



# Financial engineering in complex organizations

## *Ingeniería financiera en organizaciones complejas*

Diana Stella Algarra-Fagua  <sup>1</sup>

### INFORMACIÓN DEL ARTÍCULO

#### Historia del artículo:

Enviado: 05/08/2024

Recibido: 22/08/2024

Aceptado: 30/11/2024

#### Keywords:

Individual  
Complexity  
Organizations  
Behavior  
Figures  
Data  
Markets



#### Palabras clave:

Individuo  
Complejidad  
Organizaciones  
Comportamiento  
Cifras

### ABSTRACT

Human behavior has brought adverse situations, unsound ways of thinking in the development of organizations, causing attitudes in the individual that are not very useful in the vision of the objectives established in the organizations. The document contemplates several fundamental aspects in complex organizations, covering from the feasible point of view for the organization and pointing out necessary elements for complex synthesis. Data from real companies are taken, indicating the most relevant to the case study, generating observation of risk required in the organization. As part of this, financial engineering is contemplated, generating strategies and options in response to financial, accounting, legal and fiscal lines in companies.

### RESUMEN

El comportamiento del ser humano ha traído situaciones adversas, formas de pensar poco solventes en el desarrollo de las organizaciones provocando actitudes en el individuo poco útiles en la visión propia de los objetivos establecidos en las organizaciones. El documento contempla varios aspectos fundamentales en organizaciones complejas, abarcando desde el punto de vista factible para la organización y señalando elementos necesarios para la síntesis compleja. Se toman datos de empresas reales, indicando la más relevante a estudio de caso, generando observación de riesgo requerida en la organización. Como parte de ello se contempla la ingeniería financiera generadora de estrategias y opciones en respuesta a líneas financieras, contables, legales y fiscales en las compañías.

<sup>1</sup> Teacher Universidad Distrital Francisco José de Caldas. E-Mail: [dsalgarraf@udistrital.edu.co](mailto:dsalgarraf@udistrital.edu.co)  
CVLAC: [https://scienti.minciencias.gov.co/cvlac/visualizador/generarCurriculoCv.do?cod\\_rh=0000109033](https://scienti.minciencias.gov.co/cvlac/visualizador/generarCurriculoCv.do?cod_rh=0000109033)

## 1. Introduction

The complexity paradigm, from the context of organizations, seeks to reorient their course. It makes a new reading of change, from a different point of view, the view that implies very deep innovations in the mental structures of those who interact in the organizations. Ferguson. [1]

Therefore, the intellectual capacity of the human being is limited by the limited ability to think in the complexity of organizations, to the point of taking incoherent behaviors with very little correlation to what the organization really demands.

It is then, that financial engineering involves several aspects of interest in strengthening the changes from the complex scenario, starting from the operational center that are income, costs, expenses and cash flows, mitigating the inherent risk that affect the time of being executed and obtaining favorable responses, so that the financial structure in companies through engineering presents the detailed dynamics of its operations. tradicionales hacia operaciones estratégicas feasible, accurate with robust investment scopes and broad environments in a globalized market.

## 2. Organizational Behavior

The behavior, skills and abilities of each member of the organization, address a whole series of elements necessary to meet the objectives and goals proposed by the administration, and it is there where the previous knowledge, faithful to the decision making and determinants in the organizational behavior.

The intellectual capacity of the human being is applied collectively towards the achievement of objectives, strengthening the knowledge of what to do with what is known. The facts, information and organizational data imply covering frequent solutions generated in the processes of complex organizations.

Analyzing, interpreting and measuring the union of a human team in the confrontation of business problems, is constantly achieved under the exploration of a diversity of answers, which enter to be questioned. It is important to point out that Stacey [2], business organizations, as living beings, are systems characterized by non-linear feedback cycles because people interact with each other all the time.

This results in different circumstances and reactions applied to favorable decisions or positive states within the business scenarios, highlighting the author Watts [3], the decisions of the actors depend on their perceptions and do not impact the members of the organization in the same proportion, the non-linearity of the organizations is evidenced, in which the behavior of the group is greater than the sum of the individual results. From the latter, it is necessary to identify the policies, characteristics and business principles willing to accept diverse concepts that achieve the development of objectives through barriers that drive initiatives under robust and complex business models.

Organizational behavior is defined as an academic discipline concerned with describing, controlling, predicting and understanding human behavior within an organizational environment. When applied to individuals within an organization, it encompasses norms, values, exceptions and attitudes. Hodgetts, R. Altman, S. [4], therefore, the impact that the individual, the groups and the structure of an organization, involve in a level of improvement to the human being in the fulfillment of their functions, goals and purposes established in the organizations.

It is the study and application of knowledge concerning the way people act within organizations. It is a human tool for the benefit of people and applies generally to the behavior of people in all kinds of organizations, such as commercial enterprises, government, schools, and service agencies. Wherever there is an organization, there will be a need to

understand organizational behavior. Davis and Newstrom [5].

All this set of skills and attitudes within an organization provides concise tools to make group, individual and strategic behavioral changes in an organization, the different complex situations that are generated in an organization, leading to unexpected behaviors, such as absenteeism, turnover, productivity, which, through administrative indicators, decisions will be made prior to the issue.

Organizational Behavior includes the central topics of motivation, leader behavior and power, interpersonal communication, group structure and its processes, learning, attitude development and perception, change processes, conflict, work design and stress at work. Robbins, S. [6]. Therefore, it is necessary to point out that the understanding, communication and feedback of the whole organizational movement complements the way of interacting between the members of the organization, achieving the growth of business productivity.

### 3. The Human Being and Its Complexity

Every human being maintains diverse behaviors according to their environment and complex situations that organizations present on a daily basis, it is there where different behaviors prevail in different learning systems where the work environment in companies is the continuous knowledge, entrepreneurship and innovation that clearly define organizations that are recognized for their work, effort, merits and favorable trends in the market. The generation of knowledge and innovative ideas when a team is working together can be described as an emergent property in the sense that it arises from the interaction of individuals and is not just the sum of existing ideas; additionally, that

knowledge could generate something new and surprising Espinosa and Porter [7].

In the organizational environment there are multiple spaces to be covered within a complex context, therefore, the understanding, viable behaviors towards decision making indicate that the individual (fundamental member and participant of the organizations) must be understood as a complex being, its multiple relationships are given in such a way that they invite to resignify a position of the concept around the human condition Correa [8]. The design and the continuous evolution over time arise from the adaptive flexibility to the conditions of the environment, highlighting that the adaptation of a system to its environment emerges from the adaptation efforts of individual agents that try to improve their own adjustments Holland [9].

The process of administrative authority, the structure and group work, allows the constant and continuous socialization and transformation of skills among the members of the organization, where, at the moment of sharing work activities, competitions and imbalances are propitiated, promoting behaviors of clash and inequalities by distinctions or merits, hence the different complex situations that determine the organizational reality during the evolution and general management with an absorption mechanism, involving the essential development of each organization.

The diverse opinions and controversies generated by the members of the organization cause discrepancies towards the destruction of an official with another, with the purpose of achieving administrative organizational preferences, where in a business environment manifested in real complex scales far from that is intended to constitute in the business environment, hence the constant and continuous discrepancy from where a diffuse human behavior and continuous circumstances in organizations arise.

Society requires a set of relationships between human beings, one with the others and in this way the organizations contemplate this same need for their respective projection, the reciprocal union between individuals promotes complex connections that allow solving diffuse borders that are continuously in force between a realistic society, in the field of organizational action, frequently the business self-development depends on both the human being and the organization, establishing a system of transformation, carrying out the permanence of building, spreading, collapsing, and promoting social awareness under various uncertainty with the integration of the same.

According to the author Allaire and Firsirotu [10], who consider that the organization is constituted by three interrelated elements: (1) a socio-structural system, which supports a cultural system; (2) this cultural system, which serves as justification for the previous one, and (3) the employees who as individuals actively elaborate a coherent organizational reality. In this way the organizational environment maintains personalized principles of each human being, cultures and values, which in the organizational environment are presented by the individuals in the technological, administrative and practical development of the organizations.

The productivity of the organizations is based on performance, efficiency, effectiveness, which strengthen contextual elements in the organization, allowing it to be a robust system of continuous learning, knowledge, quality of products and services, innovation, teamwork and source of growth in the market. Organizations are constituted and move in adaptive landscapes that are constantly changing Holland [9].

The moral and mental conditions of the members of the organization, are issues that the administration in compliance with the objectives, must maintain, in this way the business satisfaction is sought, towards a collective and individual good with each member of the organization so that the complexity generated by

various aspects in the development of the activities is accompanied by favorable tools in making feasible, participatory and enriching decisions, focused on the long-term projection within the organizations.

A practical way to measure well-being has been through job satisfaction, understood as a general attitude towards work, rather than a behavior; thus the degree of satisfaction would be given by the “difference between the amount of rewards workers receive and the amount they believe they should receive” Robbins [6].

The value of each member of the organization is indifferent to the administration, when in fact its remunerative meaning does not involve interesting elements or committed contributions that are considered transcendental in the development of the organization under complex situations, therefore it is necessary to point out according to the author Edgar Morin: “The being is constructed and deconstructed at the same time, we see that each being has a multiplicity of personalities in himself, a world of ghosts and dreams that accompany his life, a particular history and a global living, that is, that everything indicates not only society and organizations are complex, but also each atom of the human world Morin [11].

Organizations are a whole administrative uncertainty, facing a series of constant competitions, determined by internal organizational policies and procedures, based fundamentally on the fulfillment of main aspects, profiles of the organization and proposed objectives. On the other hand, according to the author, Soto [12]: “The organization was developed from different points of view, the bureaucratic objectives of the organization were aimed at reducing uncertainty; from the humanist position tends to study the achievement of the purposes during the process of interpersonal relationships, given that its structure is of social type and each person has a social situation in it and is influenced and influenced by their personal

interests and values; similarly importance is given to leadership and, finally, the modern position considers that the organization constitutes a system or a set of systems. The system is understood as a set of interrelated parts that receive inputs, act on them in a planned system and, in that way, produce certain results. The additional characteristics of a system that represents the administrative functions of control, is a feedback mechanism.

It should be noted that complex phenomena are not proportional, knowledge, the reality that characterizes each organization, contemplates difficult conditions, chaotic obstacles, within an administration, human behaviors are unpredictable, fostering changing situations, indeterminate actions, dissipative structures, to the point of generating disorder, discord and confrontations among the members of the organization.

A whole transformation prevails in the human being, as long as complexity continues to be present, emotional states, fear, the functioning of organizational processes, conflicts among the members of the organization, adverse opinions in decision making, growing uncertainty in the long term, allowing to differentiate and understand the behaviors generated by this type of situations and synthesize significant group behaviors in organizations.

The frequent changes, the evolution in the organizations are more evident, it is worth mentioning that the bureaucracy, a social invention that was perfected in the industrial revolution to organize and direct the activities of the company, arose to solve the despotism and the crudeness with which the worker was treated. When the companies saw that their rigid structure, based on bureaucracy, did not give answers to the changes that society was experiencing, it was apparently replaced or with that intention (because it did not disappear completely) by the flourishing Organizational Development that have to face the

extraordinary turbulence of the present decade can give new and more innovative answers Holland [9].

Therefore, organizations contemplate sudden, experimental, rapid changes of power, where the individual needed to perform his or her tasks under strong leadership, with strong interpersonal relationships.

These changes bring some important consequences for organizations, which Hargreaves [13] points out as follows:

Organizational flexibilization and technological complexity create the need for diversity, but also tendencies toward disintegration; the paradox of globalization provokes doubt and social insecurity, and carries the danger of resurrecting and reconstructing the traditional ethnocentric and xenophobic curriculum. Although the “mobile mosaic” structures of work organization can be flexible and responsive, they can also be manipulative, so that the various parts of the organization are at the mercy of the maneuverings of an unaccountable and inaccessible core.

Personal anxiety and the search for authenticity translate into an ongoing psychological quest in a world that lacks secure moral anchors. Technological satisfaction and complexity create a world of instant images and artificial appearances. Secure simulations of reality can be more perfect and plausible than the messier, uncontrollable realities themselves. The understanding of time and space can lead to greater flexibility, better responsiveness and better communication, but they can also lead to intolerable overload, premature exhaustion, superficiality and loss of goals and orientations.

Through a complex world, in search of new transcendental changes, it seeks to investigate the multiple options of uncertainty, random situations, random phenomena, where the amount of thoughts and

ideas excel to situations rarely seen in organizations. The generation of knowledge and innovative ideas when a team is working together can be described as an emergent property in the sense that it arises from the interaction of individuals and is not just the sum of existing ideas Hull, John C. [14].

In this way complexity is about going, not from the simple to the complex, but from the complex to the more complex. The simple is but a moment, an aspect among many complexities (microphysical, biological, psychic, social). Complexity tries to consider the lines, the tendencies of increasing complexity, which will make it possible to determine the models of low complexity, medium complexity, high complexity, according to developments of self-organization (autonomy, individuality, richness of relationship with the environment, aptitudes for learning, inventiveness, creativity). But, finally, we will come to consider, starting from the human brain, the truly surprising phenomena of very high complexity, and to propose as a new capital notion to consider the human problem, the hypercomplexity Morin [11].

The environmental setting, the vision and projection that each member of the organization brings to the change, goes through complex forceful schemes, for this the author Ferguson [1], mentions: Understanding the new complex logic that brings us the new paradigm of complexity means overcoming the mistake of believing that we had to start changing: they are a reflection of our way of thinking, and changing the way of thinking is possible.

Organizations are a union of human relationships specialized in different fields of action, hence the requirement of the individual to achieve new goals, new directions, facing adverse situations, human support in various areas, realities that must be faced to change and circumstances of the environment.

To strengthen the complexity and the human being in the organizational environment, changes in

ideologies and ways of thinking contribute a determining factor in the development of highly competitive and participatory projections, towards a favorable explanation within the organization.

## 4. Engineering as strengthening organizational complexity

After having a detailed context of organizations and their dynamics in the environment of complexity, it is appropriate to approach from the financial engineering approach in a robust line that promotes solution contributions through tools and strategic guidelines for the application and collaborative work in promoting this style of industries where constant changes prevail, so this point of knowledge plays a crucial role in complex organizations by providing tools and techniques to manage decisions, assess financial risks, optimize capital structures, improve operational efficiency and create innovative financial products.

Therefore, it is of interest to highlight the factors that influence the incorporation of this area of knowledge.:

**Financial Risk Management:** Complex organizations face multiple types of risks, such as market, credit, operational and liquidity risks. Financial engineering develops strategies to identify, measure and mitigate these risks through the use of derivative financial instruments, insurance, and hedging techniques.

**Optimization of capital structures:** Determining the optimal mix of debt and equity capital is crucial to maximize enterprise value and reduce the cost of capital. Financial engineering uses techniques such as debt structuring, mergers and acquisitions, and corporate restructurings to optimize an organization's capital structure.

**Operational efficiency:** Improved internal financial management, such as cash flow optimization, cash conversion cycle management and asset management efficiency, are areas where financial engineering can offer analytical tools and strategies to improve operational efficiency.

**Development of innovative financial products:** Complex organizations often require financial products tailored to their specific needs, such as complex financing structures, structured investment products or customized insurance. Financial engineering develops and tailors these products to meet the particular requirements of complex organizations.

**Advanced Financial Modeling and Valuation:** Using quantitative techniques and advanced mathematical models, financial engineering helps organizations value complex assets, evaluate investment projects and make accurate financial forecasts in uncertain environments.

#### 4.1. VaR Risk Equation

According to the above, one of the observations in financial calculations that influence decision making is the dynamic volatility of VaR, quickly capturing strong price variations in the markets due to the weighting that the method performs, allowing to generate better forecasts in times of high volatility. The model depends on a Lambda decay factor ( which is between zero and one. Lambda determine the weights applied to the observations. This way of estimating volatility was initially employed by JP Morgan as RiskMetrics®, which was made public in 1994. The smaller the Lambda, the greater the weight of the most recent data, the formula being:

$$\hat{\sigma}_t^2 = (1-\lambda) \sum_{i=1}^t \lambda^{i-1} (R_{t-i})^2 \quad (1)$$

Where:

- $\sigma$  is the volatility of the asset

- $t$  is the time period in years, if you want to calculate the VaR for a day,  $t$  would be  $1/252$ , assuming 252 trading days per year.
- $\alpha$  is the confidence level (e.g., 95% or 99%).
- $\lambda$  0.94 for daily data and 0.97 for monthly data.

#### 4.2. Case Study VaR Historical Data

It is based on the S&P500 stock market index, created in 1923 when Standard & Poor's introduced it with a list of 233 companies, but it was in 1957 when the index was made up of 500 companies. The most representative stock market index of the US economy, it is based on criteria such as market capitalization, liquidity, economic sector, degree of internationalization and time of listing on the stock exchange. Data is taken from the investing.com website, which yields a period of 21 days, in order to proceed with the VaR calculation. The data is applied because of its importance in influencing global markets and being a of the economic state. Table 1.

Indicating the variance of 85% of the applied data, it is required to calculate the standard deviation is a much more standardized and understandable measure to determine or evaluate the risk, applying the square root understandable to determine or evaluate the risk, applying the square root of the variance of the variance. For the exercise a high risk is obtained due to the profitability, the higher the indicator, the riskier the market.

**Table 1.** Key indicator. Data are taken to be applied to the VaR simulation, thus determining the Risk according to its volatility during the period.

S&P500					
No Data	Date	Last	Rent. Discreta	Probability	Rend. Esperado
1	1/07/2024	5.446,53			
2	2/07/2024	5.458,43	0,0022	0,05	4,98%
3	3/07/2024	5.507,42	0,0090	0,05	5,66%
4	5/07/2024	5.531,63	0,0044	0,05	5,20%
5	8/07/2024	5.562,51	0,0056	0,05	5,32%
6	9/07/2024	5.574,57	0,0022	0,05	4,98%
7	10/07/2024	5.586,44	0,0021	0,05	4,97%
8	11/07/2024	5.576,53	-0,0018	0,05	4,58%
9	12/07/2024	5.590,44	0,0025	0,05	5,01%
10	15/07/2024	5.614,75	0,0043	0,05	5,20%
11	16/07/2024	5.639,02	0,0043	0,05	5,19%
12	17/07/2024	5.584,81	-0,0096	0,05	3,80%
13	18/07/2024	5.522,81	-0,0111	0,05	3,65%
14	19/07/2024	5.497,04	-0,0047	0,05	4,30%
15	22/07/2024	5.529,04	0,0058	0,05	5,34%
16	23/07/2024	5.550,90	0,0040	0,05	5,16%
17	24/07/2024	5.419,98	-0,0236	0,05	2,40%
18	25/07/2024	5.390,95	-0,0054	0,05	4,23%
19	26/07/2024	5.430,70	0,0074	0,05	5,50%
20	29/07/2024	5.444,44	0,0025	0,05	5,01%
21	30/07/2024	5.401,70	-0,0079	0,05	3,98%
				<b>Yield</b>	<b>94,47%</b>

Source: Own elaboration, data July 2024.

**Table 2.** S&P500 Variance, Deviation, Coefficient.

Variance, Deviation, Coefficient				
Rendimiento mensual	Yield. Expected	(Ren dia-Rend Promed)	Differences ^ 2	Difference ^2 * Probability
0,22%	94,471%	-94,253%	88,836%	4,23029%
0,90%	94,471%	-93,574%	87,561%	4,16956%
0,44%	94,471%	-94,032%	88,420%	4,21047%
0,56%	94,471%	-93,913%	88,197%	4,19985%
0,22%	94,471%	-94,255%	88,839%	4,23044%
0,21%	94,471%	-94,258%	88,847%	4,23079%
-0,18%	94,471%	-94,649%	89,584%	4,26590%
0,25%	94,471%	-94,222%	88,778%	4,22751%
0,43%	94,471%	-94,037%	88,429%	4,21089%
0,43%	94,471%	-94,039%	88,434%	4,21112%
-0,96%	94,471%	-95,433%	91,074%	4,33686%
-1,11%	94,471%	-95,582%	91,358%	4,35040%
-0,47%	94,471%	-94,938%	90,132%	4,29201%
0,58%	94,471%	-93,889%	88,152%	4,19771%
0,40%	94,471%	-94,076%	88,503%	4,21443%
-2,36%	94,471%	-96,830%	93,760%	4,46478%
-0,54%	94,471%	-95,007%	90,263%	4,29825%
0,74%	94,471%	-93,734%	87,861%	4,18384%
0,25%	94,471%	-94,218%	88,771%	4,22719%
-0,79%	94,471%	-95,256%	90,738%	4,32085%
		<b>VaR</b>	<b>Variance</b>	<b>85,07%</b>
			<b>Standard deviation</b>	<b>92,23511%</b>
			<b>Sum Difference ^ 2</b>	<b>1786,53619%</b>
			<b>Events</b>	<b>21</b>
			<b>Variance</b>	<b>85,07315%</b>
			<b>Desv. Standard</b>	<b>92,23511%</b>

Source: Own elaboration, data July 2024.

## 5. Conclusions

The organizational environment generates essential patterns within the behavior of the human being, through the complexity the incidence on attitudes and own techniques in decision making influences considerably, it requires innovative factors that contribute to the participation of the entire work team with the purpose of improving knowledge, functions of each of the members, the business objectives will surely meet during a period previously established by the managers of the organization.

In this way, the behavior of the human being will allow to improve certain necessary elements, which are threats, but at the same time allows to improve performance variables to strengthen motivation and relevant commitment in the company.

Complex situations lead to corroborate unpredictable behaviors, dispersed socialization among members of the organization and diverse attitudes, in the face of frequent competitive scenarios, in search of futuristic expectations and perspectives of satisfaction in the work environment.

Within all of the above aspects, financial engineering provides tools and methodologies to support the diverse circumstances that these companies face, one of them being the specific financial challenges faced by complex organizations, thus helping to optimize their financial performance and manage risks effectively.

## References

- [1] Ferguson, Marylin. *La Conspiración de Acuario*. Ed. Troquel. 1<sup>a</sup> ed. para la Argentina. 1989.
- [2] R. Stacey, "Management and the science of complexity: If organizational life is nonlinear, can business," *Research Technology Management*, 39, pp. 3-8. [Online]. Available: <https://www.scirp.org/reference/referencespapers?referenceid=2745638>
- [3] D. J. Watts. *Seis grados de separación. La ciencia de las redes en la era de acceso*. Paidós, Barcelona. 2006. [Online]. Available: [https://books.google.com.co/books?id=jt4ktVJ427QC&printsec=copyright&hl=es&source=gbs\\_pub\\_info\\_r#v=onepage&q&f=false](https://books.google.com.co/books?id=jt4ktVJ427QC&printsec=copyright&hl=es&source=gbs_pub_info_r#v=onepage&q&f=false)
- [4] Hodgetts, R. y Altman, S. *Comportamiento en las Organizaciones* (6a Ed). México: Interamericana S.A. de CV. 1985. [Online]. Available: [https://www.gob.mx/cms/uploads/attachment/file/335680/Comportamiento\\_organizacional.\\_La\\_dinamica\\_en\\_las\\_organizaciones..pdf](https://www.gob.mx/cms/uploads/attachment/file/335680/Comportamiento_organizacional._La_dinamica_en_las_organizaciones..pdf)
- [5] K. Davis y J. Newstrom. *Comportamiento Humano en el Trabajo*. (10a Ed). México: MacGraw Hill. 1999. [Online]. Available: [https://uachatec.com.mx/wpcontent/uploads/2019/11/Comportamiento\\_humano\\_en\\_el\\_trabajo.pdf](https://uachatec.com.mx/wpcontent/uploads/2019/11/Comportamiento_humano_en_el_trabajo.pdf)
- [6] S. Robbins. *Comportamiento Organizacional: Concepto, controversias y aplicaciones*, México, Prentice Hall. 1994. [Online]. Available: [https://frrq.cvg.utn.edu.ar/pluginfile.php/15550/mod\\_resource/content/0/ROBBINS%20comportamiento-organizacional-13a-ed- nodrm.pdf](https://frrq.cvg.utn.edu.ar/pluginfile.php/15550/mod_resource/content/0/ROBBINS%20comportamiento-organizacional-13a-ed- nodrm.pdf)
- [7] Espinosa y Porter. "Sustainability, complexity and learning: Insights from complex systems approaches," *Learning Organization*, 18, pp. 54-72, 2011. [Online]. Available: [https://www.researchgate.net/publication/241674402\\_Sustainability\\_complexity\\_and\\_learning\\_Insights\\_from\\_complex\\_systems\\_approaches](https://www.researchgate.net/publication/241674402_Sustainability_complexity_and_learning_Insights_from_complex_systems_approaches)

- [8] C. Correa. "De la complejidad de las organizaciones en la metateoría curricular," Nov. 2000. [Online]. Available: [http://www.icfes.gov.co/pensa/Interior/cer\\_educa.htm](http://www.icfes.gov.co/pensa/Interior/cer_educa.htm)
- [9] Holland. "Complex adaptive Systems," *A New Era in Computation*, 121 (1) (1992), pp. 17-30. 1992. [Online]. Available: <https://www.urbanresponse.org/system/files/content/resource/files/main/Holland%201992.pdf>
- [10] Y. Allaire, y M. Firsirotu. "Teorías sobre la Cultura Organizacional", en: Abravanel, H., et al., en: *Cultura organizacional: aspectos teóricos, prácticos y metodológicos*, Bogotá, Legis. 1992.
- [11] E. Morín. *Introducción al pensamiento complejo*. Barcelona: Editorial Gedisa S.A. Cuarta reimpresión. 2001. [Online]. Available: [https://cursoonlineasincostoedgarmorin.org/imagenes/descargables/Morin\\_Introduccion\\_al\\_pensamiento\\_complejo.pdf](https://cursoonlineasincostoedgarmorin.org/imagenes/descargables/Morin_Introduccion_al_pensamiento_complejo.pdf)
- [12] M. H. Soto. *Organizaciones Educativas. Programa de doctorado en ciencias de la educación*, Universidad de la Serena. 2001. [Online]. Available: [https://www.scielo.cl/scielo.php?script=sci\\_arttext&pid=S0718-07052001000100007](https://www.scielo.cl/scielo.php?script=sci_arttext&pid=S0718-07052001000100007)
- [13] A. Hargreaves. *Profesor, Cultura y Postmodernidad*. Madrid-España: Ediciones Morata, 2ª ed. 1998. [Online]. Available: [http://www.terras.edu.ar/biblioteca/17/GSTN\\_Hargreaves\\_Unidad\\_2.pdf](http://www.terras.edu.ar/biblioteca/17/GSTN_Hargreaves_Unidad_2.pdf)
- [14] J. C. Hull. *Introducción a los Mercados de Futuros y Opciones*. Prentice. 2002. [Online]. Available: [https://www.academia.edu/1025855/Introduccion\\_a\\_los\\_mercados\\_de\\_futuros\\_y\\_opciones](https://www.academia.edu/1025855/Introduccion_a_los_mercados_de_futuros_y_opciones)