captured. One by internal reflection, or Intention, and the other by active external manipulation of the outside world - the Extension.

Knowledge results from the combination of perceiving and processing experiences, thus giving way to four basic styles of learning.

- Captured experience through Apprehension and transformed by Intention is called *divergent knowledge*.
- Captured experience through Comprehension and transformed by Intention is called *assimilative knowledge*.
- Captured experience through Comprehension and transformed by Extension is called *convergent knowledge*.
- Captured experience through Apprehension and transformed by Extension is called *adaptive knowledge*.

Kolb explains the four styles and their implications in the following manner:

An orientation towards experimentation (CE) involves personal involvement. He emphasises feeling versus thought, present reality against theories and generalisations, and an intuitive approximation instead of another systematic and scientific one. This type of person is happy in relationships with others; they make intuitive decisions and are at ease in non-structured situations. Those with this type of characteristic acquire value in personal relationships; they get involved and have an open perspective of life.

An orientation towards reflection (RO) is centred on understanding the meaning of ideas and situations, carefully observing them and impartially describing them. It emphasises comprehension versus practical application. It worries more about what is correct or how things occur, instead of how they work. Reflection is more important than action. Those with these characteristics enjoy understanding what situations or ideas mean and are good at identifying their implications. They can see things from different perspectives and appreciate different points of view. They are especially valuable when patience, impartiality and weighted judgement are necessary.

An orientation towards the abstract (AC) is focused on the use of logical ideas and concepts. It emphasises thought versus feeling. It is more occupied in building general theories than in understanding specific areas. It prefers more scientific problems than 'artistic' ones. This person enjoys systematic planning, handling abstract symbols and quantitative analysis. They are especially valuable for the provision of precision, rigour, and discipline in the analysis of ideas or the creation of clean, aesthetic, conceptual systems.

An orientation towards checking (AE) is focused on actively influencing people and changing situations. It emphasises practical application versus reflexive comprehension. It worries about what is working instead of what is absolutely certain. People with this

orientation prefer to observe. They enjoy, and are good, at obtaining good results. They can take certain risks to achieve their objectives. They are usually influential in their environment, and they like seeing results.

Consequently, the divergent learning style emphasises concrete experience and reflexive observation. The strength of people with this orientation resides in their ability to see concrete situations from different perspectives, establishing relationships around a 'Gestalt[30]'. It is called divergent because this type of person obtains better results in situations that need the generation of alternatives - as in a brainstorming session.

The assimilative style of learning emphasises abstract conceptualisation and reflexive observation. Its strength resides in inductive reasoning and the ability to create theoretical models, assimilating odd observations in an integrated explanation (Grochow cited by Kolb, 1984). It is less oriented to people and more to ideas and abstract concepts.

The convergent style of learning emphasises abstract conceptualisation and active experimentation. Its strength resides in resolving problems, making decisions, and the practical application of ideas. It is called convergent because a person with this style seems to perform better in traditional intelligence situations where there is only one correct answer or only one solution to a problem (Torrealba and Kolb cited by Kolb, 1984). Knowledge is organised this way utilising hypothetic-deductive reasoning that can be better centred on specific problems. These people show control from an expressive and emotional point of view and prefer to work with technical tasks instead of matters that demand interpersonal contact.

The adaptive style of learning is opposed to the assimilative style. It emphasises concrete experience and active experimentation. Its main strong point resides in implementing plans, creating projects, and being involved in new experiences. This style is called adaptive because it is better when one adapts to changing circumstances, where theory or plans do not fit with facts, and the adaptive person should reject them. These people resolve problems by trial and error (Grochow cited by Kolb, 1984) basing themselves more on information provided by other people rather than their own analytical ability (Stabell cited by Kolb, 1984). They get on well with people but on occasions can seem to be impatient or insistent.

[30] The word Gestalt comes from German and usually refers to the Gestalt psychology. It does not have a simple translation, although it is generally understood as 'form'. Nevertheless, it can also be translated as 'figure', 'configuration' and even 'structure' or 'creation'.

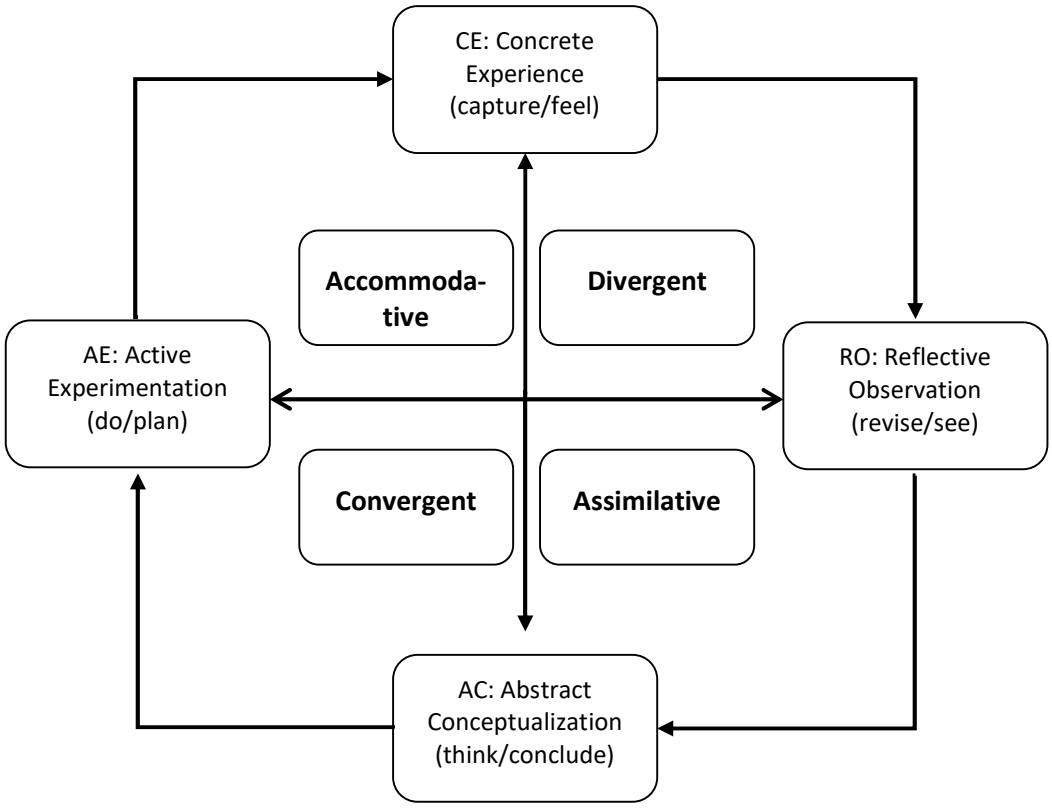

Figure 14 Summary of the Kolb Learning Styles

In practice, the four learning styles are not given in a pure manner. Kolb designed a questionnaire for identifying the individual profile, the Learning Style Inventory that is related to different professions.

5.4.3 Learning from mistakes

On 20 August 2008, one of the worst air accidents in Spain occurred in Madrid; 154 people died. The draft of the report from the Spanish Civil Aviation Accident and Incident Research Commission (CIAIAC, (Spanish initials)) about the accident indicated that a Spanair MD-82 aircraft did not have its flaps out (these provide support during take-off) and that the warning system did not warn the pilot of this abnormality which would have avoided the fatal accident. A similar fault had happened in an accident involving another MD-82 in Detroit in 1987. The Take-Off Warning System (TOWS) did not work; 156 people died in the accident. As the draft from the Accident Research Commission indicates, the manufacturer of the aircraft - McDonnell-Douglas (now Boeing) – 'recommended' that operators should always check this safety system - that warns of abnormalities during take-off - before each flight. However, Spanair only specified in its protocols that the check should be made before the first flight of the day or when both

pilots are changed. The Spanair director of operations justified this by saying 'The recommendation was over 20 years ago. Spanair did not exist, and we do not have any knowledge of having received that recommendation. It was from 1987, Spanair started in 1988'. The CIAIAC has since asked the EU and USA that this revision before take-off is made obligatory. And yet, on 5 June 2007, an Austrian Mapjet MD-83 was near to crashing in Lanzarote due to similar causes[31]. How could this happen, you may ask when there had been previous accidents and failures of such magnitude?

One of the best sources of learning in complex environments are one's mistakes; the second best is the mistakes of others. During the whole learning process that is given in the seminar, those groups that are able to identify the origin of errors and learn from the experience, are those that develop the training more rapidly. In organisations learning from mistakes becomes an essential function that should not be covered-up or avoided (Sitkin, 1995). Much too frequently small errors are obviated due to fear of reprisals or reproach from organisational supervisors. Sitkin explained how, in successful organisations, errors create a risk recognition and motivation for change. At other times, the contrary could happen - when the key to learning is precisely the ability to unlearn policies or practices that, having been valid in the past, have become obsolete due to changes in the environment.

In the training seminar groups that were successful in the penultimate cycle of the game frequently failed to achieve the objectives of the last cycle because they failed to see that considering change was necessary. On the other hand, when failing in the penultimate cycle, the group was encouraged to seek new solutions by learning from their mistakes. Sitkin indicates that not all faults allow learning, only those so-called intelligent ones and that comply with the following characteristics:

1. They are the result of deliberately planned actions.
2. They have uncertain results.
3. They are of a modest scale, small.
4. They are executed and have rapid answers, not delayed in time.
5. They are placed in sufficiently familiar environments to allow effective learning.

Every organisation with sufficient memory will be capable of avoiding the repetition of those faults already committed. On the other hand, those organisations incapable of acquiring and distributing knowledge will end up repeating past experiences. Occasionally, organisations release key employees or those with great experience, without considering adequate training for their replacement or a mechanism to recover the knowledge that undoubtedly will be lost when the employee leaves the company.

[31] Source: El País newspaper library.

5.5 Proactivity

Proactivity to relationships and proactivity to results are variables of individual scope in the model. Proactivity is one of those words that everyone knows, recognises, and uses but is not really in the dictionary[32]. That said, we can find the adjective 'proactive' or the adverb 'proactively'. Defined as 'create or control a situation instead of only answering to it' or 'acting to provoke changes and not only reacting to the change when this happens', the concept is clearly related to anticipation.

Despite there not being a sole definition, or theory, or a standard measure of the construct, we could talk of proactive behaviour as 'the taking of initiatives for improving current circumstances or for the creation of new ones' (Crant, 2000). Therefore, it refers to challenging the status quo more than the passive adaptation to current conditions. Proactive behaviour is as much due to personal differences as it is to contextual factors. Bateman and Crant (cited by Crant, 2000) introduce proactive disposition as a construct that identifies differences between persons through the extent to which they act to influence their environment.

A prototype proactive personality would be that which is not limited by forces of the moment and introduces changes in the environment. Proactive people identify opportunities and act according to them; they show initiative, take action, and persevere until significant changes happen. In studies carried out with the Bateman and Crant proactive personality scale, relationships are demonstrated with individual work results, with the evolution of professional careers, with leadership, with organisational innovation, with team results and with entrepreneurial capacity.

From an environmental point of view, people learn from what they see and react accordingly. In this respect, we define socialisation in organisations and work teams as 'a process of common adjustment that produces changes in time between a person and the group' (Moreland & Levine, 2006). The interpretation of the context and the intentions of the socialising agents affect the answer and levels of activity.

A study of over 102 new people hired in 96 firms supports this approach (Jones, cited by Crant, 2000). Organisational tactics, like formal collective programmes aimed at the interchange of experiences, facilitate an orientation towards more proactive roles. Feedback is another valuable resource at the time of facilitating proactive behaviour to help the achievement of objectives. Management support, culture or regulations will also be contextual factors that can favour it.

[32] Not in the Diccionario de la Real Academia Española, but it is in the Oxford English Dictionary or the Cambridge English Dictionary.

5.6 Summary

The first activity of groups is always the acquisition of sufficient knowledge to allow them minimally to handle the proposed environment of uncertainty. Groups in this situation show behaviours that try to achieve the objective and develop common relationships.

- The first observation variable is Proactivity to results. It consists of obtaining data by means of requesting more information and the clarification of that already received; in making action decisions and in controlling results.
- The second is Proactivity to relationships. It consists of an interest in the task of others, the interchange of information and joint analysis, and the intent of building relationships and sharing experiences.

Process	Variables	Observations
Knowledge acquisition	Proactivity oriented to results	Obtaining data Making action decisions Control of objective
	Proactivity oriented to relationships	Interaction Interchange Relationships

The result of this proactive attitude in an environment as proposed at the beginning of the simulation is the acquisition of knowledge. Everything occurs in an individual scope where we understand the individual not as a person but rather as an agent with the independent capacity to make decisions. Extrapolating this to reality, an agent could be a person, a department, or an area of the organisation as long as it acts as a sole agent making decisions in a larger system. In fact, in the simulation, we understand the individual to be the subdivision of the group. If the group is the 12 participants, the subdivision is the three that form a department, and there are four in the group.

CHAPTER 6.

COHESION

6.1 Introduction

As the course develops and its members acquire independence in terms of training, a new and vital factor appears that marks the difference between groups and allows them to achieve excellent results. This factor is called cohesion.

Although the groups with the best results indeed begin to cultivate their relationships from the beginning of the simulation, it is after successfully overcoming the first two cycles of play that 'relating' receives special attention. And, by overcoming the early cycles, I am not referring to the achievement of numerical results of the simulation asked of the group, but rather to acquiring the knowledge necessary to gain independence from the trainer. Generally, a group in the third cycle can play with a more or less clear set of criteria, has all the relevant information, and is fully engaged in verifying work hypotheses.

Nevertheless, the group is not yet capable of achieving adequate results and, therefore, begins a search for alternative routes that, inevitably, goes through the definition of some type of joint policy or strategy. It is when they initiate intragroup relationships, not in the big group but within each subgroup or department into which they were divided. At first, these relationships are exploratory. Initiatives advance in the form of proposals and tend to be consolidated by way of general agreements that cover the individual interest. They explore points of mutual benefit.

As these relationships progress and the interdependence of the departments becomes more evident, the dependency to achieve the results is also clear. In groups with the best results, the feeling of a common project then becomes general, a point at which integration and cohesion increase.

6.2 Observation variables

After acquiring the necessary knowledge to be functional, the feature that most clearly identifies the group is the relationship between its members. This relationship, which

results in a high level of cohesion, more significant in the groups with the best results, goes through an integration process for which mutual trust is vital.

1) The integration of the group is the first variable of the cohesion process. It reflects cooperative behaviours and a whole system of rules generated to set the limits of action. The team, and the involvement of its members, grow as a concept and acquires its meaning.
2) Trust generation is the second variable. It is the consequence of ensuring equality and being generous. When in balance, the group distributes burdens and benefits and ensures that no team member will profit from the others. Generosity ensures that the first decision of the participants will be for the benefit of the group. When it is for individual gain, it causes rejection and prevents the consolidation of relationships

The result of the process of integration and being generous will be a consolidated team, which is collectively self-aware and with the ability to move forward. Otherwise, those groups that fail to consolidate are not able to prevent self-interest and therefore merely make technical improvements with no other findings.

6.3 Integration and cohesion

6.3.1 Definition of cohesion

Cohesion has always been considered as one of the most important variables in all group analysis. Normally its definition is in connection with the strength of unity within a group. One of the earliest definitions in this sense was that of Festinger who defined it as the whole scope of forces that act over the members to remain in the group (Festinger, Schacter, & Back, 1950). A more up-to-date definition was given by a professor at the University of Western Ontario, Albert V. Carron, who defines cohesion as 'a dynamic process that is reflected in the tendency for a group to stick together and remain united in the pursuit of its instrumental objectives and/or for the satisfaction of member affective needs' (Carron, Brawley, & Widmeyer, 1998).

Cohesion has the effect of making group members feel well through a sense of internal unity that facilitates change and collaborative action. A united group tends to unite its members emotionally to both the task and each other, thus assuring better group stability and improving corporative diversity (Lakin, 1972).

6.3.2 Cohesion as a dynamic process

Scott Budge contributes his dynamic vision to the analysis of cohesion. One of his criticisms of research studies is the notion that cohesion is a positive static state, which the group keeps once it is reached. He argues that cohesion presents an active mobile process determined by external threats (common destiny) and by the disintegration and integration that corresponds to occasional internal group conflict. The group then

modifies its perception as a whole and experiments with fluctuations that differ from that which we would usually consider as positive cohesion (Budge, 1981).

Regarding this, I should say that my observations about cohesion in groups have rarely suffered variations, but I should recognise that this is probably due to the incremental design of the simulation. When groups progressively pass from situations of uncertainty to complexity, while increasing their knowledge and improving their relationships from start to finish, it is possible they have not had the opportunity to suffer the fluctuations referred to by Budge. Nevertheless, it has been observed that those well-united groups that failed in their strategy fell into a state of confusion and conflict that made them regress in terms of cohesion.

Regarding this, Klein observes that a well-meshed group becomes incapable of adjusting to environmental changes. Its uniformity of rules establishes that all have the same reference framework, which redounds in a lesser group capacity for identifying what will happen next. This way, they routinise their behaviour towards the environment and towards themselves (Klein, 1956).

6.3.3 Group integration

In their work about cohesion, Carron and Browley emphasise the multidimensional perspective of the construct, defining different factors that can cause a group to remain united. In their work, they identify a series of social perceptions that each member develops, related to the entire group. These social perceptions that they call Group Integration (GI) reflect individual perception about what the group believes about its closeness, similarity, and degree of adhesion as a whole. The second series of social perceptions that they call Individual Attraction to the Group (ATG) reflect the motivation of each individual to remain in the group as well as their feelings about the same (Carron & Brawley, 2000). In addition to the two approaches, they still identify two further components: one task-oriented (goals and objectives) and one concerning social aspects (relationships within the group) giving place to four possible combinations GI-T, GI-S, ATG-T and ATG-S.

In this work, the analysis variables do not allow such a concrete and specific degree of cohesion identification, but they are clearly seen. The forces that differentiate some groups from others produce in one way or the other a higher degree of integration. Therefore, I will use the term GI as a common meaning without further specification.

6.3.3.1 Integration process

If anything is clear in the courses, it is the integration process they follow. At the beginning, there is hardly any contact and, when it happens, it is merely as an exploration. Until a minimum level of technical knowledge is reached, contacts do not have a defined objective. It is when the group members sense what they have in hand they start to relate to each other with a common interest. The first thing they do is to

agree on those aspects of the game in which they think they can all win. Reaching this point is very satisfactory because it makes them think that they are collaborating - but it is very short-lived because it has a low potential for development.

The game continues, and participants should look for other alternatives that open new ways of collaboration. At that moment, they start to explore that which benefits others without individual harm: that is to say, it benefits some and does not harm anyone. At this point, we see the dilemma of correspondence. How to assure a return on investment? How to measure individual contributions such that the value of the negotiating process is equally shared? Two interesting phenomena appear now: first, the necessity for equality and second, the creation of regulations. At this level, the group seems to confirm the theory of equity according to which individuals compare their individual contributions and the benefits they receive with those of others and respond by eliminating inequalities (Adams, 1965).

The group considers that to be able to continue cooperating and, as the options of individual benefit are clear while those of common benefit are not, the benefit obtained should be shared. Likewise, the cost or harm of collaboration should be shared. If this were not the case, an individual subgroup could think that there is no point in collaborating as the load would be higher than the cost, and that would cause it the loss of opportunities to achieve its individual objective. To assure equality, participants create a whole series of regulations that assure an equal share-out. That regulatory process has a key effect by limiting action in such a way that allows identifying belonging to the group. Whoever does not follow the rules is not considered as part of the group and to the contrary of those that do, on occasions despite the result, it is considered the price to be paid for cohesion. It is the emotional border between group and team.

The level reached is satisfactory but still not optimal. Clearly, a management mechanism based on equality has the result of equal sharing but not the maximisation of results. One of the systems thinking principles says the maximisation of the parts does not necessarily imply maximisation of the whole. Much to the contrary, by detracting resources from the system to equalise results, the performance levels required by the game are still not achieved. The team should continue to search. Here is where all that which is intuitively related to teamwork – such as open-handedness altruism and trust - come into play.

The group starts to make decisions thinking of common benefit and understanding this concept not as the sum of its parts but as a new differentiated entity. Now it is not a matter of doing that which benefits everyone, or even negotiating and obtaining benefits in exchange for something; it is a matter of doing that which benefits the whole group, trusting that reciprocity will arrive and that the effort will bear fruit. At this stage, there is a key implication: participants have merged, integrated into something new - a team.

During that integration process, I identify some of the themes that Edgar Schein proposes as part of the internal integration process (Schein, 2004).

Edgar Schein Internal Integration Issues	Observations Found
Creation of a common language.	The group identifies the terminology capable of explaining concepts handled in the simulator creating specific concepts.
Definition of group limits and criteria of inclusion and exclusion.	The group clearly establishes the decisions that will identify who work in cooperation or individually.
Power and status distribution.	The members relate in accord to clear identifications of power and leadership.
Development of regulations.	Fully defined, the group identifies what should be done, what is advisable do and what should not be done.
Definition of compensations and punishments.	When any of these regulations is infringed, the group aggressively reacts against who does not respect it.
Explanation of that unexplainable.	That which escapes the knowledge that the group has accumulated until now is placed at the front as something necessary at that moment and the existence of which will be clarified further on.

Table 20 GI Matters According to Schein

6.3.3.2 Group Emotional Intelligence (GEI)

In one of the sessions I had with Joan Manel Batista-Foguet (Director of the Survey Research Centre of ESADE), during the analysis of statistical data derived from the observations, I tried to give him my point of view about some personal conclusions. When I reached Normalisation within the GI variable, he stopped and explained to me that at that time he was working on research with Vanessa Druskat who, together with Steven Wolff, had coined the concept of GEI that contained some very similar conclusions regarding the rule creation section.

Druskat and Wolff present the concept of GEI defining it as 'the capacity of a group to generate or share a series of rules that regulate the emotional process in such a way that it creates confidence, group identity and group efficiency'. Likewise, they believe that these collective beliefs facilitate the development of cooperation and collaboration among the members of the group (Druskat & Wolff, 2005).

One of the key factors they identify for facilitating cooperation and collaboration is confidence which, both affective and cognitive, implies a sense of expectation, obligation, and reciprocity, and will be analysed in the next section.

The second collective belief that Druskat and Wolff consider necessary to create effective relationships in groups is the identity of the group; this is defined as a group collective belief that this is a unique, important, and attractive entity. This belief is what I identify as cohesion.

Both beliefs, together with other aspects, are developed using the IEG rules created by the group, in the form of cultural influences. These influences channel the interpretation of emotional stimuli and subjacent behaviours in such a way that they have a positive impact on group effectiveness. In that regard, the definition of organisational culture given by Edgar Schein is worth remembering; he writes 'I will use as the critical defining characteristic of a group the fact that its members have a shared history. Any social unit that has some kind of shared history will have evolved a culture, with the strength of that culture dependent on the length of its existence, the stability of the group's memberships, and the emotional intensity of the actual historical experiences they have shared.' (Schein, 2004).

Therefore, regulations affect the emotional process stages (awareness of emotions, interpretation of events and behavioural answers in the face of emotion) constructively.

6.4 Trust

6.4.1 Introduction

The second variable to appear at the cohesion level is trust. Historically, trust has been the object of many studies that fundamentally relate it with leadership but also with positive attitudes of work, organisational justice, psychological contract, effective communication, organisational relationships, and conflict management. The role of trust in a long-term committed relationship is also considered as crucial to establish and maintain a cooperative balance.

6.4.2 Approaches

Based on the above, it is not surprising that different investigators define trust in different ways and from different perspectives. A magnificent summary is given by Larue Tone Hosmer (Hosmer, 1995):

- Trust as an individual expectation

Different authors coincide in seeing trust as a series of optimistic expectations by an individual. This expectation is related to the level of results and has the main characteristic of lack of control over this and therefore, a certain degree of vulnerability.

Therefore, trust is an individual decision based on an optimistic expectation of an uncertain result.

- Trust as an interpersonal relationship

Initially, in agreement with the previous meaning, some authors evolved to the consideration that for trust to exist it should also exist not only for the one showing it but also for the one in whom it is made. This interpersonal approximation continues to be based on the assumption of an individual decision but also adds dependence on the actions of others in response to a hypothetical consequence. Thus, reaching a definition that includes the expectation of a reciprocal behaviour is considered as essential to achieving common cooperation.

Butler and Cantrell propose five specific components of trust or personal characteristics (Butler & Cantrell, 1984):

1. Integrity. The reputation of honesty and trust of the person being trusted.
2. Competence. The necessary technical knowledge and personal capacity to carry out a task.
3. Consistency. Reliability, predictability, and handling situations wisely.
4. Loyalty. The implicit promise of one of the parties not to harm the other[33].
5. Opening. Mental accessibility of the goodwill to share ideas and information with others freely.

Daniel J. McAllister suggests two dimensions that would group the different components: cognitive and affective. The cognitive dimension would be based on the perception of integrity and training of the other party while the affective dimension would be based on the special relationship between both, fundamentally loyalty (McAllister, 1995).

- Trust as an economic interchange

From this perspective, trust is analysed as the activator of economic decisions that agents take in their transactions, mainly in line with their reputation. Therefore trust is: (1) the expectation that another individual or group will act in good faith following explicit and implicit commitments; (2) the assumption of honesty in previous negotiations; and (3) that no excessive advantage over the others will be taken, even if there is an opportunity to do so.

[33] In a later work Butler defines the dimension of loyalty in a more precise way. Here the second one is included directly (Butler, 1991).

- Trust as a social structure

In observing trust from a social point of view, reference is made to social mechanisms and especially the legal system, designed to guarantee trustworthy behaviour. The concept will vary according to the degree to which society is developed and will be accompanied by an acceptance of the need to protect the rights and interests of others.

- Trust as an ethical principle

In this case, correct decisions or actions will follow ethical principles where trust, being the result of morally correct behaviours that recognise and protect the rights and interests of others, can be derived.

6.4.3 Conditions

Helen Nissenbaum reflected on the conditions of establishing trust, listing a series of factors that without trying to be exhaustive did try to be selective (Nissenbaum, 2007).

- History and reputation

One of the best ways of showing reliability is, without doubt, past behaviour. Reputation, both good and bad, will be decisive when deciding whether someone is reliable or not.

- Personal characteristics

Occasionally, the generation of trust is favoured by the existence of characteristics that are perceived by the other party and considered trustworthy - like familiarity, similitude, or shared values. Frequently that perception is founded on external aspects - like clothes, behaviour, or general conduct. From them, we deduce values and moral commitments that support trust decisions. Other examples: a common religious education, the school or university where someone was taught, the neighbourhood where one lives or a common traumatic experience - affect the level of trust by predicting what others will do and what degree of trust can they be given.

- Common and reciprocal relationships

Relationships are also a source for generating trust or distrust. The presence of common necessities or objectives can stimulate it by the perception of 'being in the same boat'. When we fly in an aeroplane, we trust the pilot, in part, because we share the same aim with him: to arrive safe and sound.

Reciprocity is slightly different and is founded on a situation that regularly interchanges the roles so that it places each one of the parties in the hands of the other but with the security that the mentioned situation will change in the future. A clear example is constituted by the positions of responsibility in business schools that are temporarily covered by teachers who, having completed their mandate, return to their teaching functions.

- Roles

Another reason for which we trust the pilot of an aircraft or a doctor is precisely due to their professional status and the role they play. Being aware of the qualifications that such professionals must secure to exercise their role is crucial for others to place their trust in them.

- Contextual factors

Some contextual factors - like making dishonest behaviours known - help to generate trust. Some examples are seen in the valuation of suppliers that clients of companies like Amazon or eBay make or in popular websites providing comments about the quality of hotels.

Finally, being aware of the probability of punishment for the mentioned behaviours, normally employing sanctions, helps to improve the trust index.

6.4.4 Definition of trust

From all the above we could venture a definition of trust in organisational theory, as 'the expectation of positive behaviour that recognises and protects the interests of other persons, in such a way that the probability of cooperation increases and expands the final benefits within a common effort or economic interchange' (Hosmer, 1995).

6.4.5 The importance of equality

I spoke of the importance of equality earlier when I referred to integration. There comes a time when it is obvious that to evolve in integration, generate more cohesion, become conscious of the group and advance in collaboration, it is necessary to go through a phase of equality. I refer to it as a phase because it clearly means an evolutionary moment that did not exist before and should be overcome later. During this equality phase, through some clearly defined rules, the group measures up to its members, facing them with enforced situations. In other words, one is with the group, even at the cost of the individual, or one is against it.

If the majority of the group opts to become consolidated as a team and someone remains in the margin, the team has the potential to evolve, but not without emotional friction. If the majority stays on the margin, the evolution of the group fails, and it returns to individualist, rather than cooperative positions. If the majority advances, it is when some members self-exclude themselves by making individualist decisions. Depending on the importance of the decision, the timing of the impact it has had, it could abort the global evolution or simply provoke a violent exclusion reaction. All that comes from a purely emotional point of view without paying attention to the reasons, legitimate or not, for such self-exclusion decisions.

This is an important reflection because it indicates to us that one cannot abort the integration process until the group has generated sufficient trust to allow these apparent

individualist decisions to be understood, contextualised, and perhaps even improve, by variation, the process of group decision-making. Therefore, the leading coordinator must have the capacity to maintain a global and dynamic perspective that allows the identification of the group's evolutionary moment. With this in mind, the leader will be able to know whether to force the group to overcome the equality phase or, on the contrary, maintain it (despite the cost), to achieve the necessary degree of cohesion.

That said, lastly, it should also be stressed that it is difficult for the group itself to get out of the equality phase since it reinforces cohesion. When the level of trust is thought to be sound enough, it is time to reconsider whether the processes adopted, and decisions made to date have been adequate.

6.5 Summary

As the course progresses, relationships between members of the group increase and the interdependence of the departments into which it is subdivided becomes more and more clear. As participants become conscious of that, the need to interrelate in order to be successful also becomes more apparent. In groups with better results, the concept of a common project is generated, increasing integration and cohesion.

1) Integration of the group is the first variable in the cohesion process. It reflects cooperation behaviours, a complete system of general rules to establish team limits that, conceptually, are acquiring their own meaning and the implication of its members.
2) Generation of confidence is the second variable. It is the consequence of equality and generosity. The group shares burdens and benefits from equality, and it assures that no member of the incipient team will obtain benefit at other's expense. Open-handedness assures that participants' first decision will be beneficial for the group. Whenever it is for the individual benefit, it provokes rejection and impedes consolidation of relationships.

Process	Variables	Observations
Integration and cohesion of the group	Group integration	Cooperation Normalisation Implication
	Trust generation	Equality Open-handedness

The result of integration and open-handedness will be a consolidated team, collectively self-aware and able to keep progressing. Conversely, those groups that are not consolidated are not able to renounce individualist positions and therefore do not find other ways to improve other than merely technically.

CHAPTER 7.

SELF-COORDINATION

7.1 Introduction

It is typically in the last cycles of the game that cohesion develops to the extent that the group's behaviour changes. Members of the group start to think of themselves as a whole, rather than the sum of departments that existed up to that point. They start to behave like a team.

If the group has successfully overcome the integration and cohesion processes, then the moment arrives where the sensation of unity, the awareness of themselves as a whole, allows them to reach solutions that until then they were not even capable of seeing. If resources are pooled for the benefit of the group rather than a sub-section of it, and if the assignment of resources is to serve both individuals and the group rather than a sub-section, then new solutions appear. In fact, it is not that solutions had not existed; it is merely that they had not been seen.

The team understands that individual and group interests need not necessarily conflict; it is the use of resources with individual interest that clash. They understand that interdependence forces understanding, that they have to look for balance and that this is the result of dispersed individual decisions but with the same focus. The objective of the group becomes the beacon that shines a light on the strategy that guides the navigators - who react to local circumstances tacitly, according to clearly defined criteria.

Communication is fluid between them; they interchange warnings that can naturally benefit the neighbour, they know the global and particular problems of each department, they adapt their decisions to events without that being seen by others as aggressive or making an individual stand. Mutual consideration is common between equals, but they recognise differences and try to complement each other to compensate for possible consequential weaknesses.

They understand that in an interdependent system, the best individual option is the one that also benefits the group.

To the contrary, groups that maintain individual strategies to the end are either not capable of achieving the results or they fall well below the average.

7.2 Observation variables

When groups become a team and act with a single conscience, the feeling of cohesion allows them to adopt a common approach to solutions, but their implementation needs to be through an agreed set of procedures. In a constantly changing complex situation, like that created by the simulator, it is not possible to establish centralised coordination mechanisms - so the team needs criteria more than instructions. The equal relationship and criteria of action are the observation variables in this process.

1) 'Equal relationship' is the first variable of self-coordination. It is the consequence of mutual consideration and respect. It means the valuation and acceptance of different positions, organised non-aggressive discussion, construction instead of imposition, conviction more than submission.
2) 'Criteria of action' is the second variable. It is the consequence of the definition of criteria, of its unification and the establishment of another alternative. It implies an identification and evaluation process to fix and unify common action criteria; nevertheless, it should have an alternative available in the case of being inadequate.

7.3 Systems and complexity

7.3.1 Definition of system

A system is a group of interacting, interrelated, or interdependent components that form a complex and unified whole. That said, a system is more than the sum of its parts; it is the product of its interactions (Kauffman, 1980)[34].

A system is, therefore, a series of interrelated and interdependent elements that have their own differentiated global sense. Its fundamental characteristic is the synergy in that the whole is larger than the sum of the parts.

7.3.2 Systems thinking

Systems Thinking is an area of study that emerged because of the so-called Macy conferences between 1946 and 1953. It is an emerging discipline, resulting from the interdisciplinary group of scientists coming from such diverse fields as biology,

[34] This definition, repeated in many works, is occasionally wrongly attributed to Russell L Ackoff albeit indicating 1980 as a reference year. Its true author, Drapper L Kauffman, included it in a modest book (Systems One) that was intended to be to be an introduction to systemic thinking for schools. Anecdotally, I would say that its cost at the time was no more than ten Euros. Currently, on the second-hand market, it would cost over 80 Euros. Despite the existence of more complete and profound books about the theory of systems and systemic thinking, it is still, after 40 years, one of the most used references in management seminars. There is a second book (Systems Two) that was written originally as a second part of a common volume called Systems Thinking, but which the editor decided to separate to give way to a collection (The Future Systems Series) that, as far as I know, did not continue.

anthropology, mathematics, psychology, and psychiatry. The most well-known figure is, without doubt, Karl Ludwig von Bertalanffy, an Austrian biologist who, in 1950, published in the British Journal for the Philosophy of Science, Vol. 1, Nr. 2, 'An Outline for General Systems Theory'. Nowadays it is seen as a key piece for studying and understanding both complexity and change, and it is applied in fields such as engineering, computer science, epidemiology, information sciences, health, company management and environmental management.

7.3.3 Principles of Systems Thinking

Virginia Anderson and Lauren Johnson summarise the universal principles of systems thinking as a framework for their theory and practice (Anderson & Johnson, 1997):

- **Big Picture.** The focus on systems helps to be able to see the globalism (the forest) at the same time as the elements (trees) (Senge, 1990). Any situation or problem can be referred to a higher system.
- **Short and long-term.** Short-term orientation, permanent crisis management, the focus on immediate results, can all endanger long-term survival. Certainly, there are times when priority should be given to making immediate decisions, but it is equally certain that a relentless focus on the short-term can lead to the death of an organisation.
- **'Soft' indicators.** This principle indicates the existence of more factors than can be seen. The most well-known business indicators like the KPI (Key Performance Indicator) of the CSF (Critical Success Factor) or even the Balanced Score Card might reflect only a part of a situation.
- **The system itself is the cause.** This principle establishes that we contribute to the appearance of our own problems. Occasionally it will be our strength that provokes weakness, our specialisation that generates our shortcomings, our rich background that will be the cause of our limitations; our knowledge will be the origin of our ignorance. Cause-effect relations cease to have any sense as such and can be the cause-and-effect at the same time.
- **Time and space.** Cause-effect relations are not direct, and they do not have to be near either time or in space; there can also be indirect relations. Many problems today are related or are consequences of the solutions of the past (Senge, 1990).
- **Systems versus symptoms.** A problem cannot be resolved without understanding the system that generates that problem. Some tools, like the Diagram of Kaoru Ishikawa (Ishikawa, 1994), better known as the Fish Diagram, allow us to analyse the roots of problems by delving deeply into their causes.
- **Multi-causality.** Frequently there are a multiplicity of causes for any given problem or situation. This principle especially contradicts the culture of the 'recipe' or sole solution that prevails in a large part of our society. A problem

with multiple causes must be treated with discriminating criteria, understanding the problem as a whole.

7.3.4 Simple and complex systems

We could say that the complexity of a system is related to the amount of information necessary to describe it, the possibility of predicting any event or the forecast of its behaviour (Gell-Mann, 1995). The fundamental difference between a simple system and a complex system is therefore based on the richness of behaviours.

The Mediterranean forest, with its variety and wealth, needs much more information to be described than the Amazon rainforest. The complex system has a wider variety of possible behaviours, and at the same time, is less predictable. It is more difficult to manage and tends to be simplified to make it more manageable when really its complexity should be managed to retain its wealth.

Gomez and Probst have defined three different types of problems (Gomez & Probst, 1999):

> Simple problems: few variables with few interrelations between them (simple is not necessarily the same as easy).
>
> Complicated problems: many variables with a relatively high number of cross relationships. Stable structures with few dynamic behaviours (it is the world of operations research).
>
> Complex problems: complicated problems in which the interaction between variables changes with time (dynamic systems).

In a complex system, one can understand the whole despite not understanding the details. In a complicated system, one cannot infer general behaviours (belonging to the whole) despite understanding the details. (McMaster, 1996).

Some of the characteristics of complex systems can be described as follows:

- **A large number of interacting elements:** A complex system has many interrelated and interdependent elements.
- **Relations are not linear:** In a linear system, one cause has only one effect.

  In a nonlinear system, one cause can have different effects and vice versa. Interactions are so complex that the direct relations between cause-and-effect disappear. Cause-effect relations cease to have any sense as such and can all be cause-and-effect at the same time (although retrospectively direct relations can be seen).

  Complexity Theory (see paragraph 7.3.6 below) shows us that complex systems can give way to emerging behaviours because they have no linearity. The size of the cause is not related to the size of the effect. A multiplying

factor is created that causes small interventions or modifications of the system to produce large results and vice versa. Through its departments, workgroups, and together with its environment, a company becomes an interacting system with multiple relations in which small causes can have large effects and vice versa.

- **Relations are not proportional.** Relations are not proportional: small causes can have large effects and vice versa. A nonlinear system does not vary with inputs: the result is unpredictable.
- **Relations contain feedback loops.** We define feedback as a series of system information outputs that, when incorporated as inputs into it, can modify it. This concept is fundamental if the system is to be adaptable. Feedback loops can be either positive - if they amplify the system behaviour introducing changes - or negative if they reduce system behaviour to maintain their stability.
- **Complex systems are open.** An open system communicates and interacts with the environment. It appears to be more unstable, although really it is taking 'order' from that environment through interchange, improved flexibility, and adaptable evolution. A closed system may seem more stable and controlled when, in reality, it tends to overprotect, stagnate, and ultimately disconnect from the environment.
- An open system has effective feedback loops while a closed system has no feedback loops. An organisation will adapt better or worse to changes in its environment, according to the number of subsystems that work like adaptable systems. For example, if general management alone works within this model, the company will never overcome internal resistance and adapt itself accordingly for the greater benefit of the whole company. An organisation like that would be displaced by a competitor that works mainly with an adaptable complex model. In the environment in which we are currently moving, and in which we will continue to move in the future, a company organised around a mechanical scheme will not be able to compete with one that does so around a systemic and adaptive scheme.

7.3.5 Complex Adaptive Systems (CAS)

An adaptable system is that which has the capacity of evolving, adapting itself to its environment as if it were a living organism. Groups of people are adaptable complex systems, and many of their functions have nonlinear, recursive, systems relations. From this viewpoint, a group could be defined as a series of adaptable, dynamic, coordinated, and limited relationships between its members, tasks, and tools, (Arrow, McGrath & Berdahl, 2000). A group would be a system if:

- Its members consider themselves as members of the group.
- They recognise and distinguish the non-members.
- They feel connected with other members and with the project.
- They coordinate their behaviour in the search for collective projects.
- They coordinate the shared use of tools, knowledge, and other resources.
- They share collective outcomes (both rewards and costs).

Delay in a system is caused by the time that passes between when an action or intervention in the system is produced its result. As it is not possible to build complex systems without delays, we should try to reduce the delay as much as possible and clearly understand its existence, so that we do not prematurely judge measures as incorrect if sufficient time has not passed. Therefore, we should anticipate events and apply the necessary measures in the organisation to reduce the impact of the delay in time.

7.3.6 Complexity Theory

Contemporary Complexity Theory (and the overlapping but separate Theories of Chaos and Self-Organisation) are centred on interest in CAS. Complex adaptation is characterised not only by the high degree of interaction between the components but also by the way these are interactions, how they are organised and how they generate nonlinear results. If linear systems are predictable, complex systems are characterised by the appearance of emerging behaviour patterns. The emergence refers to the process by which structures appear at a global level resulting from local level interactive processes. However, the Theory of Complexity is centred not only on local interactions but also on interactions based on relatively simple rules[35]. Emergence implies novelty in the sense of new patterns appearing, and it is not predictable in the sense that we cannot anticipate the future state of a system from the initial conditions (Mihata, 1997).

Just as Agustí Canals Parera indicates in his doctoral dissertation (Canals, 2005), there are different approaches to the study of complex systems. McKelvey (cited by Canals, 2005), for example, proposes a distinction between the two main schools: European and American. The European school is centred, fundamentally, on physical sciences and is best represented by Ilya Prigogine or Klaus Mainzer. The American school, mainly represented by the Institute of Santa Fe, is centred more on social sciences and, in turn, as argued by Stuart Kauffman or Murray Gell-Mann (see The Quark and the Jaguar and What is Complexity?)[36].

[35] In this sense, I recommend entering ICOSYSTEM http://www.icosystem.com/game.htm to try the famous Icosystem game. Here we see how a simple change of rules, which are already very simple, changes the game radically (consulted in June 2009).

[36] Available on-line through the Santa Fe Institute at http://www.santafe.edu/~mgm/Site/Publications_files/MGM%20116.pdf (Consulted in June, 2009)

In terms of groups, when considering them as complex, it is equivalent to considering the number and variety of identifiable regularities in the structure of group behaviour, down to a certain level of detail, which has certain implications. (Arrow, McGrath and Berdahl, 2000):

1. The structure and behaviour of groups at the same time include regularities (that contribute to complexity) and risky elements.
2. Group behaviour includes interactions on at least three levels: Constitutional elements of the group, the group as an entity and the context in which the group is set.
3. The structure and behaviour of groups change as time passes; this involves temporary development plans.
4. Given that groups change with time, they tend to become more complex, which means that the number and variety of structural regularities proliferate.

7.3.7 Relation between teamwork and complexity

To understand the group dynamics generated in this research, we should start with the fact that social organisations, like companies, industries or clusters, are CAS (Bettis & Prahalad, 1995).

The present work uses a group dynamic that, in the terms coined by Stafford Beer, we could classify as a Probabilistic Complex System (Beer, 1985); this means a complex system that, although possible to describe, is predictable only on probabilistic terms. Using the same terms, we assume that, in turn, the company is a Highly Complex Probabilistic System: that is to say, extraordinarily complex and impossible to describe in detail, whose behaviour can only be predicted in a probabilistic manner. The group dynamics generated in the courses and the company, therefore, will be parallel exercises whose difference is due to the study conditions of the first. By trying to relate the main activity of the group in the first system, we will also find a valid relation for the second one.

The evolution of the group in the training course (T-Group) coincides with the process of group development reflected by other research that related it to complexity. In a model derived from the Kauffman Research, Campbell, Flynn, and Hay identify three group development states with three transitions from the Theory of Complexity: order to chaos, chaos to complexity, and complexity to order (Campbell, Flynn, & Hay, 2003).

> The first state, order, is marked by predictability. The patterns of the interactions are structured and controlled. The innovations or perturbations introduced by the individuals or subgroups have a reduced effect on the general behaviour of the group; this is equivalent to the principle of course dynamics when, before starting, everything seems familiar and easy due to the connection that participants make with well-known board games.

The second state, chaos, is dramatically unpredictable and very sensitive to any perturbation in the system produced by unexpected changes in behaviour. In this case, parallels exist with the first cycle when, once the game starts, participants become truly aware of the enormous difference generated between what is expected and reality. No rule seems to exist, there is no resemblance to anything known, no model is valid, and every attempt ends in frustrating failure.

The third state, complexity, occurs when the group moves from chaos to a place 'on the edge of chaos' where it begins to introduce order. Complexity appears with the introduction of simple rules. This process occurs in the course when knowledge, task specialisation and identification of relations allow the group not to dominate but perhaps be moved by the simulation.

With time the introduction of order in the system makes it organised and structured. Participants establish limits, restrict the effects of new information inputs, develop negative loops that limit the change and tend to maintain stability - making the system more predictable; this occurs at the end of the course but implies a negative effect. The group becomes excessively structured, overlooking the changing environment, thus losing adaptability and, more seriously, turning to the point of not contemplating contingency plans in their analysis and strategies.

7.4 The Cynefin Framework

One of the models that has most impressed me and that I consider best explains the amalgam of concepts around systems and complexity that comes with the experience of the Synergy simulator is the Cynefin Framework (Kurtz & Snowden, 2003). Cynefin is a Welsh word meaning 'a meeting place of multiple affiliations', in the sense that all of us 'individually and collectively' have varying roots such as cultural, religious or geographic. We could translate Cynefin as 'connection'; it is pronounced ku-nev-in.

Cynefin is based on three contextual complexity circumstances of human systems:

- Humans are not limited to only one identity. We humans interchange identities or roles dynamically either individually (as father/mother, husband/wife, son/daughter) or socially (boss, religious community member, neighbour, social, client, or supplier).
- Humans do not limit their actions in accordance with pre-determined rules. We humans are capable of collectively creating interaction structures that generate new rules that make our actions predictable. Examples of how questions of intentionality play a large role in human patterns of interaction are: groupthink, rumour, self-deception, manipulation, confusion, internal conflict, stress, the deliberate ambiguity, charisma, and cults, among others.
- Humans are not limited to acting in accordance with local patterns. We can communicate abstract concepts through language by using large scale patterns. The growing concern for the environment and sustainability is an example of how global emergent behaviour patterns have a scale of awareness that goes beyond the local, acting as reinforcement of interactions.

The Cynefin Framework identifies four different comprehension frameworks based on the three ontological [37] states called order, complexity, and chaos. These four frameworks are grouped into two ordered states: simple and complicated domains, and two unordered states: complex and chaotic domains (see Figure 15). A state of disorder will exist between these domains, reflecting the lack of clarity in their situation.

The model is a sense-making framework and not a categorisation characterised by quadrants and axis. Nevertheless, I represent it here as four quadrants to facilitate its comprehension. Thus, in the first quadrant, we would have the state of order characterised by simple linear systems. The second quadrant would still identify a state of order, but with a higher level of complication. The third would then be of the unordered side and therefore neither clear nor direct. They are complex systems. Finally, in the fourth quadrant, we have the chaotic domains. Disorder, unlike direct and emerging order, does not exist clearly or covertly – it would appear in a central position in the diagram.

In the original, it is represented like a continuous three-dimensional space that slightly decants from my first quadrant to the fourth. The result provokes a type of step that represents an added difficulty to evolution between the fourth and the first domain.

[37] Ontology refers here to the nature of reality and is equivalent to saying 'main or primary states'.

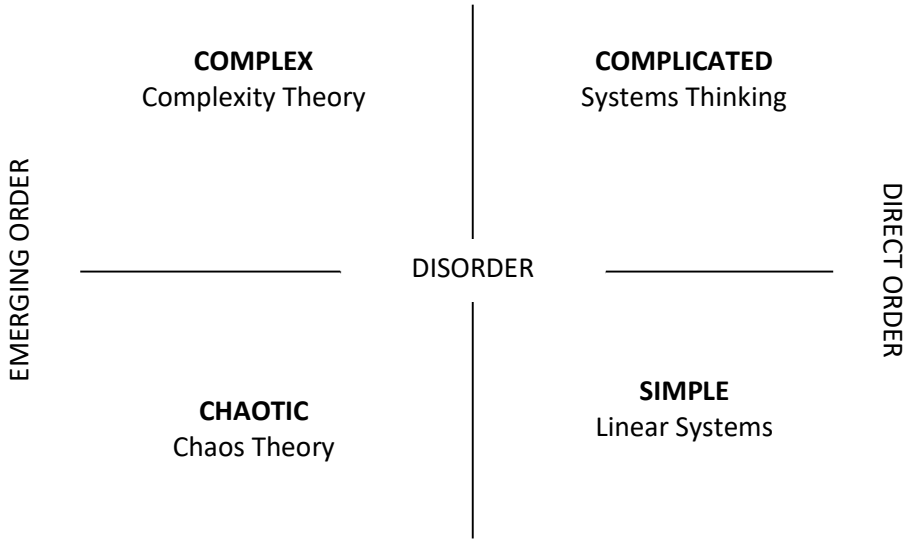

Figure 15 The Cynefin Framework

	Characteristics	Strategy	Decision
SIMPLE	Linear, empiric and indisputable cause-effect relations. The structure restricts agents (person or thing with a capacity to act). It is the field of process engineering, or problem resolving. The whole is the sum of the parts. System optimisation is reached by optimising the parts. Known knowns (things we know we know). It is centralised.	Strategy: establish a protocol search for efficiency, the best practice. The structure conditions the behaviour. Task assignment, output control using explicit measures.	Sense, categorise and respond. 'Best Practice'.
COMPLICATED	Existing cause-effect relations, but not fully known or not by all. Dependence on experts, trust in their counsel. A separate diagnosis can be made of the intervention process. For example, the repair of a technologically advanced car. It is the field of Systems Thinking, organisational and adaptation. Known unknowns (things we know we do not know). It is centralised.	Management with advice from experts. Planning in accordance with scenarios, structuring techniques.	Sense, analyse and respond. 'Good Practice'.

	Characteristics	Strategy	Decision
COMPLEX	Cause-effect relations exist but the number of agents and relationships make it impossible to define, calculate anything or apply a procedure. Emerging patterns are given as a consequence of the interactions that can be perceived but not foreseen. Retrospective coherence: once the pattern is established it appears as logical, but it is only one of the possibilities (we can learn from the past, but the past is never repeated unless by accident). Co-evolution: agents and system evolve by means of their interaction. The diagnosis is an intervention in the system and therefore modifies it. As an example, we can cite a climate survey that tries to diagnose a given situation but, just doing generates expectations and reactions that affect the employment climate. Theory of Complexity. Unknown unknowns (things we know we ignore). It is decentralised.	Manage the emergence by defining limits and allowing the appearance of patterns through the creation of the necessary conditions and sufficient stimuli (semi-structured constrain). Distributed Cognition. Decentralisation, multiple perspectives, communication diversity, an open-minded attitude, access to information. Detect patterns (global vision and weak signs[38]). Large projects (attractor: that which stimulates or catalyses toward a point or an area). Examples of projects (attractors) are large events like the Olympics or Universal Exhibitions. There are also large events, a company going public. 'Safe-fail experimentation' versus 'fail-safe experimentation'.	Probe, sense and respond. 'Emergent Practice'.

[38] A weak signal can be the one that does not adequately fit into the foreseen order. The first time it is detected can be causal, the second confirms and the third is evidence. It is a matter of identifying it as soon as possible. One of the mechanisms that focuses the attention of the human being is surprise (Simon, 1997). Urgency, stress, and pressure to obtain results are on many occasions an inhibitor of our sensitivity toward discontinuities, so that instead of paying attention to what does not fit in, we ignore it, looking for alleviation of what does fit in.

	Characteristics	Strategy	Decision
CHAOTIC	If cause-effect relations exist, they are not perceivable. Agents do not have action limits. The system is turbulent; there is nothing to analyse and waiting for the emergence of patterns is a waste of time. Action should be quick and decisive to reduce turbulence and generate order. Chaos is temporary. Theory of chaos. Butterfly effect[39] (amplification of errors that can appear in the behaviour of a complex system). Unknowables. It is decentralised.	Managing innovation. Optimal conditions: • Hunger, necessity, absence of resources. • Time pressure, stress. • Perspective, vision. An example of this in car-manufacturing can be seen in supply companies. To secure contracts for new models, which are usually for five years, they sometimes offer cars for sale at below cost price. The challenge then is to reduce production costs as soon as possible to recover the initial losses. To do this, they launch extensive collective innovation programmes at all levels. At the end of the contract period, the technological advances introduced already represent an advantage over their competitors. Acting naturally is not necessarily the ideal thing. Natural actions versus correct ones. Multiple attractors around which order emerges.	Act, sense and respond. 'Novel Practice'.

Table 21 Cynefin Framework Characteristics

[39] NOTE: The term 'butterfly effect' has built up over the years, starting from the works of the mathematician and meteorologist Edward Lorenz, a pioneer of the chaos theory. In trying to define a series of mathematic equations that would allow him to make meteorological predictions, he discovered (with the help of the new and powerful computers of that era) that small variations in the starting values gave way to completely different predictions. One of the models he studied showed a graphical representation in the shape of a butterfly that he initially called 'strange attractor' and that nowadays is known as the 'Lorenz attractor'. Lorenz confesses that he used a seagull as a symbol of *sensible dependency* (a fundamental condition of chaotic systems according to which these are sensibly dependent on the changes in starting conditions). Later, in a discussion at the 139th meeting of the American Association for the Advancement of Science in Washington DC, on 29 December 1972 (where he presented in the session dedicated to the Global Atmospheric Research Program), the title of The Butterfly Effect was adopted. It was the meteorologist Philip Merilees, the Congress President, who changed the title of the Lorenz conference '*Predictability, The flap of butterfly's wings in Brazil, caused a tornado in Texas?*' because he could not check it with him (Lorenz, 1995). Since then, other authors have collaborated in identifying the butterfly effect as an icon of chaos theory in the same way that tossing a coin is a means of randomness. As a result, we can define the Butterfly Effect as 'small variations in the initial conditions of a dynamic system can produce large variations in the long-term behaviour of the system'.

Some key concepts of complex systems are worth considering as well (Browning & Boudès, 2005):

1. Accepting complexity is always better than trying to flatten it with planning models.
2. It is important to admit failure and learn from it.
3. Self-organisation is a type of order that does not have a director or hierarchal designer but, rather, emerges through the interaction of many entities.
4. Conformity brings risks. Therefore, diverse inputs are needed to respond to complexity.
5. Action is valuable under complex conditions, and communication is a type of action.
6. Focus should be centred on small wins and how these affect complex systems[40].
7. It is important to understand the irony of bureaucratic control, according to which the attempt of such control, on occasions, produces effects contrary to those desired.

All that leads us to some important conclusions:

- Relaxing the assumption that order in management implies accepting that not all effective solutions are efficient.
- Human groups need to be effective; machines and structured human interactions (processes) need to be efficient.
- The appearance of behavioural patterns can be assumed as intentions when, in reality, they are not. The assumption of intentionality can be the cause of converting them into intentions.

[40] Small wins are defined as small essential steps that have the potential of affecting the direction of understanding of large systems. They are concrete results of moderate importance (Weick, 2001).

7.5 Equal relationship

Communication is an essential element in systems. Communication in symmetry[41], on equal terms, is a fundamental element of collaboration. Mutual respect and consideration are two easily recognised factors whose emotional impact is key to motivate cooperation

The GEI uses communication of appreciation, consideration, and respect as affective orientation. Through that, the members of the group communicate that their group values the presence and contribution of each one of its members. In a study of 67 work teams, Druskat and Wolff found that an affective orientation contributed to effectiveness and increased the sensation of security, cohesion and satisfaction among the members who, in turn, facilitated carrying out the tasks (Druskat & Wolff, 2005).

7.6 Criteria of action

In pursuing a proper self-coordination, it will be necessary to define and agree action criteria. Beyond that, we should identify a contingency plan as alternative criteria because in complexity, though necessary, any plan is only initially admitted as just one of the possible valid options. The adequate criteria, therefore, would be one that complements the planning with feedback control, flexibility, and the capacity to react.

The definition of the criteria for action is the main element in making decisions. Therefore, we can identify the making of decisions as the manifestation of these criteria. In complexity, the capacity for establishing criteria and making decisions is not easy due to the rationality of individuals being bounded by the information they have, the cognitive limitations of their minds, and the finite quantity of time they have to take decisions (Simon, 1997). Simon faces this bounded rationality with the objective rationality of an economic man taking the following three steps:

1. Analysis of options as possible alternatives.
2. Prevision and consideration of the consequences derived from each option.
3. Establishment of a system of values as a criterion of selection.

This process is faced with at least three limitations:

1. Rationality requires full knowledge and anticipating the consequences of each option.

[41] Communication in symmetry (equality) is especially useful in common development and analysis processes, which does not mean that it can coexist with communication in complementarity (inequality) when it means transferring views or objectives. Communication in symmetry is expressed through motivation while communication in complementarity is through demand.

2. Values subject to the consequences, as these occur in the future, can only be anticipated imperfectly.
3. Rationality requires being able to choose among all possible behaviours, and only a few of them can be anticipated.

For that reason, and the fact that a human being can only know a fraction of the knowledge that surrounds an action, a strictly rational decision is not possible. Alternatively, the administrator (in terms of Simon) should satisfy more than maximise, without examining all the possible alternative behaviours and assuming that those are in fact 'all' the alternatives.

In the lead article of the Harvard Business Review in November 2007 (which received an award from the Academy of Management), David Snowden prepared a leaders' decision-making guide proposing the following criteria according to the context (Snowden & Boone, November 2007)[42].

[42] This summary appears in the reference article (Snowden & Boone, November 2007).
For a deeper analysis see 'The new dynamics of strategy: Sense-making in a complex and complicated world' cost-free access at IBM Journal for Research and Development.
http://researchweb.watson.ibm.com/journal/sj/423/kurtz.html (Consulted in November 2008).

	The context's characteristics	The leader's job	Danger signals	Response to danger signals
Simple	• Repeating patterns and consistent events. • Clear cause-and-effect relations evident to everyone; right answer exists. • Known knowns. • Fact-based management.	• Sense, categorise, respond. • Ensure that proper processes are in place. • Delegate. • Use best practices. • Communicate in clear, direct ways. • Understand that extensive interactive communication may not be necessary.	• Complacency and comfort. • Desire to make complex problems simple. • Entrained thinking. • No challenge of received wisdom. • Overreliance on best practice if context shifts.	• Create communication channels to challenge orthodoxy. • Stay connected without micromanaging. • Do not assume things are simple. • Recognise both the value and the limitations of best practice.
Complicated	• Expert diagnosis required. • Cause-and-effect relations discoverable but not immediately apparent to everyone; more than one right answer possible. • Known unknowns. • Fact-based management.	• Sense, analyse, respond. • Create panels of experts. • Listen to conflicting advice.	• Experts overconfident in their own solutions or the efficacy of past solutions. • Analysis paralysis. • Expert panels. • Viewpoints of non-experts excluded.	• Encourage external and internal stakeholders to challenge expert opinions to combat entrenched thinking. • Use experiments and games to force people to think outside the familiar.

	The context's characteristics	The leader's job	Danger signals	Response to danger signals
Complex	• Flux and unpredictability. • No right answers: emergent instructive patterns. • Unknown unknowns. • Many competing ideas. • A need for creative and innovative approaches. • Pattern-based leadership.	• Probe, sense, respond. • Create environments and experiments that allow patterns to emerge. • Increase levels of interaction and communication. • Use methods that can help generate ideas: open up discussion (as through large group methods); set barriers; stimulate attractors; encourage dissent and diversity; manage starting conditions and monitor for emergence.	• Temptation to fall back into habitual, command-and-control mode. • Temptation to look for facts rather than allowing patterns to emerge. • Desire for accelerated resolution of problems or exploitation of opportunities.	• Be patient and allow time for reflection. • Use approaches that encourage interaction so patterns can emerge.
Chaotic	• High turbulence. • No clear cause-and-effect relations, so no point in looking for right answers. • Unknowables. • Many decisions to make and no time to think. • High tension. • Pattern-based leadership.	• Act, sense, respond. • Look for what works instead of seeking the right answers. • Take immediate action to re-establish order (command-and-control). • Provide clear, direct communication.	• Applying a command-and-control approach longer than needed. • 'Cult of the leader'. • Missed opportunity for innovation. • Chaos unabated.	• Set-up mechanisms (such as parallel teams) to take advantage of opportunities afforded by a chaotic environment. • Encourage advisers to challenge your point of view once the crisis has abated. • Work to shift the context from chaotic to complex.

Table 22 Decisions in Multiple Contexts

7.7 Summary

When a group becomes a team and has a unified conscience, the feeling of cohesion allows them to approach problems together and generate solutions, although they still need to be implemented through an agreed set of procedures. In the ever-changing complex situation caused by the simulator, it would not be possible to establish centralised coordination mechanisms, so the team needs criteria more than instructions. Criteria and common consideration are the observation variables in this process.

1) 'Equal relationship' is the first variable of self-coordination. It is the consequence of common consideration and respect. It means the valuation and acceptance of different positions, organised non-aggressive discussion, construction instead of imposition, conviction more than submission.
2) 'Criteria of action' is the second variable. It is the consequence of defining the criteria, of its unification and the establishment of another alternative. It implies an identification and evaluation process to fix and unify common criteria of action that, nevertheless, should have alternatives available in the case of being inadequate.

Process	Variables	Observations
Self-coordination	Equal relationship.	Common consideration. Respect.
	Criteria of action.	Definition of criteria. Unification of criteria. Alternative criteria.

CHAPTER 8.

THE COOPLEXITY MODEL

8.1 Introduction

In observing the behaviour of different management teams, I identified three fundamental processes in their action.

The first relates to the acquisition of knowledge through learning; this is neither independent of the environment nor isolated from the other members. Learning involves a circular gestation process and comparing hypotheses that include relationships with others. Therefore, experimentation is the key to building knowledge. The observation variables were as follows:

Process	Variables	Observations
Knowledge acquisition	Proactivity oriented to results	Obtaining data Making action decisions Control of objective
	Proactivity oriented to relationships	Interaction Interchange Relationship

Table 23 Process of Acquisition of Knowledge

The second process concerns group cohesion. Integration of the group and generation of trust is produced around the group's attempt to achieve a common objective. At this evolutionary moment, the existence of a common project becomes the motive for cohesion.

Process	Variables	Observations
Integration and cohesion of the group	Group integration	Cooperation Normalisation Implication
	Trust generation	Equality Generosity

Table 24 Process of Group Cohesion

In the third process, collaboration is shown at its highest point and coordination is the key to efficient performance. Shared leadership is essentially the result of emergence at this level. Here the team reaches an ability to function in a totally interdependent

manner resulting from the action initiatives that it has been taking when exploring ways of collaboration and possible joint actions. With a higher number of interconnections, this shared leadership appears more easily - and with that, the team's capacity to self-coordinate.

Process	Variables	Observations
Self-coordination	Equal relationship	Common consideration Respect
	Criteria of action	Definition of criteria Unification of criteria Alternative criteria

Table 25 Process of Self-coordination

It is around these fundamental processes and these observation variables that I put forward the Cooplexity model of collaboration; as a result, it becomes a dynamic, evolving, cooperative and collaborative model that addresses situations of uncertainty and complexity.

8.2 The initial model: the 5 Cs

When I designed the team training course, I was certain that for it to be effective, there needed to be a close parallel between what happens in the classroom and the reality of company life. The choice of developing a simulator was not exempt from that intention. Therefore, the need to recreate a real and parallel dynamism to the situations and challenges, which a company faces with multidisciplinary teams, implied following a similar evolutionary process. I decided to start with ignorance and evolve to complexity, just as happens in the majority of project teams. From the first groups tested, it was immediately clear that my choice was right. Little by little, the teams' action exceeded the initial design beyond all expectations, such that I started to observe a repetitive scheme of behaviour. That was how, in a deductive manner, my starting point was formed; my initial model, now exceeded, became a five-dimensional model that I called 'Teamwork model of the 5 Cs'.

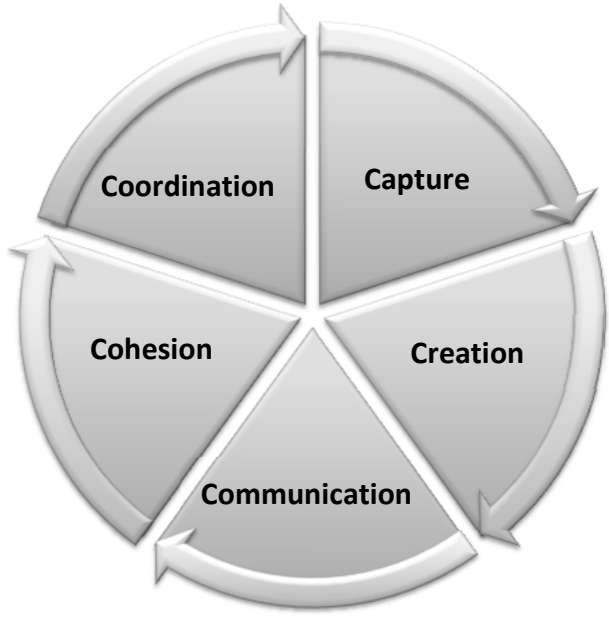

Figure 16 Phases of the 5 Cs Model

Phase I: Capture

The initial environment proposed was one of uncertainty; this meant that participants had little idea of how the simulator works and of the contents of the course. Despite receiving complete initial information, their level of abstraction and the absence (at that moment) of previous experiences, made their comprehension difficult. That is why the first activity observed could be nothing other than that of acquiring the basic knowledge that allowed them to perform. It is true that many groups gave indications of relating themselves and even of establishing some type of common action. Nevertheless, as they lacked the minimal knowledge to support those initiatives, they were immediately revealed as unfruitful and were abandoned. However, these attempts - or relationship - would be a key to creating team cohesion much later. I called this first phase *Capture*.

Phase II: Creation

On most occasions, participants prefer to 'wait and see'. That said, on other occasions they tested ideas, noting down information that appeared without knowing very well if it would be useful later. Regardless of the approach taken, sooner or later, teams started to show initiatives and to be proactive in experimenting. Their dependence on me as a facilitator decreased; they acquired knowledge about the fundamental mechanics of the game and started to generate hypotheses. These hypotheses were compared, confirmed, or rejected, in a continuous process of experiential learning. I called this

phase *Creation* in that it went beyond the mere recompiling of data and implied a voluntary act of experimenting.

Phase III: Communication

Participants begin to relate consciously and intentionally when they identify that, despite their advanced knowledge of the game's mechanics, they still do not reach the objectives. If they were unable to reach the target individually, even having mastered the game technically, something else must be missing. In this case, participants began a series of contacts to search for that 'something else'. Relationships intensified, they explored collaboration, they interchanged ideas, and they proposed joint action projects. I called this phase *Communication*.

Phase IV: Cohesion

While searching for joint actions, the game stopped being individual and became a common, motivating, challenging, stimulating project. A whole series of changes appeared in attitudes, in behaviours. This phase is, without doubt, the richest of all in terms of observable behaviours. The participants get up and mix, the physical limits of the teams disappear, information is requested and shown without the initial reservations, and ideas are spoken out loud in a collective brainstorming process. I call this magical moment of group integration, of building trust, of cohesion, of mutual identification as a single team *Cohesion*.

While the cohesion phase showed positive aspects, it was apparent that others were not. A whole series of rules appeared to confirm the cohesion process and clearly differentiate who was inside the group and who was not. Successfully overcoming these limitations will differentiate the teams in the next phase (the last) in that having a better game strategy makes them more effective and thus obtain better results.

Phase V: Coordination

The last phase reflected a complex process of planning. It was for deciding who does what, how and when. Once the team had resolved the knowledge problem and members had bonded from an emotional point of view, they still had to optimise their management to fight for the objective in the last cycle. That objective required the establishment of clear criteria, of detailed action planning by each team member and, in the most advanced cases, of establishing a contingency plan. I called this phase *Coordination*.

However, reaching that moment was not considered as the last opportunity to solve the proposed challenge. We have to consider that participants have passed through a maturity process and have invested sufficient time together, so there are maximum excitement and complete dedication. Now it is not only collaboration that is required; it is also necessary to organise it so that it can become productive.

8.3 The collaboration model

8.3.1 Complexity in Synergy

The entire analysis of the research refers to the environment built by the simulator, a context of increasing complexity over time, which represents the first axis of the model. For the study, we define complexity as a result of increasing levels of interrelation and interdependence.

Interrelation refers to the series of interactions that occur between team members and that evolve dynamically and consistently in time. Interdependence refers to the series of action initiatives that build the relationships of dependence responsible for achieving a pre-determined common result.

Interrelation and interdependency are very close to the classical ordinations around the person/relationship and the task/function. Some research in social psychology has been focused on the effectiveness of teams, showing that it not only depends on the ability of the team to work together interdependently and effectively but also on the interpersonal relationships and satisfaction level of its members (Hackman cited by Owens, Mannix & Neale, 1998).

A functional vision of teams indicates that a high level of effectiveness is the result of a variety of functions oriented to the task, together with other relationships. Regarding the first, teams should cover technical capacities, knowledge, expertise, and ability. Regarding the second, 'internal behaviour' refers to team values and behaviour rules (the capacity for working together, communication and resolution of differences and handling conflicts between others). In turn, external behaviour refers to the establishment of limits and access to external information and resources (Owens, Mannix, & Neale, 1998).

8.3.2 Temporary sequence in Synergy

Just as we saw when talking of the course, the simulation is divided into cycles, and each cycle tries to become a stop along the way that allows an analysis of experience. In turn, the research is built on a series of observations referred to in behaviour indicators. Significantly, these do not appear randomly but at specific points related to the particular activity type being carried out by the group. That allows me to refer each observation to the cycle in which it was identified. The analysis even manages to differentiate between observations that belong to those in which the team discuss the strategy to follow (moments before their turn in the game with the simulator) and those that occur when they put it into practice (their turn in the simulator).

If we temporarily refer the variables to each key process seen in previous chapters we get:

Process	Variables	Observations	Cycles					
Knowledge acquisition	Proactivity oriented to results	Obtaining data Making action decisions Control of objective	1	2				
			1	2				
				2	3			
	Proactivity oriented to relationships	Interaction Interchange Relationship		2				
				2				
					3	4	5	
Integration and cohesion of the group	Group integration	Cooperation Normalisation Implication		2	3	4		
					3	4	5	
					3	4	5	
	Trust generation	Equality Generosity					5	6
							5	6
Self-coordination	Equal relationship	Common consideration Respect		2	3	4		
				2	3	4		
	Criteria of action	Definition of criteria Unification of criteria Alternative criteria				4	5	6
							5	6
							5	6

Table 26 Temporary Sequence of the Observations

In Table 26, we can see:

1. The three processes, in any of their observation variables, start at the beginning of the activity - around the second cycle.
2. The three processes in any of their variables continue until the final cycles - the fifth or sixth.
3. The acquisition of knowledge is more concentrated in the initial cycles.
4. Cohesion clearly distinguishes the integration process in the intermediate cycles from trust generation in the final cycles.
5. Self-coordination also distinguishes the treatment between equals in the intermediate cycles and in parallel with the GI of the action criteria in the final cycles, and in parallel with trust generation.

Based on my experience I see a temporary evolutionary sequence between the first activities, fundamentally oriented to acquiring knowledge, a second oriented to integration and the cohesion that I situate in an intermediate stage, and a third (self-coordination) that reaches its maximum expression at the end of the simulation.

Nevertheless, it is true that both cohesion and self-coordination are emerging states and need certain conditions to appear. Trust does not appear immediately; it needs an integration process between participants. In the same way, self-coordination as an expression of a common and consensual action that needs common consideration and respectful treatment. In addition, both integration and treatment evolve in a parallel manner and are connected to each other.

8.3.3 Scopes of the model: individual, group and team

In that evolutionary process, and as complexity increases, each active subject is different. At the beginning, I identify individuals that later form a group that finally becomes team conscious.

Initially, they are **individuals** that experiment, investigate, compare, and learn. By individuals, I do not only mean an individual but rather a unit of independent decision. In this sense, the concept of individual scope would be related to agents that, in reality, could be departments, areas, factories, affiliates, companies, or any other group regardless of its size.

Next, these agents, that in the simulator are subgroups of three persons, form a **group**. This new situation differs from the previous one in that it groups several agents and adds relationships between them. In turn, the group continues exploring, searching for solutions, investigating, but also it does that by trying to find common points of support, help and complementarily mechanisms.

Finally, if the group has become consolidated and tight-knit, the **team** appears. The fundamental difference is that the group becomes conscious of itself as a new entity. Their characteristics differ from those that existed when they were a group in the sense

that their relationships become interrelated, they have a clear interdependence, they are conscious of how their decisions have a common effect, they consider each other and, above all, they have a common objective that should be built by the entire team. Their decisions are the result of a balance between individual and common positions and interests. In addition, all that occurs without friction, naturally and spontaneously and more like the result of an agreement rather than the result of a negotiation.

8.3.4 Levels in Synergy

When identifying the main processes which cause the evolution of the team and circumscribing them to the individual, group, and team scopes, we implicitly recognise three clearly differentiated levels.

Thus, at the individual level, the process of acquiring knowledge as a fundamental activity of the group in the early stages requires a previous level of development. The first moment of uncertainty, the experimentation and acquisition of knowledge, both of functions and relationships, is called the differential level.

After the knowledge has been acquired, the following level is the group cohesion process. In this group context, we see the first relationships of approximation that lead to the integration process and that are founded on the generation of trust.

Having passed the second level, the third - related to self-coordination - will centre all group activity on reaching the objectives based on their capacity of self-organisation. Autonomy, common action criteria, a decentralised decision-making process and distributed knowledge, all coincide with a tight-knit team, conscious of itself and with the necessary experience and knowledge to facilitate the emergence of leaderships and distributed initiatives that would lead to self-coordination.

8.3.5 Synergy catalysts

There was always a catalyst in the three identified levels capable of provoking or causing their evolution.

The first level, identified as individual scope, is fundamentally oriented to the acquisition of knowledge. In a known environment, someone or something is capable of transferring knowledge: Books, manuals, technical magazines, symposiums, conferences, courses, databases, protocols, programmes. There is a multitude of mechanisms for transferring knowledge. In the real world that knowledge can even be obtained directly by hiring experts, through collaborations and partnerships or even through mergers or acquisitions.

However, in an unknown environment, learning is done by experimentation. It is neither independent of the environment, nor isolated from the other members of the group. Here, learning is a circular gestation process of comparing hypothesis – and that includes relationships with others.

And if experimenting to learn is the leitmotiv of the first level, **proactive exploration,** oriented to both results and relationships, leads to experimentation - and with that, learning, especially in situations of uncertainty.

The second level, identified as group scope, occurs with group cohesion. Integration of the group and the generation of trust are produced around the group's attempt to achieve a **common objective**. At this evolutionary moment, the existence of a common project becomes the motive for cohesion. The effort that the group makes to convert the project into a common goal and to unite its interests, balancing their own with those of the group, is fundamental to team gestation.

Finally, **interconnections** are the self-coordination level catalyst in the team scope. For self-coordination to exist the creation of the necessary conditions that allow individual initiative and the appearance of spontaneous leaderships are fundamental. In self-coordination, the results depend largely on the capacity that the team has to manage complexity and identify opportunities and risks. Therefore, joint analysis, complementary viewpoints, the richness of approach due to diversity and spontaneous individual initiatives will be very important. Nevertheless, co-leadership is not something on which we can act directly. We should go around them, creating and managing the necessary conditions for them to appear. Those interconnections allow knowledge sharing by the agents, through their activity, their interests, their needs.

8.3.6 Communication in Synergy

Communication plays a fundamental role and has an impact on the whole group development process. Initially, it is key in proactivity oriented to relationships. Next, integration and cohesion are vitally important in the whole group cohesion process. Once again, equal relationships are the main character of self-coordination. That is to say, it is not an independent or isolated characteristic; neither constitutes a phase or level by itself. Communication happens throughout the whole process, from start to finish, becoming vitally important in the global evolution and being the second axis of the model.

The communication perspective, in this case, should be seen from constructivist and constructionist psychology viewpoints in that knowledge is obtained through self-experience.

Constructivism is oriented towards personality and educational psychology, while Constructionism is based on social and political psychology. Both schools of thought start from the same epistemological base,[43] given the thesis that knowledge consists of a psychological and social reality builder process, and the consequence that human behaviour is not biased but determined by the mentioned process (Munné, 1999)[44].

Paul Watzlawick proposed the study of communication from a pragmatic point of view. Being different from syntaxes and semantics, this would have to be considered as communication affects behaviour. Generally speaking, syntaxes would respond to problems in transferring information (codification, channels, capacity, noise, redundancy)[45] and semantics would refer to the meaning. Finally, semiotics would be the study of signs and language. Pragmatics uses not only words, their configuration, and their meaning, but also non-verbal concomitances and body language. Moreover, the context of communication would have to be added. The relationships between the transmitter and the receiver would be biased by communication (Watzlawick, Beavin Bavelas, & Jackson, 1967). Watzlawick considers that five axioms would cover all communication:

1. It is impossible not to communicate. In the same way that it is impossible not to behave and, accepting that all behaviour is a means of communication, one cannot not communicate. Neither can we say that communication is only intentional, conscious, or successful; it is always there when we interrelate.
2. All communication has a level of content and a level of relationship, in such a way that this latter aspect classifies the first, and therefore it is a metacommunication. We understand metacommunication when we use communication not for communicating as such but communicating about communication itself; it is not part of but rather about communication, meaning that all communication has, besides an intrinsic meaning of words, more information about the relationship between transmitter and receiver.
3. The nature of a relationship depends on the punctuation of the communicational sequences between the communicators. Both the transmitter

[43] Theories can be studied and organised in accordance with ontology, epistemology, and axiology. Ontology places emphasis in what is being examined, which is its true nature. The answer, generally speaking, can have three approaches: realistic (objective), nominalist (subjective) or constructionalist (real; it is what we agree to be real). Epistemology refers to how the examination is done. It studies the foundations and methods of scientific knowledge. The purpose of epistemology is to distinguish authentic science from pseudoscience, in-depth research from superficial. In turn, Axiology is the branch of philosophy that studies the nature of values and evaluative judgements.

[44] Accessible via portalpsicología.org http://www.portalpsicologia.org/servlet/File?idDocumento=2069 (consulted in June, 2009).

[45] Here we must mention the work of Claude Shannon and his Theory of Information, a mathematic theory that studies information and all that is related with it: channels, data compressing, cryptography and related subjects (Shannon & Weaver, 1949).

and the receiver of the communication will structure communication flow in a different way and, as a result, they interpret their own behaviour and that of the other, depending on the punctuation marks they establish.

4. Each interaction is also a stimulus, answer, and reinforcement, converting communication into a cyclic process.
5. Communication is, at the same time, digital and analogical. Digital communication refers to words and their agreed meanings (what is said). Analogical is all non-verbal communication (how it is said). And by non-verbal we do not only understand that which refers to body movement (Kinesics) but also posture, gesture, facial expression, voice inflexion, sequence, rhythm, word chaining and any other non-verbal manifestation adopted by we humans.
6. Communicational interchanges can be both symmetrical and complementary, depending on whether they are based on equality or difference. In a complementary relationship, there are two different positions. One occupies the higher, or main one, and the other the lower, or secondary position. These types of relationships are frequent in certain cultural contexts, such as a mother and son, a doctor and patient, or a teacher and student. Both parties are considered to be on the same level in a symmetrical relationship.

Based on what we have seen up to now, communication should be understood in the model to be the decisive factor in the relationships between the members and the one responsible for evolution through the different individual, group, and team scopes.

8.3.7 Graphic representation of the Cooplexity model

Given everything we have seen so far, I propose a theoretical collaboration model, which I call Cooplexity. The name refers to a Cooperation-Collaboration Model in Uncertainty and Complexity.

In Cooplexity, the three fundamental processes will be arranged in levels. Each level represents an objective to be reached for team development. Although we have seen the three levels overlapping in time, and therefore not forming independent phases, the differential activity of each level is indeed concentrated sequentially. From a pedagogical point of view, it is more graphic to draw the fundamental nucleus of the activity at each level as if it were an evolving process in time, starting from a common moment; this is how we represent that the construction of the three levels should be taken into consideration from the beginning and that all those group decisions help to do that, notwithstanding that the fundamental process of each level will require special attention when needed and taking into account the level of complexity that has been reached.

Thus, each level would evolve about two reference axes, one referring to the increase in complexity over time as a cause of the necessity of each level - and the other to the evolution of communication that makes the transition between levels possible. Both

axes start from a minimal common point. This point represents the minimum amount of communication necessary to apply to this model.

In each level, the observation variables will become factors, understanding these as causal elements of the level.

In the first level, *Knowledge*, participants develop an action-oriented to exploitation and based on initiatives. The factors of the first level are the 'Proactivity to results' and the 'Proactivity to relationships.'

As time goes by, members of a group will get to know the keys to their environment and will have the necessary abilities, albeit simple, to handle it adequately. Then they will enter the second level, that of *Cohesion*. Here, the 'GI' and 'Trust generation' will be their corresponding causal factors. The common project and joint effort to achieve it will be the motive.

The group will start to perceive itself as a unit and will become self-aware. Finally, the group will feel they are a team; they will commonly consider each other and will communicate in symmetry with respect, giving way to the 'Equal relationship' factor. The second level factor will refer to the definition and unification and, at best, the identification of a contingency plan. It is the 'Criteria of action' factor. The equal relationship and the established criteria allow *Self-coordination,* thanks to the communication flow through the interconnections between members.

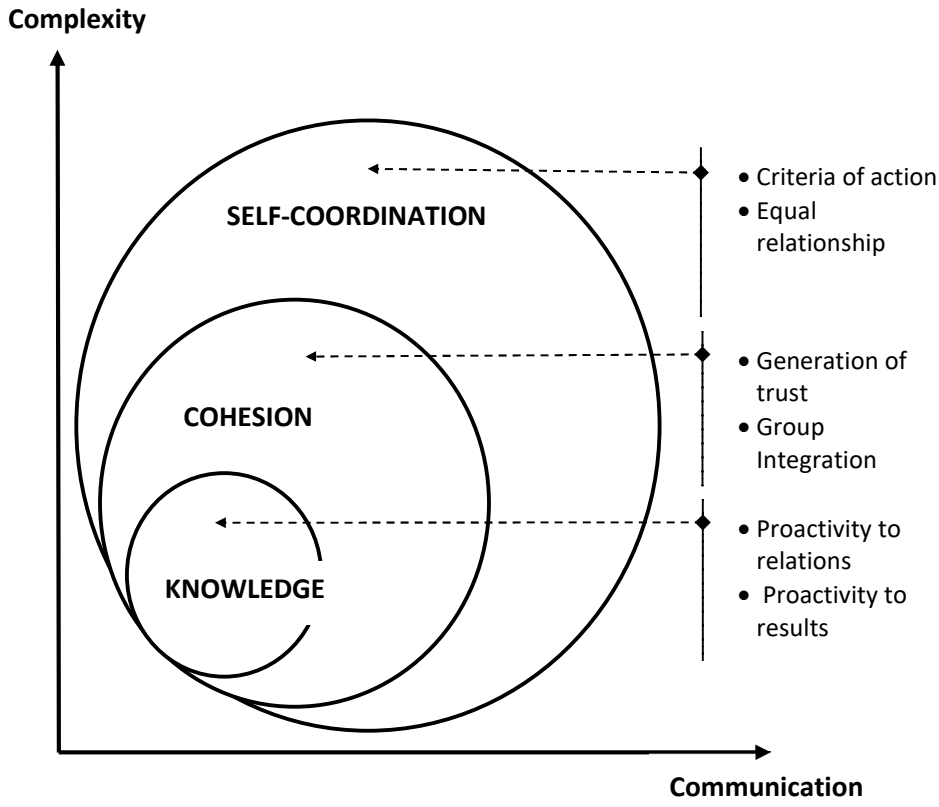

Figure 17 Graphical representation of the Cooplexity Model

8.3.8 'Teamworking Mix': EPIC

In addition to finding a graphic way to explain the model so that it is easily understandable and identifiable, one of my wishes was to find a simple way of transmitting what I understand to be the keys to its success: an easy way of remembering them, of understanding their mechanisms and their application.

That is why I call the group of the four essential catalysts of the model 'Teamworking Mix', identified by the acronym[46] **EPIC**:

*Let's **E**xplore, having a common **P**roject, and building **I**nterconnections, through **C**ommunication*

'Explore' freezes the fundamental action of acquiring knowledge in uncertainty, where the absence of information makes formation from already known or existing instruments less viable. It does not substitute but rather complements these other means (such as training, consulting, and publications), but it emphasises and concentrates knowledge level factors, proactivity to results and relationships. Likewise, it includes another aspect at this level, tolerance to failures and learning from mistakes, inherent to all experimentation and vital at the time of acquiring knowledge.

The framework of a '**Common project'**, includes facing day-to-day activities, maintenance, repetition. A project challenges, concentrates attention and resources, stimulates, and provokes. A common project is shared, helps team integration and trust generation. In terms of systems, it is an attractor that catalyses cohesion.

'**Interconnections'** covers points of encounter, interchanges, interrelations, interdependencies, all of which allow a team with knowledge and cohesion to self-coordinate themselves in a spontaneous, natural and voluntary way. A team whose agents are interconnected has the necessary links for information to flow. Information added to the commitment to cohesion favours flexibility and adaptation, reaction to possible risks and taking advantage of opportunities.

'**Communication'** is understood as a social interaction instrument, as a mechanism not only for interchange but also as a building process. When communicating, agents affect each other, giving rise to new realities constructed from these interactions. Communication from this perspective influences behaviour, and this, in turn, is a form of communication.

[46] An acronym is the use of initial letters that are pronounced as a word, for example: U(nidentified) F(lying) O(bject) (UFO). It is more useful for my purpose in this case because it uses the name of each catalyst and allows better identification of the final message.

8.4 Summary

Based on the above, I propose a theoretical teamwork model, which I call Cooplexity: A Cooperation-Collaboration Model in Uncertainty and Complexity.

Scope	Levels	Catalysts	Factors	Activities
Individual	*Knowledge*	Exploration	Proactivity oriented to results	Data gathering Decision-making Control of the objective
			Proactivity oriented to relationships	Interaction Interchange Relationship
Group	*Cohesion*	Common project	Group integration	Cooperation Normalisation Implication
			Trust generation	Equality Generosity
Team	*Self-coordination*	Interconnections	Equal relationship	Mutual consideration Respect
			Criteria of action	Definition of criteria Unification of criteria Alternative criteria

An acronym to help remember the keys of the model is **EPIC:** *let's **E**xplore, having a common **P**roject, and building **I**nterconnections, through **C**ommunication.*

CHAPTER 9.

QUANTITATIVE RESULTS

9.1 Introduction

This chapter details how the research was carried out and reflects on the hypotheses by discussing the relationship between teamwork and complexity as well as reviewing the supposed existence of phases.

The basis of the research is the observation of behaviour by company directors who were faced with the challenges presented in the course. Detail of a repetitive series of behaviour was collated and systematically compiled for analysis.

As the course evolved around a business simulator that measures results obtained by groups, later it was possible to relate the results with the behaviours of each group.

The results obtained after different statistical treatments indicate that effective teamwork in highly complex situations is significantly related to the results. The data does not indicate the existence of independent phases, despite it is showed a temporary sequence.

9.2 Fundamental concepts

9.2.1 Complexity

The first objective of this work was to decide up to what point there is a relationship between complexity and teamwork. Therefore, we should first define what is understood by complexity in the simulator.

The *complexity index* in the course is defined as the number of resulting interconnections derived from multiplying the average number of judged projects by the number of cycles of the average age of a judged project, by the average number of players with investment in them.

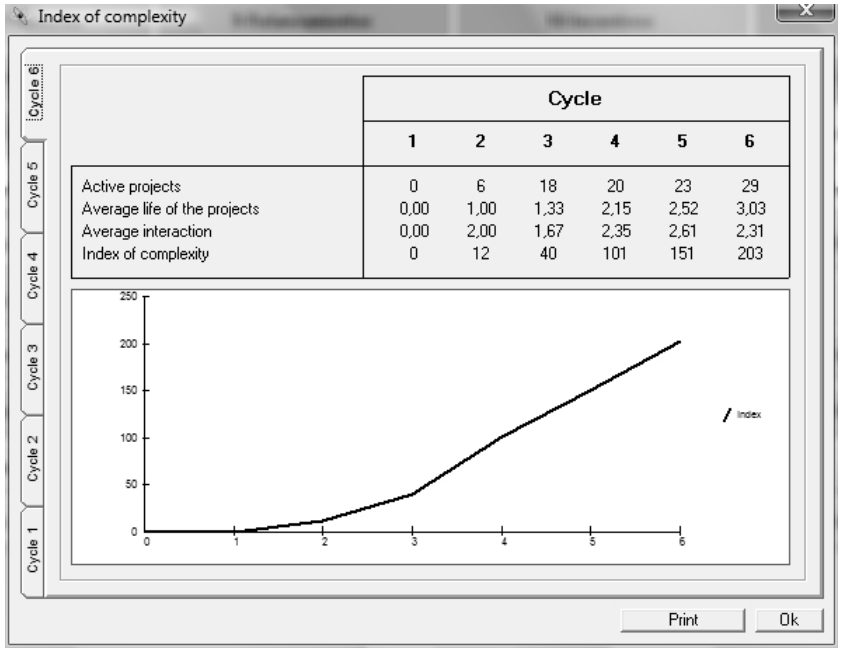

Figure 18 Complexity Index

In Figure 18, we can see how the index of a course of managers from Aguas de Barcelona (AGBAR) - chosen as an example - increases exponentially throughout the cycles. This index is only a part of the complexity potential that the simulation can reach if we take into account that throughout the six cycles players can have up to 65 active projects. Moreover, it is also affected if they play alone or in combination with others and in which order they play. Therefore, it is an environment that reproduces an exponentially increasing situation of complexity.

For the analysis, we will take it that the degree of complexity that each group reaches corresponds with to the last cycle.

9.2.2 Teamwork in Synergy

In this environment, teamwork is defined as the result of a set of collaborative decisions and behaviours capable of leading to a certain result.

9.2.2.1 Collaboration decisions

Decisions are measured using the game criteria implicit in the choice of projects. Playing certain projects and not others and playing them alone or together will make a clear difference between groups. The measurement of those decisions is done through the *interrelation index* that accounts for the number of commonly judged projects. Therefore, the interrelation index of a player would be the result of adding up the different multiples of the number of players by the number of projects judged by the

mentioned players. The '*Interrelation index*' would be the measurement of the four players.

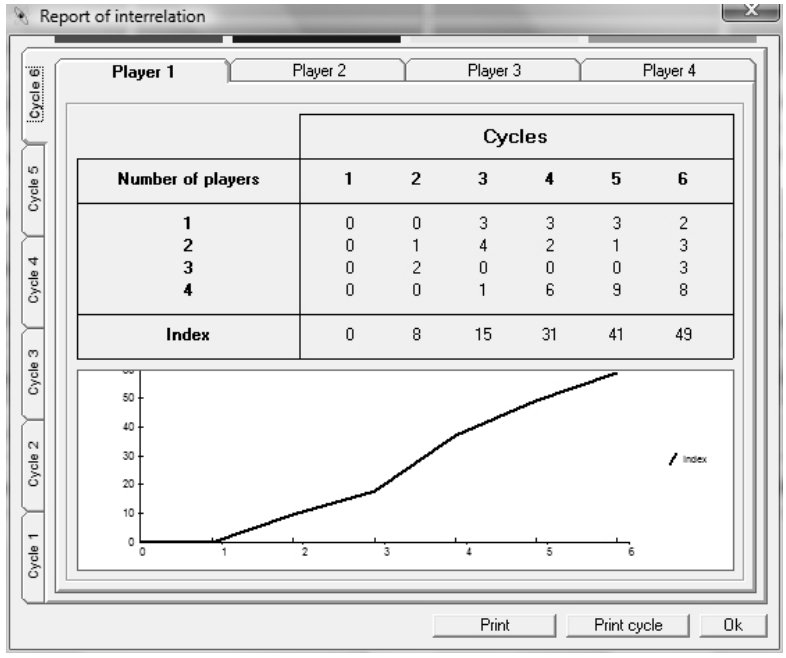

Figure 19 Interrelation Index

Figure 19 shows an example that corresponds to the same course of managers from AGBAR. The index of player 1 is obtained by (1x2) + (2x3) + (3x3) + (4x8) = 49. For the analysis, we will use the average of the data accumulated by the four groups of players in the last cycle.

9.2.2.2 Collaboration behaviours

Collaboration behaviours will be reflected in the group of observations taken cycle by cycle and in real-time. Each behaviour is first identified, and when its recurrence is confirmed, it was standardised. Once the cycle or cycles where it appeared were defined and to what degree or intensity, it was associated with a variable name. For the recompilation of data, a database was defined that allowed marking the moment the behaviour appeared. Using this process, no appearance meant a value of zero while its appearance was assigned a positive value according to the observed degree. The series of variables (see Annex A - Behaviour Indicators) later served to identify the group of collaboration behaviours necessary to complete the final formula.

Having taken the observations and referred them to their corresponding courses indicating the dates, company, participant, and other identity data, they were grouped.

To reduce the dimensionality of group variables, those in which the same behaviour was observed in different cycles were grouped. Using the statistical packet SPSS (version 15) the Categorical Principal Components method was applied using Optimal Scaling (because the variables are cardinal rather than nominal). The new series of variables included filtering of those that were not significant (see Annex B - Grouping of Variables). The percentage of explained variance, a measure of the quality of observable indicators (obtained by measuring the subjacent factor), was very high. Percentages ranged from 51.24% to 89.64% with component loadings (the degree of relationship between variables) from 0.641 to 0.947 (see the Annex C - Values Obtained by Means of Optimal Scaling).

As a result, the subsequent step allowed the application of Factor Analysis (FA) to identify the relationships. This step started from the initial theoretical model that, after some modification (suggested by the results obtained), finished with a combination of six factors (see Annex D Classification of Variables by Levels). The percentage of variance explained again was very high, going from 51.25% to 79.86% with component loadings from 0.601 to 0.894 (see Annex E 'Values Obtained by Means of FA').

Ideally, checking the model would have been finished by using the FA again to confirm its grouping by pairs, in the three final constructs that form the multidimensional construct of *Collaboration*. Nevertheless, this was not possible as it was a formative model rather than reflective (Bisbe, Batista-Foguet, & Chenhall, 2007).

In reflective models, the implicit causality direction goes from the construct to the indicators. The indicators, therefore, reflect or manifest the construct mentioned; this means a change in the construct will imply a change in the indicators, and the correlation between them is due to their common cause. What is more, an indicator could be replaced by another without altering the final meaning. For example, we can refer to the intellectual coefficient (IC) and measure it based on comprehension indicators, arithmetic, memory, vocabulary, and reasoning.

However, in formative models, a construct is formed or induced by indicators that describe or make up its different phases. The causality direction goes from the indicators to the construct, and its meaning is formed by the entire series of indicators. The indicators do not necessarily show co-variances and are not necessarily interchangeable by others. Here, for example, we can analyse the social status and explain it using, say, academic achievement, income, or family name. In this case, a high academic level is not necessarily related to the income level, and if family names are removed from the analysis and replaced by another indicator, the final meaning of the construct can be modified.

Finally, the factors or constructs obtained using FA allow a formative model of *Collaboration* to be built in the following way:

Levels	Factors
Knowledge Acquisition	Proactivity to results
	Proactivity to relationships
Cohesion Level	Group integration
	Trust generation
Level of Self-Coordination	Equal relationship
	Criteria of action

Table 27 Factors Obtained by Means of Factorial Analysis

9.2.3 Relation function

The resulting function will relate the benefit obtained (dependent variable) as a consequence of the relational dynamics acquired by the group (complexity index) and their teamwork, that is, the series of decisions taken for the management of projects (interrelation index) and the observed behaviours (collaboration behaviours).

To certify that relation, we will use a Linear Regression Analysis with a Collinearity Diagnostics in the following way:

1. The result obtained by the team is understood as a combination of certain behaviours and determined decisions in a given environment. In this case, the indicator of the dependent variable responsible for measuring the result will be the accumulated benefit obtained by the group in the last cycle.

Bº= Complexity + Decisions + Behaviours

2. We measure complexity and decisions by their respective indexes.

Bº= Complexity index + Interrelation index + Behaviours

3. Taking into account the constants that would affect each one of the factors, plus the residual error the final formula would be:

$$B^{\circ} = \beta_1 \text{ Complexity index} + \beta_2 \text{ Interrelation index} + \beta_3 \text{ Collaboration behaviour} + \text{Residual error } (\varepsilon)$$

4. The behaviours are identified through observations that, conveniently grouped, should define global collaboration behaviour.

$$Obs_1 + Obs_2 + \ldots + Obs_n = \text{Collaboration behaviour}$$

Nevertheless, as previously explained, as this is a formative model, we cannot group the indicators to obtain a common construct, so the final function should reflect the maximum degree of the grouping of variables obtained which really would be:

$$B^{o} = \beta_1 \text{ Complexity index} + \beta_2 \text{ Interrelation index} + \beta_3 \text{ Factor 11} + \beta_4 \text{ Factor 12} + \beta_5 \text{ Factor 21} + \beta_6 \text{ Factor 22} + \beta_7 \text{ Factor 31} + \beta_8 \text{ Factor 32} + \text{Residual error } (\varepsilon)$$

Where the cited factors are:

- Factor 11: Proactivity to results
- Factor 12: Proactivity to relationships
- Factor 21: Group integration
- Factor 22: Trust generation
- Factor 31: Equal relationship
- Factor 32: Criteria of action

Having defined the regression formula, we see that effectively the benefit obtained by participants is significantly related to the degree of complexity obtained by the simulation, with the consequential interrelation index of their management decisions and with the observation grouped into constructs. In summary, the results obtained by the statistical analysis are:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.865[a]	.749	.702	206.422

a. Predictors: (Constant), F32-Criteria of action, F31-Equal relationship, Complexity cycle 6, F22-Generation of trust, F12-Proactivity to relationships, F11-Proactivity to results, F21-GI, Interrelation average cycle 6

Table 28 Summary of the Statistical Analysis of the Model

The 70.2% percentage of explained variance of the model can be considered as a very high result.

Continuing with the analysis, when descending to the coefficient levels although it is significant as a group (Sig. <0.05), apparently not all their variables are significant. Initially, the non-significant variables should be eliminated from the model. Nevertheless, we must take into account the very high Variance Inflation Factor (VIF) due to its collinearity. The VIF is a measure of how a determined variable helps to explain the variance percentage; this means that if a variable such as, for example, the Equal relationship (F31), were independent (VIF equal to 1), then it should be rejected from the model due to its significance test not being significant (Sig. =0.616). However, not

only is it not independent but its degree of collinearity (relation to the other variables) is high, contributing 2.7 times more than itself to the entire variance.

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	T	Sig.	Tolerance	VIF
1	(Constant)	2367.053	201.307		11.758	.000		
	Complexity cycle 6	8.441	1.399	.753	6.036	.000	.375	2.666
	Interrelation cycle 6	-18.061	5.000	-.473	-3.612	.001	.340	2.942
	F11-Proactivity to results	27.427	44.034	.073	.623	.537	.431	2.321
	F12-Proactivity to relationships	73.655	39.352	.195	1.872	.068	.540	1.853
	F21-Group integration	122.207	46.553	.323	2.625	.012	.386	2.594
	F22-Generation of trust	42.533	34.131	.112	1.246	.219	.717	1.394
	F31-Equal relationship	24.238	48.002	.064	.505	.616	.363	2.758
	F32-Criteria of action	33.405	36.662	.088	.911	.367	.622	1.609

a. Dependent Variable: Accumulated benefit

Table 29 Results of the FA of the Model

All the variables, called factors in the theoretical model, are either significant (Sig. <0.05) or help considerably in explaining the variance of the model (VIF above one). The model includes six variables as observable collaboration behaviours (F11 to F32). Also, it includes the average interrelation of cycle six and the complexity index of cycle six, considering both indexes in cycle six as accumulative.

The linear regression function that relates accumulated benefit as a dependent variable of the rest of the previous variables gives a percentage of 70.2% of explained variance, a figure that could be considered as very high. Therefore, we can conclude that:

The data indicates that teamwork in situations of high complexity, considered as all collaboration behaviours and interrelation decisions, are significantly related to the desired result.

9.2.4 The importance of Integration

A parameter that I consider relevant in the research refers to the GI variable (F21). Its high collinearity is outstanding (2.594), as well as its level of significance (0.012). In fact, it is the only significant collaboration behaviour variable (<0.05); this leads one to suppose possible higher importance over the rest of the variables that will be checked in future research.

9.2.5 Determination of existence of phases

The second objective was to identify the possible phases of the team development process. To be able to identify this, a linear regression analysis was carried out focused exclusively on collaboration behaviour, taking as a dependent variable the benefit accumulated by the group in the last cycle. If the phases were sequential, they should increase the variance in the measure that factors were added. If we take the levels as an initial supposition of sequentiality, the result obtained is as follows:

Variables by level	Explained variance %
1. Level of knowledge: • Factor 11: Proactivity to results • Factor 12: Proactivity to relationships	 30.7 38.6
2. Cohesion Level: • Factor 21: Group integration • Factor 22: Trust generation	 48.5 48.1
3. Level of Self-Coordination: • Factor 31: Equal relationship • Factor 32: Criteria of action	 47.5 46.5

Table 30 Variance Increase According to Variables and Levels

Apparently, there is certain sequencing. It seems that we could affirm that there are two phases, one more technical and related to knowledge, and the other related to cohesion and self-coordination - but the data does not show a clear sequence that corresponds with the three levels of the model.

The data does not indicate the existence of sequential phases in the team development model.

9.3 Summary

We defined a linear regression function that will relate the benefit obtained (dependent variable) as a consequence of the relational dynamics acquired by the group (complexity index) and their teamwork, that is, the series of decisions taken for the management of the projects (interrelation index) and of the observed behaviours (collaboration behaviours).

Bº= Complexity + Decisions + Behaviours

We measured the behaviours based on six observation variables identified as factors and distributed in three levels.

Levels	Factors
Knowledge acquisition	Proactivity to results
	Proactivity to relationships
Cohesion Level	Group integration
	Trust generation
Level of Self-Coordination	Equal relationship
	Criteria of action

The linear regression function that relates accumulated benefit as a dependent variable of the rest of the previous variables gives a percentage of 70.2% of explained variance, a percentage that could be considered as very high.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.865[a]	.749	.702	206.422

a. Predictors: (Constant), F32-Criteria of action, F31-Equal relationship, Complexity cycle 6, F22-Generation of trust, F12-Proactivity to relationships, F11-Proactivity to results, F21-GI, Interrelation average cycle 6

The data indicates that teamwork in situations of high complexity, considered as all the collaboration behaviours and interrelation decisions are significantly related to the desired result.

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2. Cohesion Level: • Factor 21: Group integration • Factor 22: Trust generation	 48.5 48.1
3. Level of Self-Coordination: • Factor 31: Equal relationship • Factor 32: Criteria of action	 47.5 46.5

It seems that we can affirm that there are two phases: one more technical and related to knowledge, and the other relational – in terms of cohesion and self-coordination. That said, the data does not show a clear sequence that corresponds with the three levels of the model.

The data does not indicate the existence of sequential phases in the team development model.

CHAPTER 10.

QUALITATIVE RESULTS

Over the years that this work was undertaken, I observed not only those aspects directly related to the model, but also gave attention to other behaviours that were not being compiled by the research variables. In this chapter, I explain the conclusions drawn from those observations.

10.1 The definition of uncertainty objectives

When speaking of 'Action Criteria' in uncertainty, we saw that the capacity of establishing clear criteria and making decisions is limited by the available information, by individual capacity and by the finite quantity of time to take them (Simon, 1997). This bounded rationality was built by Simon throughout the time that he defines as 'objective rationality' that formed the main axis of his theories in the first editions of his book. When speaking of objective rationality, Simon indicates:

> 'The decision task implies three steps: (1) the listing of all the alternative strategies; (2) the determination of all the consequences of the mentioned strategies; (3) the comparative evaluation of all the consequences. The word 'all' should be used carefully. Obviously, an individual cannot know 'all' the alternatives or 'all' the consequences; this is the starting point of limited rationality.'

Even if we take into account the limitations of that rational analysis process, the process is still valid if we maintain intact the flexibility and capacity to adapt when confronted with the appearance of new inputs in the decision-making process. Some way or other, rationality is limited to known scenarios while the organisation stays open to new scenarios and maintains its capacity for adapting to the changes that their appearance could introduce. Limiting though it might appear, this process of conscious filtering is necessary to introduce order to the large and tangled series of options that appear in complexity.

Derived from the Simon model introduced in the course, groups that took the following steps gained control, self-confidence, clarity and security and were better prepared to understand new scenarios, to understand the introduction of changes and, finally, to achieve the objectives.

1. Identification of the range of possible objectives in the future.

Before producing a strategy, the group identifies the objectives. As a situation of uncertainty does not allow excessive clarity, these are always varied and alternative.

2. Analysis of the options or possible alternatives to reach each one of them or any combination of them.

Now they did define action strategies to achieve each one of the possible identified objectives. On occasions, a single strategy could cover several objectives at the same time.

3. Prevision and consideration of the positive and negative consequences derived from each option.

Later there was an evaluation of the consequences of the possible strategies, indicating positive and negative aspects of each option along with its strengths and weaknesses.

4. Establishment of a system of values as a criterion of selection that organises the possible alternatives according to the level of preference.

Strategies were derived from the objectives, and the consequences were derived from the strategies. At the time of choosing, the group established a series of reference values. What would they do, what is important for them, what motivated one decision over another? These values organised the strategies according to preference.

5. Identification of the basic condition for the chosen option.

At this level, the situation was still confused, and the group was not clear about what they had to decide either because several strategies competed at equivalent preference levels, or even because the criteria were still confused. They then added a basic condition that had to be fulfilled. Normally the consequence was a simplification of the analysis process that consequently gave them clarity and security - even if they were wrong. Nevertheless, they now had a main order and strategy.

6. Analysis of the options on a technical level allows the basic condition to be fulfilled.

From now on, they had to put the strategy into operation, which meant defining how.

7. Evaluation of the error cost of the options analysed to disregard those for which the cost was high.

Once defined, they added the possible cost of being wrong to the evaluation. Using the earlier process of disregarding and by including it in the filter of simplified basic conditions, this new perspective allowed them to reduce risks.

8. Prevision of the positive and negative consequences of the filtered options.

Having defined the tactics to follow the chosen strategy and filtered out those with a low cost per error, they could still have more options than they would like. They had won in clarity by simplifying and in security by adding the cost per error in the analysis, which gave them flexibility because it allowed them to change their decisions in real-time. Once again, they had to evaluate the filtered options.

9. Establishment of an evaluation system that allowed them to identify the best performing option.

Even so, some groups still took a further evaluating step, this time again considering tactics in order to leave only one definite option.

10. Decision-making

Finally, they made the decision.

Not all groups acted in such a systematic and rational manner. What is more, some took certain steps while and others took others. I have chosen to make a maximalist reading of my observations so as to recompile all the actions of the best groups in a Decalogue that without the necessity of closely following it, can help in the decision-making process in uncertainty. What this Decalogue really does is select alternatives in a continuous process of filtering by the introduction of error cost into the analysis, thus allowing the necessary flexibility for future adaptations to be maintained.

10.2 The inverse definition of the road map

When starting the course, although abundant, information was difficult to assimilate and not very enlightening. The group suddenly felt submerged into a situation of high uncertainty. In this context, the objective could be clear, but the way of achieving it was not. The group then defined a series of steps to reach it, based on their current knowledge (which, as we have said, was very scarce initially) and using the starting position as a reference. In other words, knowing where I am and what I have, and from here what I should do to achieve the objective. This analysis, which could be valid in certainty, is not so in uncertainty given that the number of unknown variables is higher than that of the known.

An analysis of the road map from the starting point includes the identification of an immense decision tree. If I do A; a, b, c, and d could happen and if I do B; e and f could happen. In turn, if A happens; 1, 2 and 3 could happen and so on. The result used to be that the group ceased planning the road map because it became overloaded with too many options. What they were really doing was simply identifying the initial steps to follow; if they did not take the wrong direction, this would be the route that would allow them to carry on dynamically by defining each subsequent step. The result was that the

group was able to go almost as far as it was able to foresee but did not achieve the objective.

Some groups carried out an inverse analysis in an exceptional manner, obtaining extraordinary results in this phase of uncertainty. Instead of starting from the current situation and taking account of the limitations, they started from the objective, without considering any limitation. With maximum rigour, they were defining the steps to follow. All they needed was to answer the question plainly and rigorously 'what exactly do I need to do to achieve X?' The objective is X and to achieve it V should happen, so I need U. To achieve U (new objective), T should happen, so I need S (new objective) and so on. This method limits the options and assures completion of the analysis that will conclude in the 'A' starting situation.

Consequently, security (but not success) was obtained by reducing the number of options. Clarity was obtained by resolving the shadowy area that appeared with forward planning as a consequence of increasing the decision tree. In addition, broad-mindedness was obtained by delaying the judgement of the deficiencies themselves. This last point was extremely important because many groups identified initial limitations derived from a strategy that they thought was valid. While making the inverse definition of the road map the strategy changed, and what were limiting factors for the majority, did not appear to be relevant and were not even considered to be exceptional by these groups. Other groups advanced problems and limitations and, while trying to decide strategies (many of which would have been adequate), they started a round of problem identification before finishing their profiles. The result was that without yet having managed to assess the strength of their plan, it collapsed because all the difficulties they would come up against were clear.

The correct actions would be to identify first the need, then the solution(s) considered to be the most adequate, and, lastly the foreseen difficulties; this would allow effort to be concentrated on resolving those difficulties or impediments.

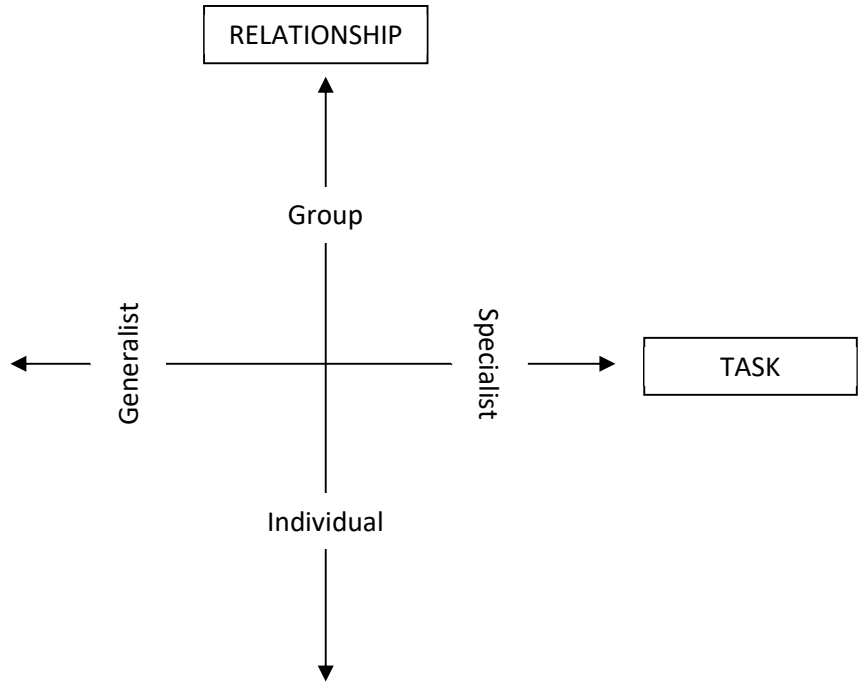
The groups that centred on discussing problems ended up exaggerating them. Consequently, they assumed some limits that they did not explore even though they were not strictly aware if those limits were real. These groups became discouraged and felt that reality was overwhelming them.

Those groups that were more systematic and tried to isolate problems and assess their impact were able to find partial solutions to get around them. In reality, the winning strategy depended on being able to identify differences and adapt the solution accordingly because there is no magic or a unique solution for all problems.

10.3 The team leadership roles

An obligatory question when portraying what was seen in the model is how the leader acts in trying to achieve results. In this case, it is a trick question as one of the things the model teaches precisely is that there is no leader in the traditional sense but rather a series of leaders acting in a parallel, overlapping, and spontaneous manner; this does not help a lot if we consider that in organisations, there is usually only one person who brings together the responsibility of one function. The answer, yet again, comes from the observation of how the participants act.

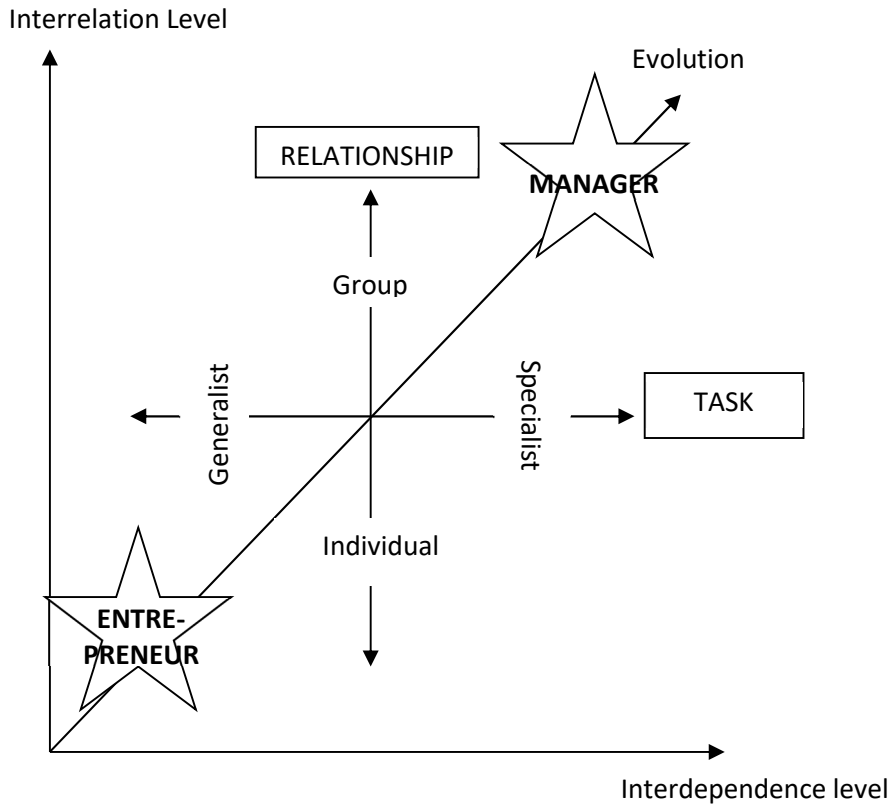
Firstly, we will consider a traditional dichotomy in the dimensional divisions of management - like orientation to task and orientation to relationship. We can view it from a dynamic point of view where the relationship can evolve from individual to collective, and the task from general to special. In this way, the axis we would obtain would be as follows.



Source: Own preparation

Figure 20 Axis of Leadership Roles

Now we place the axis in the context of the model by referring to the levels of interrelation and interdependence that lead us to a situation of complexity.



Source: Own preparation

Figure 21 Axis of Leadership Roles in Context

Two extreme and opposed leadership manifestations appear. One is based on personal capacities, on intuition, on taking risks, on the capacity of influence, on persuasion and on personal charm; we can identify those characteristics with an entrepreneur. At the other extreme, we find the managing director of teams, wary of risks, respectful of rules, more professional, stable, secure, and predictable.

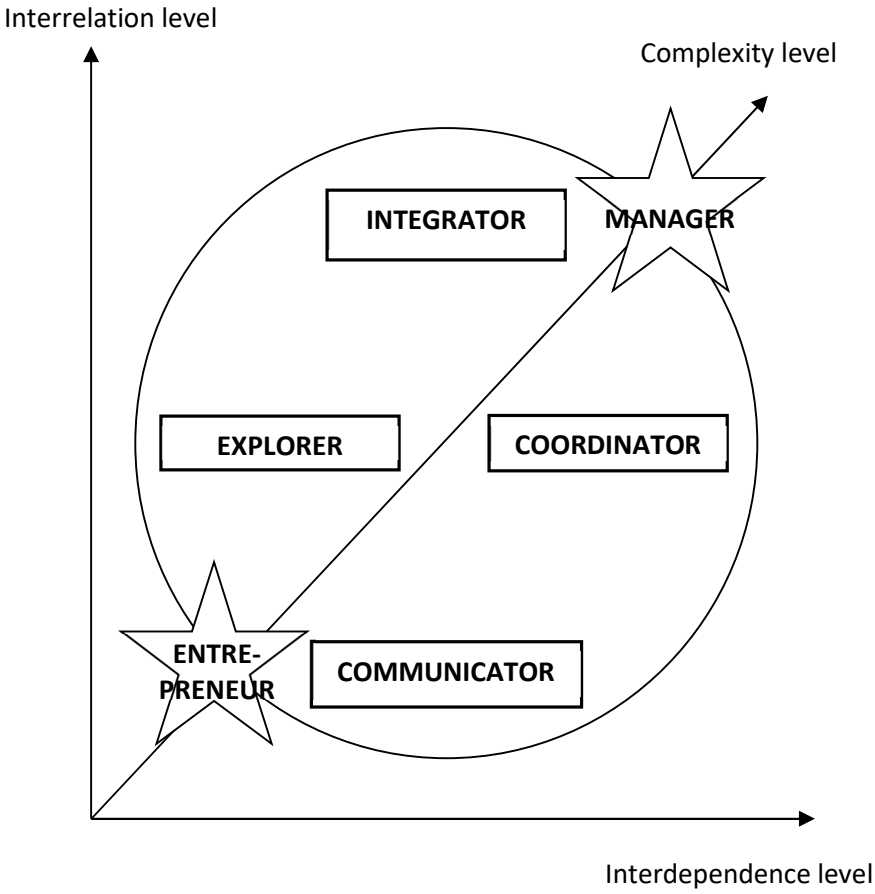
The first would be capable of breaking schemes, creating, acting adequately in uncertainty, and attracted by experimentation, for discovery. However, they would be bored with an organisation when it is mature, complex, or with levels of detail that they no longer control. On the other hand, the second would be attracted by size, complexity, and interrelations. More political and skilful with relationships, they coordinate more than they actually do and connect more than they think.

Recent studies have identified the differences between both profiles around bias and heuristics (inquiry and discovery). The entrepreneur would be more inclined to take

biased and intuitive decisions than the managers of large corporations. In uncertainty conditions, these can be more efficient and innovative while managers can be more global and cautious. The over-confidence in one's self would make them more optimistic. Their capacity of representativeness, of generalising about a person or a fact-based on only a few attributes of the person or a few observations of the phenomenon, would lead them to underestimate the impact of the error and not to consider that small samples are unreliable. All that suggests that this type of pattern can be more suitable in company ventures and take advantage of opportunities that do not offer sufficient information for a more rational analysis (Busenitz & Barney, 1997).

Entrepreneur and Manager, therefore, are complementary profiles and respond to the necessities of different situations and moments in time; both types appear in the course. The 'entrepreneurs' immediately take the initiative. Right from the start, they take sides for determined actions, wrong or not. They organise, they are the lead players in the first cycles. Bit by bit they lose this prominence in the second profile. The numerical contents of the game become evident, the growing complexity demands method, and the need to formalise or specialise becomes evident. Finally, the 'managers' are those that share leadership, distributing tasks and coordinating actions.

When breaking down the leadership prototypes into the two previous dimensions, two pairs of characteristics appear to be necessary: explorer-communicator (for the entrepreneur) and coordinator-integrator (for the manager). The combination of the four characteristics covers the full range of necessity, even though it is certain that no individual is capable of covering it all. Hence the magic of a team.



Source: Own preparation

Figure 22 Basic Team Leadership Roles

Nevertheless, we could find ourselves faced with extreme positions of roles that, instead of having a positive effect on the group, collapse it, confuse it, or limit its development; this happened on occasions with either very strong or limiting participants whose leadership level in the organisation was so high that it limited the group's natural evolution. None of these courses is included in the sample as the courses were considered as abnormal regarding the model. Nevertheless, observing them leaves us the following proposal.

At one end of the relationship, the entrepreneur becomes an individualist and acts as a brake, limiting and blocking the group. As this approach does not allow the group to evolve, the manager does not even appear.

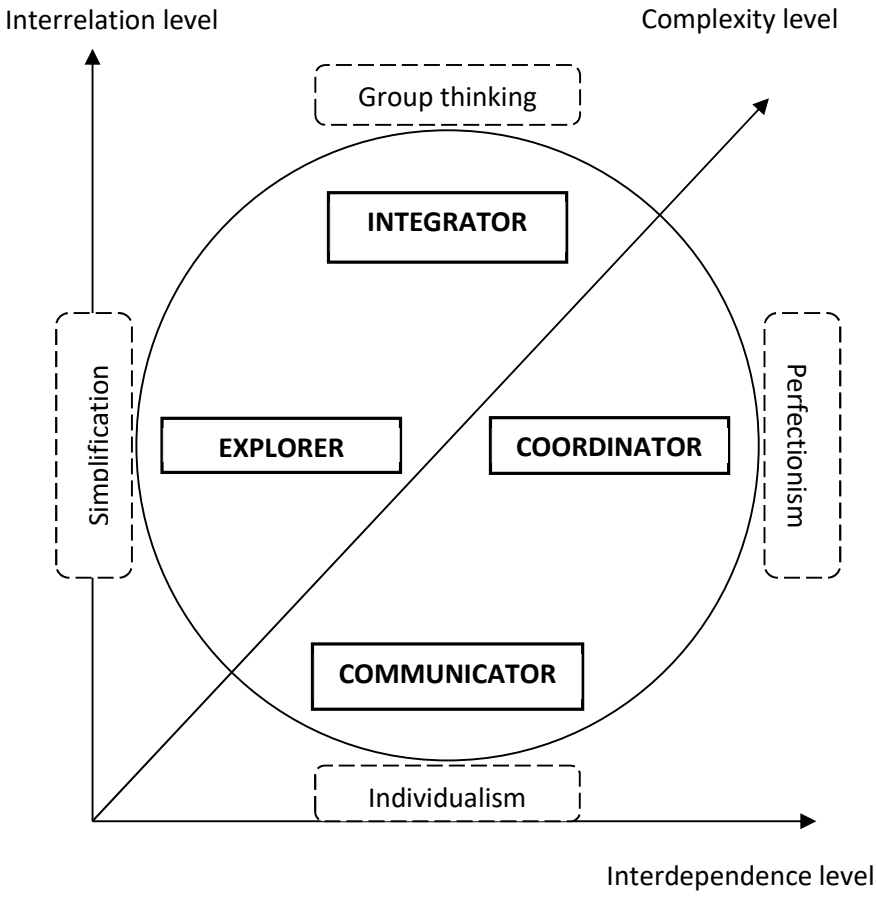
At one end of the task, the entrepreneur simplifies and underestimates the potential of the simulator, breaking momentum and introducing doubts about the actions of others when they try to adopt control mechanisms or make detailed plans. They search for a trick in the simulator and are convinced that if they find it, 'the' solution will depend on it. However, the evolution of the course overwhelms them and catches them off-guard. By the time a method is clearly needed, the volume of lost information makes it impossible for them to recover.

At the end of the relation, the manager achieves a level of integration to such a degree that the group becomes a prisoner in a species of group thinking near to Groupthink (Janis, 1982)[47]. Here they cling to the less conflictive solutions rejecting criticism and even to the extreme of ignoring the interventions of the contrary participants or those that propose alternatives. The phenomenon rarely occurs at the end of the course, but it has been observed halfway through when the process of integration is at its maximum peak, and the group feels a growing strength of union. At that point, the interventions that involve dissidence, many of them correct, are silenced or ignored.

The manager loses connection with the objective, becomes isolated and imbued by the specifics of each area of involved knowledge. The contents of the task itself become more important, with a focus on its level of detail or its correct finalisation rather than the objective they are trying to achieve. Their coordination task becomes obsessively centred on the task itself, losing sight of the original aim that led to putting a value on paying attention to detail. This attitude does appear at the end of the course when the level of complexity is at its maximum, and normally leads to the group failing to finish planning its action in the available time. All energy is lost along the way in trying to reach a level of perfection that does not compensate for the time spent on it. Usually, the result is that the group asks for more and more time, and if it is not granted, it causes them to collapse when they are in the middle of an action (game). They become incapable of making decisions, having lost their focus, they become inflexible and dependent on their planning and their strategy. When this fails due to 'lack of time' they have no alternative or capacity for reaction. The group forgets that in complexity, there is no sole, optimal

[47] Janis studied empirically the phenomenon known as groupthink after what happened with the assessor group of President John F. Kennedy in the decision process that lead to military disasters like that of the Bay of Pigs and of the missile crisis. The groupthink members reach such a level of cohesion that any element that is potentially negative for the emotional integrity of the group is systematically denied or rejected. That includes not only the rejection of external criticism but also the cancellation of all types of self-criticism. The group selects a point of view that feeds cohesion and is self-convinced of it being the only possible solution.

solution and that the investment needed to try to achieve it is not compensated by the result.



Source: Own preparation

Figure 23 Team Leadership Roles

10.4 A Decalogue for making decisions

We remember that the course is set against situations ranging from uncertainty to complexity. Participants do not know what they are going to find and, little by little, they learn the basis for resolving the proposed objective. Along the way, they see an opportunity for obtaining synergies through interrelation and interdependence. Thanks to them, they can optimise their investment, thus improving their results.

Throughout all the processes described, there is a series of decisions that the group should make to be successful. I have tried to summarise, in a simple, easy to follow Decalogue, those steps that the most successful groups followed. That does not necessarily mean that the best groups took them all, but that they did take some or others, and obtained better results at each referential moment. Taken together, therefore, they constitute a magnificent recommendation for making decisions in uncertainty and complexity.

1. Be proactive when facing uncertainty.

The first that happens to the groups is that at the beginning, and as a result of uncertainty, they are disconcerted, lost. They make off-chance questions responding to impulses, guided more by intuition and occurrence than by a rational or analytical process. It is the first contact point. Many simply let themselves be led on, others apply the philosophy of 'wait and see', but others try to be proactive, have initiative and seek agreements. As McClure suggests, when facing anxiety, 'The way to freedom is through the fire, not going round it' (McClure, 1998).

2. Never lose sight of the objective.

Nevertheless, when they start to play, a whole series of mental models related to the game trap them, thereby modifying the objective. They change their perception of what they want to achieve and are self-convinced by it. It is like a Monday when we plan our week but, as the week goes by, we have to 'put-out fires'. Our strategic objective is replaced by a tactical one. If we act in the short-term, where we know the steps to take immediately, the level of anxiety caused by uncertainty is reduced. Nevertheless, acting in the short-term does not exempt us from the obligation of thinking about the long-term, as the short-term can modify what happens to the point of invalidating the long-term.

3. Use information as a base for action.

At the beginning, groups are not usually rigorous in treating the information they are given, even when they know the uncertainty is provoked precisely by the lack of information. In part, this is due to them still being incapable of structuring it and giving it meaning. At this point, it is especially important to obtain as much information as possible and check it to maximise and contrast information.

4. Try to limit mental schemes to avoid them limiting you.

As the course advances and groups learn the basic mechanics of the simulator, they gain confidence and become aware of the true dimension of what they are doing, of its parallels in the company and of its practical application. Nevertheless, they are still prisoners of their mental ability (the eye cannot see what the mind does not let it see), without realising that the proposed situation is new, different, and cannot be resolved using known solutions.

5. Faced with uncertainty, evaluate the cost of error.

Perhaps one of the most important aspects of decision-making is the influence that the prevailing scheme of cost efficiency and scarce resources has over the group; this scheme can induce them to make gross mistakes. Faced with apparently simple decisions, they give priority to the optimisation of resources and saving, without stopping to think whether the resources they are saving really are scarce. This implementation of their instinctive thinking can jeopardise the objective. In real life, we tend to think that, by definition, economic resources are scarce, when really on many occasions, it is ideas and opportunities that are more important than resources. To save tangible resources, they incur unnecessary risks that frequently make them miss the objective.

Nevertheless, some groups evaluated the cost of the error, that is, they found out what mistakes cost, and compared that cost with the importance of estimated savings. If making a mistake was potentially ‘expensive’ they should allow themselves an action margin or reduce risk. As such, resources should not be an objective but rather a means to achieve it. Unfortunately, and even though this reasoning becomes evident later, it is necessary to make several mistakes to realise it.

6. Systematise and procedure to move forward.

As the game advances, the simulator acquires its full potential. Participants know how to play, what decisions to take, and they start to identify fundamental relations. Something new then appears on the scene. The volume of information that they start to handle

increases and inertia has driven them to the point of pausing to allow them to think it over. The need to find a method to capture, organise and structure the use of information, becomes evident.

7. Facing complexity work as a team.

With multiple projects on the table, different types and quantities of resources to manage them, files and files of information, a record of previous decisions that affect the performance of the projects, dependency on other players... things get complicated. At this point, the individual capacity to understand and manage what is happening gets less and less clear, while the evidence of a need to work collectively becomes more and more clear.

8. Get emotionally involved to achieve great results.

This is a key moment in deciding the group's success. If they manage to pass the challenge of the increased complexity, if they manage to pass the border of individualism, if they manage at last to become unified, their future potential for success will increase considerably. No group that has reached this point while remaining in individualist positions has later achieved the objective[48]. Not even those with a high technical capacity who considered that they could pass the challenge, based on the deductive logic that 'should' prevail in a simulator, managed to do so. These groups forgot that the simulator is not of an analytical type, programmed on the basis of a model, but rather behavioural and therefore oriented to the stimulus of specific behaviour.

9. Grant yourself the margin of action and foresee a contingency plan.

At the end of the day, we find an integrated group, with a high level of knowledge and cohesion, exchanging information, alerting each other naturally and spontaneously about opportunities and risks - and planning together. Everything seems ideal, except that, too frequently, it is precisely that state of perceived security (that is commonly

[48] I remember an occasion on which I was delivering a course to a management team from a large company. The President had a very dominant traditional style character. Given the circumstances, his subgroup (department), just limited themselves to following his lead. Additionally, he was also very competitive and thought he could always 'win'. Surprisingly, he lost the view that it was the company in its entirety that should win, and not one concrete player. The rest of the subgroups collaborated, among them the General Director and other first-level directors. At the end of the six cycles, the other subgroups achieved the objectives while the President's group did not. We arrived at the conclusion that his group had 'sacrificed' itself for the others. The true reason for the failure did not escape the attention of anyone, not even him. Despite this masking, the training point was still made, and consequently they ordered more courses for lower organisational levels.

strengthened by each of them) which, on occasions, fails them. If everything is clear, the alternatives are not necessary; therefore, they were not even sought. The perception of security fuelled by members of the team leads to a reduction in the level of awareness and a minimisation of the evaluation of alternatives and risks. Here is where some groups failed, despite all the investment in time and energy in a plan that 'could not fail'. They forgot that although their level of expertise and confidence was high, the environment keeps changing, and they did not have the necessary flexibility to implement possible changes in strategy in real-time. When reality dawned, if this did not correspond with what was planned, they did not have the capacity to react; this is a serious error in complexity, where flexibility and capacity for adaptation become very important.

10. Teamwork is not a state it is dynamism. Do not allow inaction to lead you to a worsening of the situation.

Finally, my last reflection is not referring to that observed in the course but to the level that groups acquire. It would be a mistake to think that the level of cohesion and effectiveness that the high-performance groups obtain is permanent. To the contrary, it is necessary to have a policy that assures maintaining that level; this should include actions that are capable of maintaining the stimulus, capable of correcting a natural deterioration of relations, and capable of compensating the potential worsening of situations to which, day-by-day, we are led on so many occasions.

By way of a summary, the Decalogue for making decisions in uncertainty and complexity says the following:

1. Be proactive when facing uncertainty.
2. Never lose sight of the objective.
3. Use information as a base for action.
4. Try to limit mental schemes to avoid them limiting you.
5. Faced with uncertainty, evaluate the cost of error.
6. Systematise and procedure to move forward.
7. Facing complexity, work as a team.
8. Get emotionally involved to achieve great results.
9. Grant yourself the margin of action and produce a contingency plan.
10. Teamwork is not a state; it is dynamism. Do not allow inaction to lead you to a worsening of the situation.

CHAPTER 11.

CONCLUSIONS

11.1 Initial reflection

Corporate culture is the result of environments fuelled with different types of incentives and has direct consequences on the level of teamwork that can be achieved. Cooperative collaborators or non-cooperative collaborators are self-chosen in the mentioned environments, thus reinforcing the culture (Kosfeld & Siemens, 2006).

Management commitment and its active implication is fundamental to obtaining an adequate environment that is capable of escalating into collaborative efforts. Company policies have to be in consonance with the aim of creating the necessary conditions for such an objective.

Kosfeld and Siemens prove that in competitive markets, workers are self-selected, giving place to emerging corporate cultures oriented to teamwork and cooperation. The key mechanism is the fact that cooperative workers can accept lower salaries in exchange for being separated from selfish workers. Nevertheless, the latter are attracted by high salaries and are less willing to accept compensation other than financial.

Workers sometimes do cooperate, and a large part of this cooperation is driven by so-called conditional cooperation. That is, a preference to cooperate conditionally on the cooperation of others. Selfish workers only respond to monetary incentives, and when they do not see any economic consideration in teamwork, they never cooperate if it is not in exchange for something. Conditional cooperative workers can be stimulated both economically and non-economically.

Therefore, the combined implementation of a series of incentives alongside economic factors and other forms of teamwork stimulation strongly supports the existence of cooperation.

Without doubt, a retributive policy is one of the most important. However, a similar analysis could be made with the leadership exercise, communication and access to information in the company, the stimulation of relationships and common knowledge,

recognition, and the definition of responsibility levels if we want to include teamwork as one of the components of corporate culture.

11.2 Key aspects of the Cooplexity model

Cooplexity refers to a Cooperation-Collaboration Model in Uncertainty and Complexity.

The model provides a framework for managing teams in conditions of uncertainty and complexity. Traditionally, decision-making and management are founded on order, stability, and certainty. Managers are often not trained or accustomed to coping with unpredictable situations. The anxiety and bewilderment that comes with conditions of uncertainty and complexity are confusing and inhibiting. Providing ourselves with a model capable of indicating a path in these situations is especially valuable in times of crisis.

What makes the Cooplexity model so unique is the fact that it is based on a vast number of observations of synthesised behaviour through the repeated application of the same constructed environment. It is also notable that this behaviour is generated during a two-day programme attended by managers, who are generally difficult to isolate from their normal environment. The understanding gained from these sessions has provided us with a framework that tells us where to start, what steps to take and what fundamental aspects should be taken into consideration.

In uncertainty, it is riskier to stay still than to move in the wrong direction. Proactivity, initiative, and experimentation will keep us moving, investigating, advancing, and adapting ourselves. Stability is reached using trial and error actions that permanently try to find an adequate internal configuration to the new environment[49].

Individual, group and organisational scopes are not something we can unbind from each other. The three start at the same point and the three are interlocked. Some policies are not independent of others; all should have consistency among themselves in a global manner.

All the same, in each level of the model, we will have a more emphasised approach that, without losing sight of the group, allows us to concentrate on more relevant subjects for now (knowledge, cohesion and self-coordination), enabling us to concentrate our efforts on a temporary sequence.

[49] Referring to homeostasis. Homeostasis (from the Greek word homeo that means 'similar', and stasis, in Greek στάσις, 'position', 'stability') is the characteristic of an open or closed system, especially in a live organism, through which the internal environment is regulated to maintain a stable and constant condition. The concept was created by Walter Bradford Cannon in 1932 (Source: Wikipedia, consulted in June 2009).

Cohesion is by far the most important factor. Considered as a key variable by most scholars of teamwork, it is an essential requirement if full collaboration is to be achieved.

Self-coordination is the authentic artificer of efficiency. It loses its attributes and its effectiveness when coordination is centralised, and there is no cohesion. The promotion of self-coordination or, to be more precise, its emergence, shifts the traditional approach to management. It shifts from actions and decisions focused on the group to actions and decisions focused on the context of the group. Creating adequate conditions to facilitate the emergence of self-coordination instead of forcing pre-determined actions is fundamental to the model.

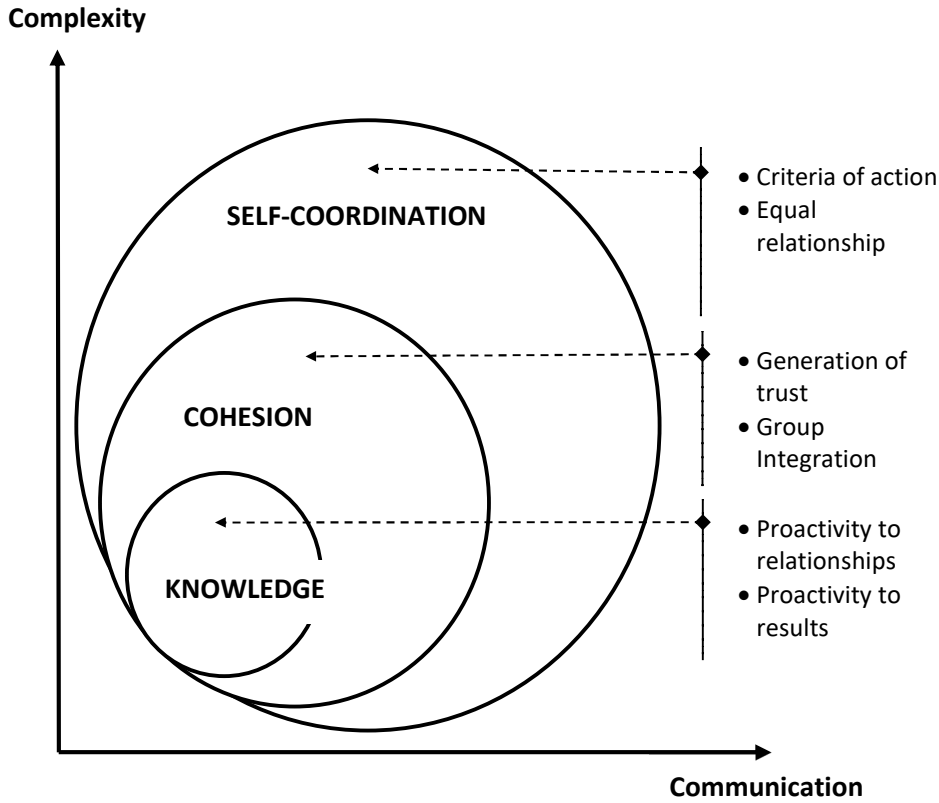


Figure 24 Graphical representation of the Cooplexity Model

The leadership model necessary to boost the three levels of the model implies Tolerance of Error for individuals, aligning goals around a Common Project for teams and a known Established Criteria at the organisational level. In the end, the objective is to empower skilled and motivated collaborators to make decisions following the strategy. It means the emergence of decentralised and spontaneous, full collaboration.

11.3 Teamwork is not a universal solution

During the first years of imparting Synergy, I was absolutely convinced of the merits of teamwork. One day I delivered a course to the investment division of Deutsche Bank. The fundamental task undertaken by investment agents consisted of adequately knowing, analysing and interpreting both information coming from markets and reports coming from headquarters, to build the package of solutions they would later offer or manage. Logically, they should also know their clients, their preferences, their objectives, interests and even personalities. Drawing on both sources of information, they built the investment portfolio whose mix responded to the desired profitability/risk binomial for each one of them. Under these circumstances, the contact that each agent had with others was circumstantial. At the end of the course, the group had not achieved the established objectives despite the level of its participants, their goodwill and strong relationship.

During the course, the difference between their usual work environment and that presented by the Synergy simulator became obvious: they had acted as they usually would have done, but the result in a new environment was a failure.

If we link this experience to the first result of the research, where I say that 'we can conclude that, effectively, teamwork in highly complex situations is significantly related to the result', we could infer the contrary conclusion, 'teamwork is not related in a significant manner in non-complex environments'. Nevertheless, research shows the first affirmation but not the second. This supposition could be the motive for later research.

Teamwork is not a universal solution. It acquires value as long as the agents of a system have interconnections of interdependence and interrelation (complexity).

11.4 Excessive cohesion is a disadvantage

When analysing the results, there was a figure that surprised me. In the linear regression formula, the average Interrelation of cycle 6 appears with a negative coefficient.

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	2367.053	201.307		11.758	.000		
	Complexity cycle 6	8.441	1.399	.753	6.036	.000	.375	2.666
	Interrelation cycle 6	-18.061	5.000	-.473	-3.612	.001	.340	2.942
	F11-Proactivity to results	27.427	44.034	.073	.623	.537	.431	2.321
	F12-Proactivity to relations	73.655	39.352	.195	1.872	.068	.540	1.853
	F21-Group integration	122.207	46.553	.323	2.625	.012	.386	2.594
	F22-Generation of trust	42.533	34.131	.112	1.246	.219	.717	1.394
	F31-Equal relationship	24.238	48.002	.064	.505	.616	.363	2.758
	F32-Criteria of action	33.405	36.662	.088	.911	.367	.622	1.609

a. Dependent Variable: Accumulated benefit

Table 31 Results of the FA of the Model

Did that mean that interrelation is contrary to teamwork? That does not seem logical. I found the answer once again in the action of the groups. I remembered a reproach from the Head of Human Resources at Arbora y Ausonia. With good judgement, he observed that those courses whose groups were extraordinarily motivated had outstanding action from a team point of view, they had maximum cohesion but did not necessarily obtain the best results. At the time he blamed a defect in either the course or the simulator. If the groups did well, they should obtain a better result and vice versa.

The explanation I give him has more to do with GI processes. The more integrated it is, the better the adopted agreements remain together, and the less flexible they are when faced with changes. The capacity of reaction against unforeseen circumstances is lost; its planning becomes a limiter of its action.

This way, the groups that achieve a reasonable level of cohesion (but not the maximum) would have a slight advantage, as the simulator propose permanent changes in all cycles of the game. Participants would gain in flexibility and would be capable of introducing

un-planned variances without the necessity of agreement. Therefore, when a group has better cohesion, the game runs more fluidly and thus delivers better results.

To confirm that excessive cohesion is a disadvantage, exceptionally, some groups were able to reach the objective set for the fifth cycle. Far from being an advantage, the effect was totally noxious. The group concentrated on the strategy that would take them to success and consolidate their cohesion. In nearly all cases the consequence was a worse result in the sixth cycle than in the fifth. The team had lost the capacity to adapt to changes during the last cycle and was not capable of correcting their strategy.

In parallel, observations indicated that initially, the results of the team seemed to be lower than individual ones. On occasions, participants complained, with comments about style: 'I do not see the sense of working as a team' or 'playing alone, I obtained better results in the previous cycle'. The effort given to relationships, to understanding, to reaching an agreement for a common strategy, the time dedicated to interchanging and comparing information, at the beginning seemed something sterile. That was especially clear when I met with highly capable individuals from an intellectual point of view, well oriented to action and highly motivated by achievement. Those groups that were influenced by poor initial results and were convinced that the time and effort would not be worth it obtained better results in the first cycles, the learning ones, and worse ones in the last cycles, those of the interrelation phase.

The combination of both observations defines an 'S' shaped performance curve.

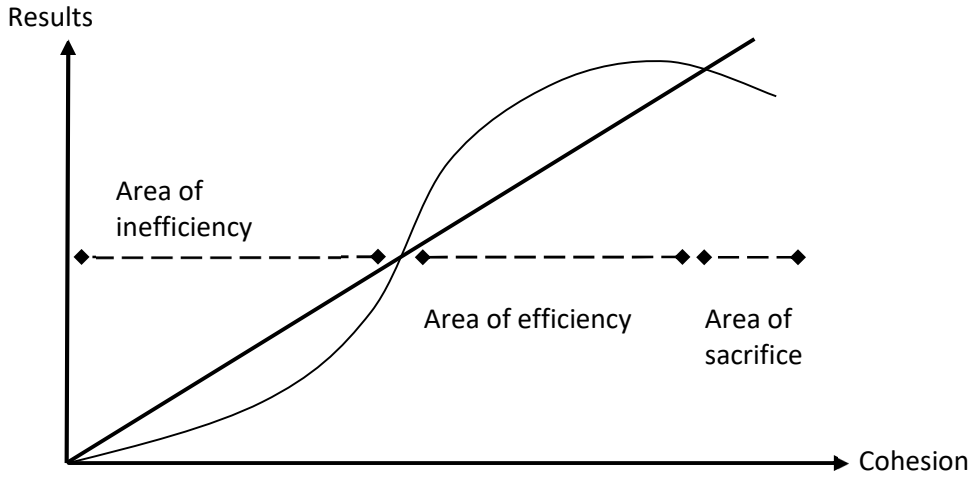


Figure 25 Team Performance Curve

This curve reminds me tremendously of the team performance curve drawn by Katzenbach. In it, he differentiates work teams from true teams in that their members trust exclusively in the sum of their individualities, and accept the risks of conflict derived

from uniting the fruits of their work and starting the necessary collective actions to build a common purpose (Katzenbach & Smith, 1992).

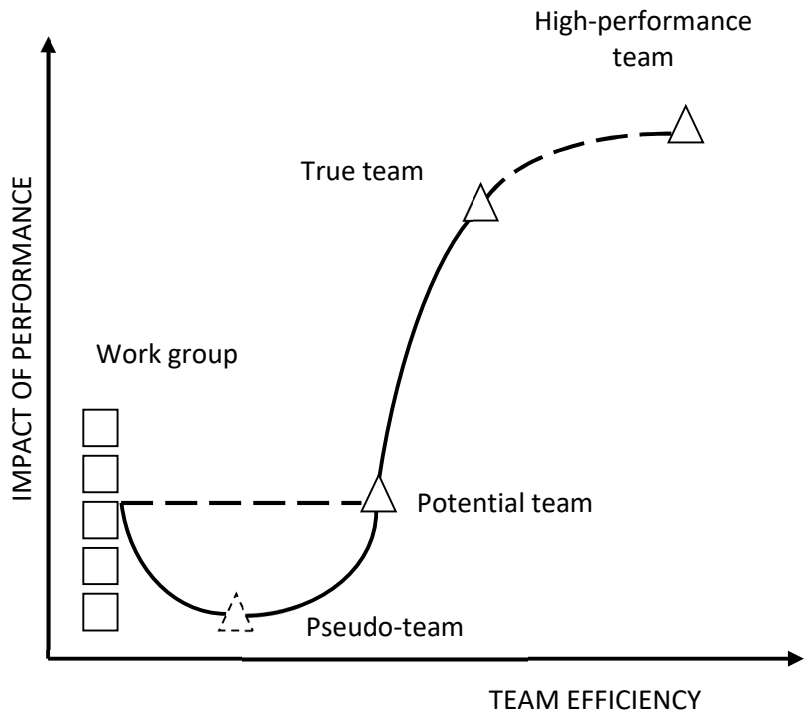


Figure 26 Katzenbach Team Performance Curve

As a result, a pseudo-team would call itself a team, but it would not really assume the risks of the conflict willingly, unlike the potential team that would. If a team manages to become a true team, and if it is capable of renewing its foundation, in time, it will become one of maximum performance. To do that it would make recommendations to others, receive new members and change leaders.

I also identify excessive cohesion as something negative, with the study that Professor Olson carried out in a family environment. In his circumplex model,[50] he centred on three dimensions that repeatedly are considered as very relevant in a range of theoretical models and approximations of family therapy.

Cohesion, defined as the emotional vehicle that family members have with each other, has four levels: disconnected, separated, connected, and entangled. Flexibility is understood as the quantity of change in leadership, the relational roles, and the relational rules, has four levels: rigid, structured, flexible, and chaotic. The focus of flexibility is like the systems they balance: stability versus change. Communication is the third dimension of the model and is considered as a facilitation dimension. It is considered critical for the movement between the other two dimensions but being facilitation, and it is not graphically represented (Olson, 2000)[51].

Nearly 700 students have published about the Olson circumplex model using different versions of the Family Adaptability and Cohesion Evaluation Scale (FACES) questionnaire. The results confirm the hypothesis that the central dimensions of the model (flexible-separate, flexible-connected, structured-separate, and structure-connected), in other words, the balanced ones, tend to be more functional than the extreme or unbalanced ones (Olson & Gorall, 2003).

11.5 Teamwork is not an end in itself

By referring to the effect of excessive cohesion in the previous point, I also hinted at the present conclusion. The first time that I ran a course in the United States, I found the approach the group had to teamwork especially interesting. I was used to seeing it as something that participants value. In many European countries, and especially in all the Mediterranean area, it is a value in itself and something that all companies want; everybody thinks, without doubt, that it should exist. Yet the treatment I came across in the United States came from another premise: is cohesion useful at this time and in this

[50] The circumplex models define different typologies around a circle built in two dimensions under study. The objective is to achieve a simple and structured description through certain variables integrated in a multidimensional scheme, in such a way that it offers a simpler and comprehensive view of the complexity of the problem under study. Although in reality this rarely happens in pure form, it is accepted by the scientific community that the typologies facilitate a more relevant diagnostic evaluation and that they offer better statistical results in the empirical descriptions and predictions (Polaino-Lorente & Martínez Cano, 1998).

[51] This article has cost-free access through the editorial, but there is a copy in full colour facilitated by the Noeticus community at http://www.noeticus.org/uploads/5-Olson-Circumplex_Model.pdf (consulted in June 2009).

situation? If the answer was yes, the group was dedicated with the same level of intensity that I had seen in courses before.

During the research, when the *interrelation index* was negative, I looked for the answer to that observation. Remember that the index accounts for the number of projects played in common. In other words, it would be the result of multiplying the product of the number of players by the number of projects played by the mentioned players in each cycle played up to that point. It measures whether players are taking part in a more, or less, entangled manner. In the final formula, there is an index of the last cycle whose coefficient, being significant, is negative, indicating that the benefit obtained is the more entangled, the better the play.

If we carry out a linear regression analysis with the accumulated benefit but related to the indexes cycle by cycle, we obtain the following result. Firstly, the percentage explained variance by the new model is not as high, but it is still very high.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.829[a]	.687	.653	222.750

a. Predictors: (Constant), Interrelation average C6, Interrelation average C2, Interrelation average C4, Interrelation average C3, Interrelation average C5

Table 32 Summary of the Interrelation Indexes by Cycle

The average interrelation of cycle 1 is not significant and is neither multi-collinear (inflation factor of low variance) - therefore I disregard it; this is wholly logical because the first cycle is simply about making contact. The rest are either significant or highly multi-collinear.

In the analysis, only cycles 2 and 4 are significant. These (along with the three that are not), have positive coefficients and are where the group fundamentally acquires knowledge and unites. It means that although, in the general model, interrelation has a negative factor when we break down the cycles at least two of the initial three appear as positive (we do not count the first cycle). In those, the interrelation would favour the result.

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	2245.117	201.230		11.157	.000		
	Interrelation C2	50.162	10.859	.497	4.619	.000	.588	1.701
	Interrelation C3	2.469	8.765	.033	.282	.779	.500	1.998
	Interrelation C4	40.808	8.917	.523	4.576	.000	.521	1.921
	Interrelation C5	-5.426	6.687	-.124	-.812	.421	.290	3.447
	Interrelation C6	-3.579	5.096	-.094	-.702	.486	.381	2.625

a. Dependent Variable: Accumulated benefit

Table 33 Coefficients of the Interrelation Indexes by cycles

Clearly, it cannot be concluded that cycles 5 and 6, where the group fundamentally self-coordinates, probably penalise interrelation because of multi-collinearity. That said, the qualitative observation did indicate to me that in the last cycles, a less entangled game would have been desirable.

Due to the characteristics of the course, the declared teamwork objective and the level of cohesion reached in the last cycles; the group considers that working in a criss-cross way is a mechanism that helps them achieve the objective. It consolidates a mechanism that has worked correctly, without being revised or updated, to new situations in the last game cycles, becoming part of the emerging mental model. With it, they lose the capacity of maximising opportunities swiftly.

Teamwork converted into an end acts as a limiter of personal advantage, introducing an imbalance that reduces those contributions and, indirectly, those of the whole group.

11.6 Teamwork is an emerging pattern

On many occasions during my professional life, I have been asked for teamwork courses. In many of the cases, the intervention was reduced to just an outdoor course. If only it was that simple!

First, we have to distinguish between the activity of 'team-building' as purely a relational activity with emotional objectives and 'teamwork', the authentic pattern of behaviour oriented to taking advantage of synergies through collaboration and coordination between members of a group.

Certainly, therefore, teamwork is not easy to achieve, much less so after a short and isolated intervention. Here we have seen a model of certain complexity that contemplates different scopes, levels, factors and catalysts. However, the most important fact from my point of view is that teamwork is an emerging consequence of some concrete conditions, which are reached in an evolving manner.

We consider emergence as the appearance of new and coherent structures, new patterns, and properties during the process of self-organisation in complex systems. The emerging phenomenon occurs at the framework level, in contrast with the micro-level at which components and processes are produced (Goldstein, 1999).

From a systematic perspective, Lawler emphasises employee involvement as a key ingredient in the design of a successful organisation. He argues that the role of top management is to sculpture a vision, implement structures and compensations and create a general climate that supports teamwork (Lawler, 1993).

Consequently, Directors and company policy should be aware of the true dimension of the objective and dedicate time, attention, and the necessary resources to it.

11.7 Teamwork is decentralised

On the self-coordination level, collaboration is seen at its highest point and coordination is the key to efficient performance. When a group has knowledge and is cohesive, now is the time to know who does what, how and where. For this reason, in circumstances in which all members are motivated, involved, contributing and participating, centralised coordination would be inefficient. It is very important and significant that coordination is decentralised. The centralised definition of objectives, decision-making, and implementation is not effective as there should also be autonomy of action.

If one dyad has a possible interconnection, a triad has 3, a quartet has 6, a quintet has ten and so on[52], then in a group that is generally of 12 members, we would have 66 possible interconnections: too many. Another type of decentralised coordination is necessary; emerging, natural and spontaneous. I call it self-coordination.

If, in the complex environment reproduced in Synergy, a person or a subgroup takes responsibility, centralises coordination and focuses on the process, they will become overwhelmed and lose vision. I have repeatedly seen how, in an attempt to improve their coordination, some groups designate a person for this specific role. Then one or two people were made responsible for organising the application of the strategy that was previously jointly defined. Problems started when the accelerated dynamics and the permanent changes impeded managing the new situations that emerge with the agreed strategy.

The group had lost flexibility; all decisions were taken in a centralised manner, and the person in charge became a bottleneck and slowed down the activity of the others, condemning them to dependency. The departments waiting for instructions were inactive, while the centralised coordination unit was overwhelmed. Even worse, departments had lost knowledge; they had to wait for information to reach them and had completely lost the ability to react. Feedback did not exist, only reports. On occasions even dynamism was halted to recover data lost in the whirlpool, converting the data itself into something more important than its significance or implication. It goes without saying that the rest of the group had to wait for the recovery of the lost data, thus wasting precious time.

The result of the emergence of this level is, in essence, shared leadership. The team comes to the end of its evolutionary process in a totally interdependent manner because of the initiatives of action that have been taken when exploring ways of collaboration

[52] Generally speaking, if N is the number of participants and the quantity of possible interconnections, the general formula is L=N*(N-1)/2.

and possible joint actions. With a higher number of interconnections, this shared leadership appears more easily and, with that, the capacity of the team to self-coordinate.

11.8 Collaboration is not always possible

Three levels of collaboration in groups are clearly observed according to the moment at which they happen, and the three have different implications. With the first, that I identify as the *Alliance*, everybody wins, and nobody loses. The agreement is obvious; nobody rejects it. As soon as an opportunity for collaboration under these circumstances appears, it is accepted.

While the group evolves and the integration process follows its course, new opportunities for cooperation emerge, that although not harming anyone, do create unequal benefits. Here is where the group usually reaches agreements that produced benefit is attributed to one's self earlier or later as compensation or reciprocity. It is the interchange level or *Cooperation*. In day-to-day reality, we could consider that win-win negotiations are located here. The parties negotiate an exchange value and agree with the corresponding compensations. The level of cooperation is not bad, although we cannot yet consider that it produces optimal results for the whole

Global necessities are addressed in the third level at the same time as individual ones but, contemplating the group as a whole, as a system, as an entity with its own differentiating personality and particularities. As such, its members feel that they have made an important qualitative jump; this is the *Collaboration* level.

When reaching this point, it becomes necessary to make an essential distinction between cooperation and collaboration. Cooperation is linear, concrete, oriented to an objective. In cooperative work, the tasks are subdivided between the members and which one works separately. Coordination is important in terms of who does what, how and when (Nezamirad, Higgins, & Dunstall, 2005).

Collaboration is a creative process between two or more persons, with complementary abilities that interact to create a common understanding that nobody previously had and would not have been able to acquire alone. Collaboration creates common contents about a process, a product, or an event. In this sense, nothing is routine; this is something that did not previously exist (Schrage, 1990).

Collaboration is a state that has many components, and one of them is cooperation. Cooperation also is about a common purpose but at a lower abstraction level, more operative. Collaboration is a creative process where the result is the emerging product resulting from interaction. If cooperation needs coordination, collaboration needs self-coordination.

If we were to place the three levels of collaboration in relation to the achieved team conscience, we would have a scheme like the following:

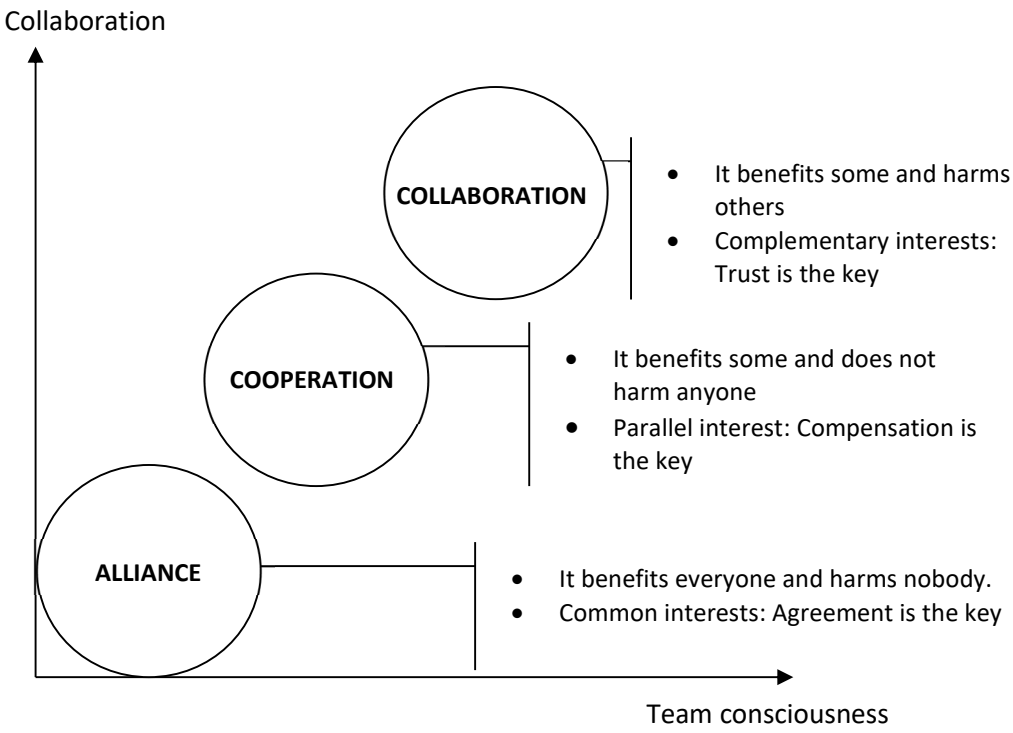


Figure 27 The Three Possible Collaboration Levels

Trust is very important in the last level as we assure that although actions apparently contrary to individual interests exist, these decisions will not be judged as transgressions or aggressions but rather as a search for a common benefit that includes the individual that takes it into account and finally balances it.

In the *Collaboration* level individual and common objectives lose their differentiation. They should be achieved together and in a balanced manner. Going to the other extreme, that the group 'only' thinks of a group, is not positive; it should also think of the individual. As in a company, the dichotomy is clearly proposed among the objectives from a conceptual point of view but hardly defined from an operational point of view. To go after one's own interest is only logical; to do it only with attention placed on a common interest (even at the expense of the individual) is also logical. The problem lies in reconciling both objectives in a balanced manner. Unfortunately, here, as in most situations of complexity, there are no recipes; it is a case of obtaining a balance between individual and global interests.

Curiously, when a group is integrated it is perfectly capable of understanding the need to balance individual and global interest and achieving that aim; it is very important that it does, as we are in the final process of evolution. Previously, any attempt to achieve common benefit by the more collaborative participants is rejected when considering that individual benefit is at risk. For individuals to be collaborative in the long-term, they should also achieve their objectives or have a reasonable expectation that, sooner or later, the cost of collaboration will be compensated.

When agents or not interdependent, survival is reduced to win-lose competition, where the strongest individual survives. However, in complexity, this is not applicable. Interrelations and interdependencies cause the most selfish decision to be precisely the most collaborative. Not only that, but the self-interested use of resources with the sole aim of making individual gains will also be rejected by the group. On occasions, decisions taken in this direction were identified in the groups, with disastrous results for cohesion and regression to previous more individualist positions. These groups usually obtained worse results after a crisis than those obtained in previous game cycles.

Some may think that those who meditate only for their own interests are selfish. On occasions, this assumption may not be totally correct. The degree of collaboration observed in groups was directly related to the level of trust and therefore to the perceived level of risk. There is a natural tendency in all human beings that pushes them to survival. Therefore, perceiving risk releases a series of self-protection mechanisms that push one to take up more individualist positions. As a group increases the level of trust among its members and reduces in parallel the perceived risk of the decisions it takes, it becomes more capable of showing collaborative attitudes. Therefore, the trick consists of regulating the key to trust and risk, allowing the appearance of such decisions.

In his work The Evolution of Cooperation, Robert Axelrod contributes some keys that we can recompile perfectly here. Using the famous 'Prisoner's Dilemma' game, created around 1950 by Merrill Flood and Melvin Dresher and later formalised with its current name by A.W. Tucker, Axelrod invited experts in game theory to a tournament. The competition consisted of sending programmes in which the participant should choose between making a cooperative decision or a non-cooperative one faced with a series of repeated interactions of the game. Among them all, the strategy called 'Tit for Tat', from Professor Anatol Rapoport of Toronto University always won. What was surprising is that its strategy was also the simplest. It held that the first decision was always cooperative while after that, it systematically repeated the decision of its opponent (Axelrod, 1984).

As in the Tit for Tat strategy, the group that initiates its activity in a cooperative manner and gives the system an opportunity, advances further in the processes of the model. Likewise, the reciprocity concept, a key in the Axelrod work, was like a consequence of complementarity of the interests of the group, of its capacity to reject cooperation if the expectation of returns did not exist and of the real and close perception that the cooperative effort would be compensated. Thus, one would be cooperative with the other party, and this would generate a common benefit. On the contrary, it would not be if the others were not.

When extrapolating these teachings to the reality of groups, therefore, we have to take into account that the size of these plays against the perception of individual contribution and the expectation of returns. In addition, it would be a negative factor if the benefit of cooperative effort were shared unequally among the members, giving way to a less clear expectation of reciprocity. Therefore, when designing teams and compensatory policies, it would be necessary to divide large groups into smaller teams to improve this perception.

By integrating collaboration levels in the model, we observe that the Alliance level is accessible to any series of individuals with coinciding interests. The level of cooperation would be within reach of those groups that have initiated integration processes and have minimum trust, sufficient to sustain the negotiating process and the establishment of compensations on equal terms. When the minimum level of trust is missing, negotiation cannot progress even though both parties consider a potential agreement as beneficial. Finally, the maximum level of collaboration forcedly needs to be situated at the highest level of the model.

11.9 Equality is a limiting element

Equality appears in the model as a necessity and is important when trying to achieve a level of cohesion that transforms the group into a team. Together with generosity, they build the Trust Generation factor; this, together with Group Integration, forms the *Cohesion* level. I have commented that from my observations, I derive that equality also

acts as a brake for the group if it is not overcome. By this I mean it is true that equality is necessary and a key to achieving the level of cohesion, but if the equality policy is maintained (by everyone, equally), it degenerates into rivalries, and degrades the same cohesion; this happens because it is inevitable that the real dynamics create differences and is even clearer in the absence of resources, under time pressure or in the face of taking advantage of occasional opportunities.

The group should accept those differences and build on them in a complementary way to move forward to the results level. Achieving an optimal level of results globally does not consist of adding the individual (local) optimal results, but in understanding that the group as a system has its own characteristics and rules. Optimising it often involves creating inequalities. Moreover, by putting the focus on the common aim, attention is necessarily diverted from the individual, and that can create the feeling of achieving fewer results as a team than working alone.

A group that embraces equality manages to share benefits and loads but does not obtain the maximum joint result. Optimising the whole does not mean optimising the parts. The team member who benefits the least has to admit that others will benefit more - and that is only possible if the right conditions exist. This step is only possible when the team has a common conscience and therefore, the idea that there are less favoured individuals in comparison with others, disappears. Here the group defines and unifies the criteria of action based on the approach to results.

11.10 Teamwork is not an individual competence

Just as we saw when speaking of competences, the operative approach to teamwork materialises when this is included in the dictionaries of competences and organisations begin to consider it as one of the desirable characteristics of their managers. We also saw that the definition of levels referring to individual behaviours that were related to the existence of collaborative relations.

On multiple occasions during the program, a person with supposed collaboration characteristics and attitudes volunteered to cooperate in the first cycles and was simply ignored. Each participant at such times was more worried about understanding the operation of the simulator than trying to make a joint attempt at solving the problem. On other occasions, the group, or part of it, seemed to take advantage of that generosity for their own benefit. When that profiting became obvious, it provoked irritation and confrontation. On many occasions, it was the motive for the appearance of rupture strategies that retreated in the collaborative approach. Simply put, the context in which those initiatives had appeared was not yet mature enough to be evaluated.

On some occasions, aggressive, individualist directors participated yet defended roles derived from hierarchical positions. Their competitive attitude and their decisions did not at all favour evolution toward teamwork.

On the one hand, I see it clearly that teamwork is not a competence in the strict sense of the individual. The definition leaves no place for doubt: 'as an underlying characteristic of an individual that is causally related to criterion-referenced effective and/or superior performance in a job or situation' (Spencer & Spencer, 1993). Therefore, it is a collective state.

I accept that the different levels of the traditional definition of teamwork competence are desirable characteristics in the person to favour or facilitate their emergence. Despite not being directly related to its appearance or not being the only cause or condition, its lack is indeed a problem that is difficult to overcome; this is especially true for small groups, where these gaps are more visible. In large groups, they can compensate for it.

I have observed that if individuals with this type of personality maintained certain discretion and controlled their influence, limiting it only to their subgroups, they were compensated by the entire group. We can say that because of the collective nature of teamwork, the personal characteristics of its members can be compensated; this reduces the requirement to achieve high individual levels on the competence measurement scale. Unfortunately, many top directors extended that influence to the entire group, on occasions with fateful results. The traditional definition of teamwork competence, since it is individual, is a necessary condition but not sufficient.

Teamwork is not a single-dimension construct. We should also relate it to a pre-determined level of knowledge, of integration, of trust between team members, with a determined type of interrelation or treatment, with a determined type of interrelation or treatment and to a shared criterion for action.

It is not ex-ante; it is the emerging result of some given conditions that provoke cooperative interaction. It is collective behaviour that appears in a natural, spontaneous manner as a consequence of maturity. It is something non-dissociable of its evolutionary process.

Finally, it is not difficult to see consulting companies involved in the processes of definition and implementation of competency assessment systems that include teamwork as a managerial competence. The dictionary definition is useful when defining requirements for positions, for selecting candidates, for evaluating performances, for conditioning career plans or compensation policies. Nevertheless, these same companies fail in delivering training and developing on the subject. Success cannot be obtained in teamwork only by working on individual aspects and without considering management responsibility.

All the above requires organisations to become aware of the importance of company policies and strategies and their impact on behaviour. Structures condition behaviour impeding or favouring collaboration.

11.11 'Teamwork Intelligence'

From a complex and multidimensional perspective, even accepting the general definition of the Teamwork and Cooperation competence as the characteristics that an individual should have to facilitate the appearance of teamwork, it is not certain that we should refer exclusively to the focus of cooperation. As we have seen in the model, at each level, there is a series of factors that demand equal relationships. Therefore, it would be much more correct to refer to a series of competences capable of covering the different aspects to be considered when facilitating the evolution that allows the group to develop itself collectively.

Based on its international experience, the human resources consulting agency Hay Group (heir of the David McClelland School), concludes that the main competences for success at work are summarised in a series of 20 general competences (Bethell-Fox, 1994).

a. Competences of achievement and action:
    1. Motivation for achievement: care to work well or to compete for overcoming a standard of excellence.
    2. Care for order and quality. Care for decreasing uncertainty using controls and checks and establishing clear and orderly systems.
    3. Initiative: predisposal to undertake actions, improving results or creating opportunities.
    4. Searching for information: curiosity and desire to obtain much and concrete information to get to the bottom of matters.
b. Competences of help and service:
    5. Interpersonal sensitivity: capacity to adequately listen and to understand and respond to thoughts, feelings or interests of others, without these having expressed them or only partially expressing them.
    6. Orientation to client service: desire to help or serve others by finding out their necessities and then satisfying them. Among the clients, the work colleagues within the company or other units of the organisation should also be considered.

c. Competences of influence:
    7. Impact and Influence: desire to produce an impact or a determined effect on others, persuade them, convince them, have an effect on them or affect them, so as to get them to follow a plan or a line of action.
    8. Organisational knowledge: capacity of understanding and using existing dynamics in the organisations.
    9. Building of relations: capacity to create and maintain friendly contacts with persons that are or will be useful to achieve the aims related with work.
d. Managerial competences:
    10. Development of persons: capacity to undertake efficient actions to improve the talent and capacities of others.
    11. Management: capacity to communicate to others what is necessary to do and manage to get them to comply with one's desires, taking in account the long-term benefit of the organisation.
    12. Teamwork and cooperation: capacity for working and making others work, collaborating with each other.
    13. Team leadership: capacity for carrying out the role of leader of a group or team.
e. Cognitive competences:
    14. Analytical thinking: capacity of understanding situations and resolving problems by breaking them down by their constituting parts and meditating on them in a logical and systematic way.
    15. Conceptual thinking: capacity of identifying models or connections between situations and of identifying key or subjacent aspects in complex situations.
    16. Expertise (knowledge and experience): capacity of using and increasing technical knowledge or of getting others to acquire work-related knowledge.
f. Personal efficiency competences:
    17. Self-control: capacity of maintaining control of one's self in stressful situations or that provokes strong emotions.
    18. Self-confidence: belief in one's own capacity for directing an adequate approach for a task and carry it out, especially in difficult situations that mean a challenge.
    19. Flexibility: ability to adapt and work efficiently in different and various situations with diverse groups and persons.
    20. Commitment with the organisation: Capacity and desire of orienting one's behaviour in the indicated direction due to necessity, priority and aims of the organisation.

Taking them as a solid base, many of these competences could be considered part of that great teamwork competence. If we consider this summary as currently one of the most appropriate, we could adapt it to identify those that seem necessary for taking correct action according to the model.

In my opinion, we should also modify some competences and especially add others that touch aspects that perhaps are not completely covered by the current list. I propose that the Teamwork and Cooperation competence (12) be redefined as Cooperation considering that teamwork is the result of the model group. The Leadership competence (13) would be re-named to co-leadership, including the capacity for sharing it.

Thus, we could call 'Teamwork Intelligence' a series of competences causally related to a successful teamwork action.

The following series of competences can be derived from my observations.

Level	Factor	Competences
Knowledge	Proactivity oriented to results	Motivation for achievement (1) Initiative (3) Searching for information (4) Impact and Influence (7) Building relationships (9) Knowledge and experience (16)
	Proactivity oriented to relations	
Cohesion	Group integration	Interpersonal sensitivity (5) Motivation (new) Integration (new) Cooperation (12) involvement (new) Honesty (new)
	Trust generation	
Self-coordination	Equal relationship	Assertiveness (new) Co-leadership (13) Analytical thinking (14) Conceptual thinking (15) Planning/Organisation (new) Flexibility (19)
	Criteria of action	

Table 34 Teamwork Model Competences

The new competences can be explained as follows:

Motivation: Recognise own and others' merits, incite and encourage the team, evaluate the contribution of others. Is an optimist and shows positive thinking. Prompt to notice successes and not failures.

Integration. Acts in an integrative manner. Stimulates participation and cooperation from those less-active members. Looks for roles assumable by potentially conflictive persons to fit them into the team.

Involvement. Implicitly and emotionally gives of one's self. Does not appear as indifferent. Openly and honestly shares the common objective, considers the project as his own. Is identified with the group values. Participates in group satisfaction, feeling it as his own.

Honesty. Manifests honesty, transparency, and integrity in his relations. Is reasonable and just. Respect pacts and commitments.

Assertiveness. This is defined as a personal ability that allows us to express feelings, opinions and thoughts, at the opportune time, in an adequate manner and without denying or disregarding the rights of others (Salmurri, 2004).

Panning/Organisation. Is the capacity of foreseeing or anticipating the course of an action, determining the necessity of resources, conveniently administering, and coordinating them?

11.12 Future studies

When finishing this work, I felt enormous satisfaction that the results obtained compensate for the abundance of effort involved. On the other hand, and in parallel, one feels inner anxiety about those aspects not covered but that are clearly identified as necessary. I also ended up with the sensation of having developed insufficiently some of the qualitative conclusions that potentially had the same or higher penetration as the original research itself. That sensation is the motive that impels me to continue along this investigative path.

From all that, I especially identify an aspect that I believe can have a large impact on the business world: distributed leadership.

11.12.1 Distributed Leadership as the following level of the model

Traditionally, theory and practice of leadership have concentrated on the characteristics, behaviours, and actions of the individual leader. Effort is centred on finding the best leader. With the appearance of complexity, a less linear concept emerges, more based on shared or distributed leadership, in leadership as a consequence of teams and the interactions of their members. Leadership is considered as a dynamic process that appears between persons in a given context. Now it does not depend on one person, but rather it is a consequence and, more importantly, of the psychological processes related with aspects of dynamics (emotions, trust, motivation and identity) be they social (training and group regulations), or cognitive (perception, learning, acquisition of knowledge) and of coordination and power (Karp & Helgø, 2008).

By increasing the view of leadership to teams, we find different frameworks for understanding so-called team leadership. Some adopt a collective level (shared leadership, distributed leadership) and their effects related to the results of the team. Others adopt a relational view centred on quality and the degree of differentiation of interchanges between the leader and the team as a group. Others define it with an individual approximation, as the effect of the leader over the team (Day, Gronn, & Salas, 2006).

Nevertheless, there is no unanimity in the definition of the different types of leadership that can be related to teams. James Spillane distinguishes between distributed leadership, collaborative leadership, democratic leadership, and co-leadership. While collaborative leadership is, by definition, distributed, distributed leadership does not have to be collaborative but rather will depend on the situation. From my perspective, distributed leadership can be democratic or autocratic. In turn, co-leadership (or shared leadership), reflects a distribution of leadership among several leaders while in distributed leadership practice it has sense as the interaction between leaders, the followers and the situation itself (Spillane, 2006).

Spillane indicates three essential elements of distributed leadership:

- The main concept is not the leader but rather the practice of leadership.
- The practice of leadership is generated by the interaction of the leaders, the followers, and the situation. Each element is essential.
- The situation defines the practice of leadership and is in turn, defined by this.

In a wider manner and after an exhaustive revision of the literature about delegated, democratic, dispersed and distributed leadership, Nigel Bennett identifies three fundamental factors (Bennett, Wise, Woods, & Harvey, 2003).

- The first refers to leadership as an emerging property from the interaction between individuals of a group or network.

- The second suggests the opening of leadership limits, beyond conventional leaders, to include other contributors.
- Finally, the third refers to the distribution of knowledge among the majorities versus the accumulation of it by minorities.

He proposes that if distributed leadership should be contemplated as something differential, it will be because it is the emerging product from the joint or concerted activity of a group or network.

The three characteristics appear in the Cooplexity model, suggesting an intimate relationship between teamwork and distributed leadership. In fact, self-coordination, the third level function, is obtained on the basis of different leaderships and action initiatives that appear spontaneously and selflessly in some the team members. Nevertheless, the differentiation that Spillane makes between distributed leadership and collaborative leadership can separate the first from the model. Regarding this, a series of authors clearly relate both distributed leadership and teamwork.

Peter Gronn centres on distributed leadership as a concerted action[53] in front of an additive idea. Distributed leadership is sensible as something emerging from the organisational grouping of different members and is defined as 'the demonstrated and alleged structural influence attributable to members of an organisation acting in a concerted manner' (Gronn, 2002). Therefore, he understands leadership as something attributable to an individual, to an aggregation of several individuals, to small groups of individuals acting in a concerted manner or to larger or smaller organisational units. Distributed leadership as a concerted, continuous action would have at least three forms: spontaneous collaboration; intuitive and practical institutionalised work relations.

This time there is not only a new clear parallel between the model and distributed leadership, but the notion of size also comes into play. In addition, it is precisely here where I believe that there could be a connection between the model and distributed leadership. I propose that the Cooplexity model, as a collaboration model in complexity, would be placed on the third level, that of teams, while distributed leadership would reach a fourth level, that of collectives.

[53] "Concertive action" in the sense that the group is more than the sum of the parts.

Scope	Level	Catalyst
COLLECTIVES	CO-MANAGEMENT	Institutions
TEAMS	SELF-COORDINATION	Interconnections
GROUPS	COHESION	Common project
INDIVIDUALS	KNOWLEDGE	Exploration

Table 35 Distributed Leadership in Cooplexity

In this case, I propose that the collectives exercise distributed leadership at a co-management level, having institutionalisation as a catalyst. Associationism and social interactions (Association and Interaction) would stand out as social realities or factors.

11.12.2 Massive collaboration as the last level of the model

However, we could even go further, surpass the limits of collectives, enter globalised society and ask ourselves if there is yet another level where technology, demography and the global economy converge in an era of participation toward a revolution in the way of understanding business. Technology focused on communication platforms. Demography as emerging common interest networks with new openings, participation and interactivity ethics at work, communities and markets, and a global economy that allows new forms of economic cooperation (Tapscott & Williams, 2006).

In a social scope, the collaboration model would extend from distributed leadership to massive collaboration. This social level of massive collaboration would come through social structures. Concretely it would come through modern technologies, like information and communication technologies, as those especially capable of supporting forms of distributed organisation and ecological constructions (versus ego-logical) (Hosking, 2002).

Scope	Level	Catalyst
SOCIETY	COLLABORATION	Social structures
COLLECTIVES	CO-MANAGEMENT	Institutions
TEAMS	SELF-COORDINATION	Interconnections
GROUPS	COHESION	Common project
INDIVIDUALS	KNOWLEDGE	Exploration

Table 36 Massive Collaboration in Cooplexity

Collaboration will be built on individual and collective collaborations, and identification with the project and the social use are sensed to be important factors that would facilitate the appearance of a social conscience.

An interesting debate could centre on altruism as a basic mechanism of voluntary work. In my opinion, this would be an inadequate debate or at least insufficient in the model. Pure altruism is an act of exceptional generosity and, as such, an exception is not transferrable to the whole of society. The system should contribute to different individuals or collectives and have sufficient utility to promote interchange as a natural mechanism of common enrichment. Once again, we find ourselves before the necessity of a certain balance between self and general interest - not exclusive but, rather, complementary.

This way, individuals acquire knowledge through learning; they form tight-knit groups through a common project to constitute teams that self-coordinate through interconnections. These teams form collectives they co-manage through institutions as forms of collective organisation. Finally, the whole group will massively collaborate using contributions that originate in different scopes, from individuals to collectives and through social structures like those that allow modern information technologies.

All that, nevertheless, should be the subject of confirmation through specific future research.

STUDY APPENDIXES

Annex A - Behaviour indicators

A list of behaviour indicators of each observation variable and characterisation of the same. The observation cycle (C1 to C6) is taken into account in the coding of variables and if the observation occurs during the previous analysis phase of the group (CxPy) or during the game (CxCy).

Variable	Behaviour indicators
C1P1	More information is requested
C1P2	Information is noted down
C1P3	Clarification of objective is requested
C1P4	The starting situation is discussed or passively assumed
C1P5	Discovery that they are the same projects
C1P6	The difference between presentation (from 1 to 30) and the projects sheet (from 1 to 4) is questioned
C1P7	What is synergy is asked
C1P8	Project numbers are asked
C1P9	They try to coordinate a common action
C1C1	Projects are played
C1C2	Time of play is controlled
C1C3	They help themselves with answers to the cards (they cheat)
C2P1	They identify that the profiles are different for each player
C2P2	Discovery that they are the same projects
C2P3	Discovery that the resources are not scarce
C2P4	More information is requested
C2P5	Information is interchanged
C2P6	Individual or common planning
C2P7	Individual or group analysis
C2P8	Organised discussion
C2C1	Investment is made at 10, 10, 10 when they discover no limit applies
C2C2	The bet is elevated to 5, 5, 5 when analysis fails
C2C3	Obtaining the objective is controlled
C2C4	They help themselves with answers to the cards (they cheat)

Variable	Behaviour indicators
C2C5	They focus more on quickly playing projects than on guessing the exact investment of resources
C3P1	Individual or common planning
C3P2	They agree to reach a previous quantity of points
C3P3	The information is noted down in a structured manner
C3P4	Organised discussion
C3P5	They commit collectively
C3C1	They control the process; the game is more technical, more competent.
C3C2	Obtaining the objective is controlled
C3C3	They control spend on resources
C3C4	They do not self-limit investment of resources
C3C5	They help themselves with answers to the cards (they cheat)
C3C6	The group creates rules of operation
C3C7	They play with Synergy consciously
C4P1	Individual or common planning
C4P2	They understand the reports correctly
C4P3	They define criteria to organise the game
C4P4	Organised discussion
C4P5	They commit collectively
C4C1	They organise cards according to defined criteria
C4C2	They play with Synergy consciously
C4C3	The group creates rules of operation
C4C4	They do not self-limit investment of resources
C4C5	They help themselves with answers to the cards (they cheat)
C4C6	They control spend on resources
C5P1	Individual or common planning
C5P2	They define a contingency plan
C5P3	They specialise in tasks
C5P4	They define criteria to organise the game
C5P5	Integrating behaviours appear (are we all in agreement?)
C5P6	Mediating behaviours appear (let's talk one by one)
C5P7	They commit collectively
C5C1	They share game elements (dice, shakers, ...)
C5C2	They do not self-limit investment of resources
C5C3	The group creates rules of operation
C5C4	They take a project, and they play it by player order
C5C5	They play low common interest benefit projects
C5C6	They control possible conflicts that are generated
C5C7	They play with Synergy consciously
C6P1	They identify relationships and basic concepts
C6P2	Independent planning or assisted by the monitor
C6P3	They define a contingency plan

Variable	Behaviour indicators
C6P4	They specialise in tasks
C6P5	They define criteria to organise the game
C6P6	Integrating behaviours appear (are we all in agreement?)
C6P7	They commit collectively
C6P8	They form equal terms' relations
C6P9	Organised discussion
C6C1	They share game elements (dice, shakers, ...)
C6C2	They do not self-limit investment of resources
C6C3	They take a project, and they play it by player order
C6C4	They play low common interest benefit projects
C6C5	They compare unsecured or unknown information
C6C6	They control possible conflicts that are generated

Annex B - Groups of variables

The initial series of variables is filtered and grouped giving way to a new series of grouped variables

Grouped variable	Behaviour indicators	Grouped variables names
A1C2C4	They help themselves with answers to the cards (they cheat)	Cooperation
A1C3C5	They help themselves with answers to the cards (they cheat)	Cooperation
A1C4C5	They help themselves with answers to the cards (they cheat)	Cooperation
A2C2P6	Individual or common planning	Common consideration
A2C3P1	Individual or common planning	Common consideration
A2C4P1	Individual or common planning	Common consideration
A3C3P5	They commit collectively	Implication
A3C4P5	They commit collectively	Implication
A3C5P7	They commit collectively	Implication
A4C4P3	They define criteria to organise the game	Definition of criteria
A4C5P4	They define criteria to organise the game	Definition of criteria
A4C6P5	They define criteria to organise the game	Definition of criteria
A5C5C4	They take a project, and they play it by player order	Equality
A5C6C3	They take a project and they play it by player order	Equality
A6C5C5	They play low common interest benefit projects	Generosity
A6C6C4	They play low common interest benefit projects	Generosity
A7C3C7	They play with Synergy consciously	Relation
A7C4C2	They play with Synergy consciously	Relation
A7C5C7	They play with Synergy consciously	Relation
A8C2P8	Organised discussion	Respect
A8C3P4	Organised discussion	Respect
A8C4P4	Organised discussion	Respect
A9C3C6	The group creates rules of operation	Normalisation
A9C4C3	The group creates rules of operation	Normalisation
A9C5C3	The group creates rules of operation	Normalisation
A10C5C1	They share game elements (dice, shakers, ...)	Common property
A10C6C1	They share game elements (dice, shakers, ...)	Common property
A11C5P3	They specialise in tasks	Specialisation
A11C6P4	They specialise in tasks	Specialisation
A12C5P2	They define a contingency plan	Alternative criteria
A12C6P3	They define a contingency plan	Alternative criteria

Grouped variable	Behaviour indicators	Grouped variables names
A13C5C6	They control possible conflicts that are generated	Control of conflicts
A13C6C6	They control possible conflicts that are generated	Control of conflicts
A14C1P1	More information is requested	Obtaining data
A14C1P3	Clarification of objective is requested	Obtaining data
A14C2P4	More information is requested	Obtaining data
A15C2C3	Obtaining the objective is controlled	Control of objective
A15C3C2	Obtaining the objective is controlled	Control of objective
A16C3C3	They control the spend on resources	Control of resources
A16C4C6	They control the spend on resources	Control of resources
A17C4C4	They do not self-limit investment of resources	No self-limitation
A17C5C2	They do not self-limit investment of resources	No self-limitation
A17C6C2	They do not self-limit investment of resources	No self-limitation
A18C6P1	They identify relationships and basic concepts	Understanding
A18C6P2	Independent planning or assisted by the monitor	Understanding
A19C1C1	Projects are played	Action decisions
A19C2C2	The bet is elevated to 5, 5, 5 when analysis fails	Action decisions
A20C2P1	They identify that the profiles are different for each player	Interaction
A20C2P2	Discovery that they are the same projects	Interaction
A21C2P5	Information is interchanged	Interchange
A21C2P7	Individual or group analysis	Interchange
A22C5P5	Integrating behaviours appear (are we all in agreement?)	Unification of criteria
A22C6P6	Integrating behaviours appear (are we all in agreement?)	Unification of criteria
A23C1C2	Time of play is controlled	Order and control
A23C4C1	They organise the cards according to defined criteria	Order and control

Annex C - Classification of variables by levels

Classification of all the observations ordered according to the corresponding level.

Grouped variable	Grouped variables names	Level id final model	Sublevel id final model	Action id final model
A14C1P1	Capture of data	1	11	111
A14C1P3	Capture of data	1	11	111
A14C2P4	Capture of data	1	11	111
A19C1C1	Action decisions	1	11	112
A19C2C2	Action decisions	1	11	112
A15C2C3	Control of objective	1	11	113
A15C3C2	Control of objective	1	11	113
A20C2P1	Interaction	1	12	121
A20C2P2	Interaction	1	12	121
A21C2P5	Interchange	1	12	122
A21C2P7	Interchange	1	12	122
A07C3C7	Relation	1	12	123
A07C4C2	Relation	1	12	123
A07C5C7	Relation	1	12	123
A01C2C4	Cooperation	2	21	211
A01C3C5	Cooperation	2	21	211
A01C4C5	Cooperation	2	21	211
A09C3C6	Normalisation	2	21	212
A09C4C3	Normalisation	2	21	212
A09C5C3	Normalisation	2	21	212
A03C3P5	Implication	2	21	213
A03C4P5	Implication	2	21	213
A03C5P7	Implication	2	21	213
A05C5C4	Equality	2	22	221
A05C6C3	Equality	2	22	221
A06C5C5	Generosity	2	22	222
A06C6C4	Generosity	2	22	222
A02C2P6	Common consideration	3	31	311
A02C3P1	Common consideration	3	31	311
A02C4P1	Common consideration	3	31	311
A08C2P8	Respect	3	31	312
A08C3P4	Respect	3	31	312
A08C4P4	Respect	3	31	312
A04C4P3	Definition of criteria	3	32	321
A04C5P4	Definition of criteria	3	32	321
A04C6P5	Definition of criteria	3	32	321
A22C5P5	Unification of criteria	3	32	322
A22C6P6	Unification of criteria	3	32	322
A12C5P2	Alternative criteria	3	32	323
A12C6P3	Alternative criteria	3	32	323

Annex D - Values obtained by means of optimum scaling

Percentage values of explained variance and of component loadings obtained after the first grouping of variables by means of optimum scaling.

Grouped variable	Explained variance	Component loadings
A1C2C4	63.72%	0.699
A1C3C5		0.889
A1C4C5		0.795
A2C2P6	70.81%	0.869
A2C3P1		0.797
A2C4P1		0.857
A3C3P5	72.27%	0.899
A3C4P5		0.887
A3C5P7		0.757
A4C4P3	72.97%	0.862
A4C5P4		0.922
A4C6P5		0.773
A5C5C4	67.89%	0.824
A5C6C3		0.824
A6C5C5	51.24%	0.746
A6C6C4		0.685
A7C3C7	67.56%	0.793
A7C4C2		0.874
A7C5C7		0.797
A8C2P8	59.16%	0.716
A8C3P4		0.835
A8C4P4		0.752
A9C3C6	62.13%	0.792
A9C4C3		0.855
A9C5C3		0.712
A10C5C1	53.84%	0.742
A10C6C1		0.725
A11C5P3	84.65%	0.920
A11C6P4		0.920
A12C5P2	84.64%	0.920
A12C6P3		0.920
A13C5C6	68.95%	0.830
A13C6C6		0.831
A14C1P1	66.99%	0.909
A14C1P3		0.879
A14C2P4		0.641
A15C2C3	75.01%	0.866

Grouped variable	Explained variance	Component loadings
A15C3C2		0.866
A16C3C3	73.31%	0.856
A16C4C6		0.856
A17C4C4	65.04%	0.723
A17C5C2		0.852
A17C6C2		0.838
A18C6P1	89.64%	0.947
A18C6P2		0.947
A19C1C1	66.70%	0.817
A19C2C2		0.817
A20C2P1	64.64%	0.804
A20C2P2		0.804
A21C2P5	81.83%	0,905
A21C2P7		0.905
A22C5P5	61.30%	0.784
A22C6P6		0.782
A23C1C2	66.40%	0.815
A23C4C1		0.815

Annex E - Values obtained by means of FA

Percentage values of explained variance and of component loadings obtained after the second grouping of variables by means of an FA.

Sublevel	Construct	Variable	Name	Explained variance	Component matrix
11	Proactivity to results	A14	Capture of data	58.90%	0.601
		A19	Action decisions		0.850
		A15	Control of objective		0.827
12	Proactivity to relations	A20	Interaction	58.39%	0.797
		A21	Interchange		0.806
		A07	Relation		0.683
21	Group integration	A01	Cooperation	69.11%	0.889
		A09	Normalisation		0.814
		A03	Implication		0.787
22	Trust generation	A05	Equality	68.76%	0.829
		A06	Generosity		0.829
31	Equal relationship	A02	Common consideration	79.86%	0.894
		A08	Respect		0.894
32	Criteria and decision-making	A04	Definition of criteria	51.25%	0.613
		A22	Unification of criteria		0.808
		A12	Alternative criteria		0.713

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TESTIMONIALS

'Participating in SYNERGY was an intellectual challenge due to the different way of approaching a well-known subject. The idea of overcoming our mental models to embrace new ideas and not be anchored to traditional ones became perfectly clear. Learning to control natural leadership and to adapt it to good teamwork was another very effective practice.'

'On the whole, an intense and highly recommended experience for those who want to learn about different methodologies.'

Jordi Ballesté
Managing Director
Grupo Angelini

'The configuration of a new team of people coming from different business areas, and even from other organisations, with the aim of taking on a large project, created the need to develop a training programme that would facilitate interpersonal knowledge sharing and promote teamwork. Above all, it was necessary to establish the challenges and problems that we face, using this innovative training activity. The experience with the Cone of Equilibrium was at the same time rewarding and successful, as it brought together playing aspects (games and simulators) and operational ones (specific work projects) that led to the objectives being met, in terms of both cohesion and efficiency.'

Ricardo Alonso Fernández
Director of Corporate Banking
Global Banking & Markets
Banco Santander

'SYNERGY is an intelligent way of demonstrating by play that in a company we are all needed, and that union is strength. It is a testament to transversality, and in Dannon it has been very useful in making people aware of the importance they have in all functions, each one in their role, so that projects advance and become reality.'

Robert Cosialls
Purchasing Director of South Europe
Dannon

'Without doubt it is a professional and well-organised game. It creates initiative and excitement in the participants without being too competitive. It helps to form teams and enables participants to attain the desired outcome. I mean, of course, everyone knows that collaboration is important, and everyone knows we should trust one another, but this exercise helps people to really experience it. I think that the game can cover a large variety of learning objectives such as teamwork, collaboration, team-building, etc.'

Jeff Tomlinson
Director of Production
HEINEKEN

'A few years ago, I met Ricardo Zamora. He presented a teamwork project to us that we might like. The truth is, that as it was innovative and unusual, I have to confess that my initial reaction was to forget the whole thing. Nevertheless, we thought it over and decided to send an elite group to attend the training. It was an outstanding success, a total innovation in our training system, and, most of all, the team enjoyed it and admitted having learned important subjects like communication, teamwork, and works systems. Over the past three years, all our managers and middle managers have taken part, with excellent results when it comes to applying the acquired knowledge in their day-to-day work.'

Antonio Mateo Navarro
Director of Industrial Relations and Training
Lafarge

'It has been an outstanding personal experience for me and all of my team. Using the innovative and active methodology, which starts with individual knowledge and experience that is developed through game or simulation techniques, we have acquired knowledge by discovery that consolidates our own experience and gives immediate benefits with the transfer of that knowledge to our professional work as a team. We are always looking for ways to apply it day-to-day.'

José Poch Riba
General Manager Automotive Foam Division
Grupo Copo

ABOUT THE AUTHOR

Ricardo Zamora has a Bachelor of Science in Business and a Master's in Business Management from ESADE (Top 10 European and International Business Schools).

Ricardo Zamora specialises in Distributed Leadership, which is considered to be a set of spontaneous and interconnected collective initiatives. Distributed Leadership relates to talent, team effectiveness and self-coordination and is applied to the agile world, liquid organisations, and shared leadership.

Ricardo has been an Adjunct Lecturer of the Department of People Management and Organisation at ESADE Business School since the year 2000.

He is also an entrepreneur. In 1995 he founded Training Games, a laboratory for training solutions, specialising in the conception and development of team dynamics. Its motto is: Motivate your team!

In 2011, Ricardo founded Cooplexity, whose objective is to provide high-level training, related explicitly to Distributed Leadership and the Cooplexity Model (Cooperation and Complexity). Its motto is: Break the silos!

In 2016, Ricardo launched ecoaching.biz, an online development programme for young professionals, to learn to emulate the functional behaviours of four leadership profiles that have proved to be effective in changing situations. Its motto is: Develop your holistic leadership style!

In 2020, Ricardo launched Training Sims, a tutored corporate business simulation to motivate, commit and create a sense of community in remote teams by building trust.

Twelve companies from IBEX 35, as well as multinationals such as Abertis, Beiersdorf, Dannon, Heineken, Lafarge, REE, Santander Banking Group and Banco Sabadell, are customers.

Ricardo has taught international seminars in countries including Argentina, Brazil, China, Italy, Mexico, Netherlands, Spain, the UK, and the USA. He is a member of NASAGA (North American Simulation and Gaming Association) and the System Dynamics Society.

In complex and interdependent environments where the individual is overwhelmed or is dependent on others to achieve goals, it is the team that takes up the baton. A new management approach is necessary to manage in this context, allowing the organisation to confront potential risks and take advantage of potential opportunities and synergies.

Confronting permanent change and uncertainty is something that organisations should do collectively from a team perspective with Distributed Leadership.

Cooplexity presents a collaboration model in complexity that rigorously embraces three levels of working: individual, group and organisational.

All Ricardo's research is based on the behaviours observed in senior management teams, interacting in Synergy, a training course that, structured around a behavioural simulation, sets participants challenges in situations ranging from uncertainty to complexity.

In this book, readers will find guidelines to facilitate the development of collaborative behaviours. Additionally, they will find a series of conclusions that challenge the classic concepts of teamwork and leadership as they have been understood to date.