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Neuroeconomics in Cooperatives: Hierarchy of Emotional Patterns in the Collective Decision-Making Process for Sustainable Development

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Abstract: The goal of this study is to determine the level of adaptation of agro-industrial cooperatives of small producers of alternative crops, and it considers the hierarchy of patterns to evaluate their systemic responses to accelerated change following the COVID-19 pandemic by evaluating the risk of their structures adapting to the digital environment. With a total of ($n = 90$) volunteer responders, the study is experimental, transactional, descriptive, and correlational, with a control group (CEN-FROCAFE) and an experimental group (ACEPAT) (24 producer partners, 14 producer managers, and 7 employees for each cooperative). In Step 1 (SOFT aspect), it measures the organizational memory (OM) of $Y_0 = 0.32$ in the (control group) and $Y_1 = 0.59$ in the (experimental group) by measuring hidden plots in the formal and informal interrelations of its members with the correlation of the holistic competencies of innovation. In Stage 2 (HARD aspect), the impact of the digital operational risk (DOR) is measured in the adaptation of the organization structure, which results in the control group with a Digital Operational Risk (DOR) = (3.4), which is “High” and greater than the experimental group with DOR = (3.3), which is “Moderate”. In conclusion, Hypothesis 1 is met with a greater adaptation of the experimental group, greater organizational memory, and lower digital operational risk, which reflects that the memory of the organization would reflect the temporal memories of the human brains of its members, and that, in the same way, its behavior could be predicted linearly.

Keywords: neuroeconomics; sustainable development; management; Industry 4.0; organizational behavior; innovation



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1. Introduction

Considering the changes in the environment that agro-industrial cooperative organizations could have experienced as intelligent systems [1] (Sengue, 1998) in the face of global macro trends [2] (Ferras, Ponti 2007) in the process of lifelong learning [1], their small producers, with less than five hectares, on average [3], who were dedicated to planting coca in the valleys of the central jungle of Peru in the provinces of Jaen and Tocache [4] (Ministry of Agriculture, 2016), and who, as the result of a joint strategy between the Peruvian State [5], USAID, and the United Nations, motivated decisions of individual and collective entrepreneurship with alternative crops to transform their microworlds away from violence and extreme poverty.

To promote changes in an intelligent organization according to the theory of lifelong learning (Sengue, 1998), it is advisable to consider the adaptability of the system based on the stimulus of the systemic learning process and the continuous feedback of its members in their microworlds, which find, in the interaction between chaos as an option of lifelong learning, the inference that updates their mental models based on their experiences. On the other hand, it is reaffirmed in wisdom when it finds solutions to the problems that generate permanent changes [6] (Friston, 2010).

In this sense, in the decision-making process of small producers who decided to adopt alternative crops to coca, we could find the emotional configuration of their predisposition

to change and their learning by taking into account the importance of neuroeconomics and the coherence between the subprocesses of a “fast decision” (emotional process) and a “slow decision” (rational process) [7,8], and their impact on agricultural sustainability [9] (Zúñiga, 2021), where the productivity of collective entrepreneurship was greater than individual entrepreneurship [10]. However, collective groups could be more productive, depending on the incentive level and the individual efficiencies of the members that formed it [11].

According to Branas-Garza and P.; Cabrales (2015) [12], the search for utility and productivity could be related to the rational process, and the heuristic model to the emotional process.

Through this study, we question the possibility of continuing the process of the lifelong learning in cooperative organizations when they face accelerated changes, such as the one experienced before the COVID-19 pandemic [13] (WHO, 2020), which, among other related changes, confined the world population to ensure survival, which triggered a global economic crisis that drives the digitalization process [14].

The research gap to which this study aims to contribute is to identify the level of the predisposition to learning and the adaptation of the structure of cooperatives that are governed by principles that empower their users [15], who are facing accelerated changes and who seek changes in their value chains to adapt to the new environment from a systemic approach through the emotional process (Acs and Audretsch, 2020: Pg.15) [16]. For Sengue, systemic thinking lies in the fact that business and human enterprises are also systems. “They are also bound by invisible plots of interrelated acts” [1]. Organizations could be configured by emotional organizational patterns from the interrelation of the holistic competencies of their members, which would follow the pattern hierarchy theory of the neocortex temporal memory of George’s biological brain [17,18], and Markov’s hidden pattern hierarchy [19–21] would configure to infer an organization.

The post-COVID-19 context shows the bankruptcy of globally recognized companies that did not adapt to the digital environment and others that could [14]. The ability of intelligent organizations to decide in the face of accelerated-change scenarios could be blocked at the cognitive level because of the influence of stress on their members [22] (Hunter, L and Thatcher, S, 2007) and the effect on productivity that burnout would have (Robbins and Judge, 2013: Pg.602-605) [23]. However, the learning process could continue from the emotional side of the brain and reflect on the interrelation of the holistic competencies of innovation [24]. Then, it could be pertinent to identify, from the emotional process, which holistic innovation competencies [24] of the members of the ACEPAT cooperatives in Tocache [25] and CENFROCAFE in Jaen [26], which are both located in the jungle of Peru, presented a higher correlation and emotional alignment that would connect the sensation and action of each member [27] at each level of the hierarchical structure, and that could predispose to the collective decision promoted by the leaders of the organization with the support of the bases, such as digitization projects versus the change of reality after the pandemic [14]. The context influences the business decision and, according to Peters and Waterman (1980) [28], the organization is divided into the hard part (strategy, structure, systems) and the soft part (shared values, skills, styles, personal), which, at the individual level, are manifested in the decision process’s slow track (rational aspect) and fast track (emotional aspect) in the human biological brain [7,8].

2. Literature Review

The purpose of this article is to show that organizations can function as an organizational brain that reflects the average sum of the biological brains of the people who make up the organization.

If we analyze a cooperative as an intelligent organization and from the point of view of systemic thinking, the managers could decide collectively with the support of the base partners and employees as a process of emotional alignment, very similar to the connections established in the human brain through the physical dendrites and the nervous system where the interneuron is located, which receives the message from the sensory

cell and interprets it to take it to the motor neuron [29] (Rose, 2008: Pg.43), which in the case of organizations would be evidenced in the high correlation of holistic innovation competencies that all its members would share in the face of the challenge of adapting their business model to scenarios of accelerated change, through the convergence of “interrelated competencies” as organizational neurons that ultimately interpret the collective message and then drive a collective decision. In Allred, Snow and Miles (1998) [30]. The importance of a cellular business structure is identified where the competencies of its members interact holistically and manage to impact productivity. According to Declerck, Boone, and Emonds (2013) [31], the motivation to cooperate of its members would be evidenced in the interrelation of the holistic competencies of innovation of the members of a cooperative would be driven by the striated body of the brain in the ventromedial prefrontal cortex of the neocortex that would show two neural networks. On the one hand, a cognitive control system located in the lateral center of the prefrontal cortex processes extrinsic cooperative incentives such as the benefits that the implementation of a digital project in the cooperative would mean. On the other hand, a social cognitive system located in the temporoparietal junction in the medial prefrontal cortex and the amygdala processes trust and threat signals that would process holistic innovation skills at an unconscious level. To the extent that members of a cooperative would be interrelated at the level of holistic competencies demonstrating greater organizational memory would manifest greater confidence and support for the project proposed by management. On the other hand, the absence of the interrelation of holistic competencies would reflect a lower organizational memory and a greater distrust of the project, which would discourage the team’s commitment to implementing the digitalization project.

The effect of sustainability by collective decision-making of the cooperative seeks to achieve a win–win outcome [32] among all the members that make it up and that it would contribute to reducing the risk of corporate governance considering that crises and expectations of loss could decrease the risk aversion and undertake new projects in organizations [33]. It is also very possible that an open innovation culture will be promoted in the cooperative [34], which could be strengthened by the acquisition of new technologies from outside and the generation of new technologies from within that add value to the digitalization process within the organization as it points out (Chesbrough, 2005) [35].

2.1. *The Organizational Brain*

The decision-making process that would operate in the human brain thanks to a deep ability to recognize patterns, because according to (Kurzweil, 2012) [36] their logical processes are very limited. To reason logically, we need to use the neocortex as a pattern recognizer according to the neocortex model (Hawkins and George, 2003) [18], which mentions that each of the 300 million neural pattern recognizers is made up of three parts: The first part is the input, which consists of the lower-level patterns that make up the main pattern and which are not repeated under an optimization principle. The second part is the axon, which is the output of each pattern process. The third part is the highest-level set of patterns, which it is a part of.

Each pattern recognized at a certain level triggers the next level at which it is part of that higher-level pattern.

The links are represented by physical dendrites that flow into the neuron of each cortical recognizer. The junction is constructed considering that each neuron can receive unprecedented inputs from multiple dendrites and produce a single axon. The axon will be able to send signals to multiple dendrites [29] (Rose, 2008). Similarly, in organizations, links and recognizers would be generated following the pattern of hierarchical structures and information flows in the organization. When we review the parabola curves of decreasing returns [37] of small producers in the field and compare them with the curve of the “cooperative genius” pointed out by Cook (2007) [38], we can recognize coincidences that could have some relationship between the manifestations of the individual entrepreneurship of the small producer in the field could be replicated at the organizational level in the behavior

of the collective entrepreneurship of the small producer in the cooperative. According to Ortmann and King (2007) [39], the adaptation of the cycle of cooperatives is due to changes in the economy and technology among other aspects such as the digitalization process that would require a response from these types of organizations to adapt to the new reality.

In the organizational brain, information would be moved as in the physical dendrites of the human biological brain, through emotional flow in correlation with the holistic innovation competencies of its members, which would act as organizational neurons and optimize information following the principle of singularity [36] (Figure 1).

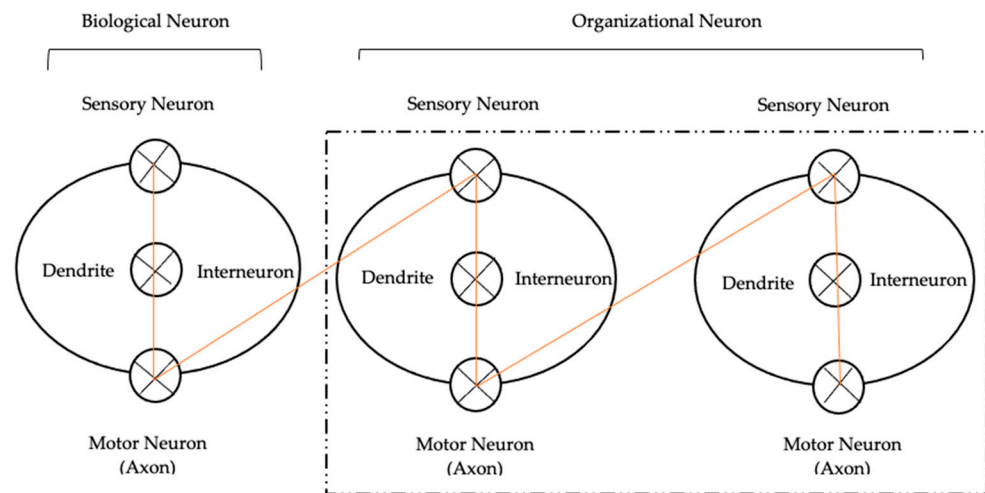


Figure 1. Hierarchical emotional alignment of organizational neural patterns.

Considering the principle of the hierarchy of the neocortex model [18] (Hawkins and George, 2003), memory is structured by the hierarchical system that describes the method of temporal memory [17] (George, 2008) with which it could be founded that the organization of human brain memory would configure the organization of the organizational brain taking into account the flow of information flows from top to bottom and vice versa [36] (Kurzweil, 2012). In the organization, information flows between the different levels of its hierarchical structure such as grassroots partners, managing partners, and collaborators by measuring the level of correlation between their sixteen holistic innovation competencies such as stress management, belief in being creative, self-knowledge, introspection, logical and lateral thinking, intuition and reason, high self-motivation, ease of formulating problems, a constant search for ideas, transgressive attitude, adventurous attitude, creative leadership, knowing how to think naively, search for recognition, search for life improvement, and level of holistic innovation (Zúñiga, 2020) [24]. The emotional alignment of the organization would manifest itself in a greater correlation of the holistic competencies of innovation that are located in the neocortex of the members of the different levels of the organization, consequently, to greater organizational memory, and lower corporate risk [33] and greater sustainability [9].

The theory of mind based on pattern recognition that Kurzweil (2012) [36] discusses refers to recognizing patterns using the neocortex redundancy factor and the hierarchy of concepts in the individual that would appear to operate in organizations with emotion-recognizing patterns that would be evidenced through the correlation of holistic innovation competencies among managers, bases and collaborators that would follow a holistic pattern hierarchy and that would influence the collective decision to implement digital projects in the face of accelerated changes. Learning in organizations would be a reflection of learning in time at the individual brain level that would operate as Bayesian inference to structured learning (Konovalov and Krajbich, 2018) [40]. On an emotional level, the members of an organization would share some holistic competencies of innovation that would predispose

it to adaptation and learning of the organization even in contexts of accelerated change (Figure 2).

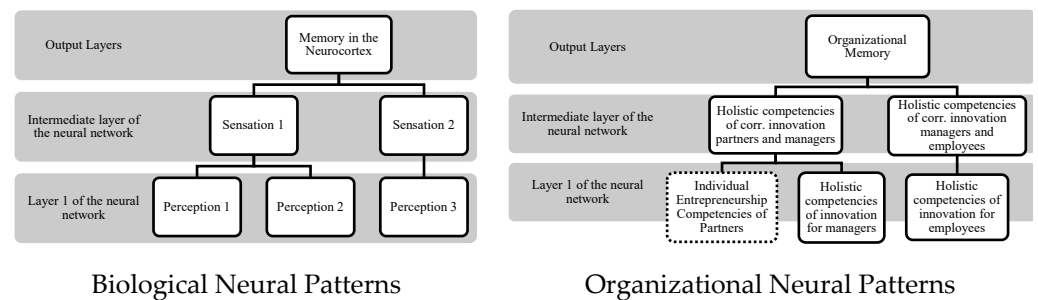


Figure 2. Hierarchical structure of biological and organizational neural patterns.

When we analyze the variables that could impact the longevity of cooperatives in the world, different experiences emerge as in the United States of America where it is concluded that it should be the level of training of the directors and the implementation of projects that would generate an emotional link with the members according to Franken and Cook (2017) [41].

Likewise, in Spain, Italy, and the Netherlands the context would be related to the generational shift of agricultural exploitation, according to (Plana-Farran and Gallizo, 2021) [42] in a sample of 156 young students from 14 agricultural schools in Catalonia, 88.5% would intend to continue family farming. However, 11.5% would desist due to the search for professional viability, entrepreneurial orientation, and having their own family agricultural business. According to Isabel Bombal Díaz [43], director-general of rural development of innovation and forestry policy of the Spanish Ministry of Agriculture, Fisheries and Food, a rural training plan is in place that would aim to achieve a large percentage of the directors of cooperatives at the doctoral level. Therefore, even if young people in the agro-industrial sector remained in the sector, they might still have the possibility of achieving the development of their training.

In Spain, likely, the strengthening of the social economy sector (Social Economy Week, 2020) [44,45] takes place mainly in the interrelation of members of the business, university, and government sectors and the alignment of their holistic competencies [46] and values that they share (Declerck, Boone and Emonds (2013) [31]) as unconscious patterns [17,18]. Consequently, the effect of the longevity of cooperatives is related to the strengthening of the values of the family business, which in turn would favor continuity. However, Antón Costas states that the COVID-19 pandemic would be the opportunity to rethink the new social contract that consolidates the so-called third sector [47].

The succession of its members based on emotional aspects such as full attention would not only be considered as a psychological trait of the individual or personality, but rather on a psychological state at the collective level in the organization since they define three aspects such as the first in the full attention of the present, the second being aware of the factors (Declerck, Boone and Emonds (2013) [31]) of internal influence as thoughts, sensations, emotions that are perceived at the moment and that external physical or social factors that could influence, in third place raise the need to stay away from establishing a judgment regarding what is happening. Using mindfulness as a tool to measure the full attention of the organization as a state with which it can be achieved at a collective level [48] could measure the focus on its vision. However, it occurs with holistic competencies that would be found on the unconscious side of the organization members.

The objective of this research is to identify the level of correlation of holistic innovation competencies of members of agro-industrial cooperatives in the central jungle of Peru when faced with the need to implement digitalization projects in contexts of accelerated change after COVID-19 and their ability to adapt and learn at an organizational level. One of the fundamental aspects of the influence of the cooperative team in front of projects is the

impact of higher goals such as the digitalization process mentioned by Pinto, Pinto, and Prescott (1993) [49]. For this purpose, it studies the behaviors of members of cooperative organizations when they face the challenge of adapting and learning in contexts of accelerated change and how organizational patterns would be configured following the rational aspect and the emotional aspect of learning processes following the principles of the hierarchical theory of temporal memory (George, 2008) of the biological brain to operate at the level of the organizational brain and which could collectively decide to achieve adaptation and learning in each cooperative.

According to Márkov, the model is based on the possibility of crossing the states of a chain, and in the case of achieving this, causing a state belonging to the next highest level of the hierarchy (Kurzweil, 2012: Pg.138) to fire.

2.2. *The Organizational Memory*

Consequently, the concept of organizational memory arises as to the adaptation of the configuration of vector quantification and the initial topology of the hierarchical states of the biological brain to the organizational brain, which could be an extension of genetic evolutionary processes from the human being's capacity to create and configure organizations to infer themselves linearly (Márkov, 1971) [20]. However, Bryan Christiansen and Lechman (2016) [7] show the behavior of memory flexibly, for example, in the face of changes in the environment, speculation, and price rise, for example, of some stocks, the memory of the investor would be flexible to adapt to changes. Flexibility could also be given in the organizational memory because it would consist of the level of correlation between the probability averages of the holistic competencies of innovation of the members of the cooperative (interrelation of the leader with the bases) that would allow the emotional alignment necessary to predispose the organization to innovate with projects of changes such as the adaptation of its business models to digital in contexts of accelerated change. The effect of organizational hierarchy with projects such as cost-saving strategies, and benefits could be positive in agribusiness cooperatives according to Valentino, 2020 [50]. Lack of organization could hurt productivity. According to Ajzen (2011) [51], the effect of control and regulation could influence the thinking and condition the intention of small producers. The same goes for companies that do not align their processes and manage the business cycle focused on throughput [52]. In analyzing the differences in business and cooperative realities in Iliopoulos and Hendrike (2003) [53]. We identified that governance costs would be higher in cooperatives than in companies because of the social structures that would be added to the business structures, however, it would be identified that cooperatives with higher-paid managers would be more productive. Likewise, the effect of efficiency on decisions would impact strengthening governance and reducing capital risk [54].

2.3. *The Hierarchy of Emotional Organizational Patterns*

The hierarchy of organizational patterns would be a form of collective thinking according to Wegner (1998) [55], group memories would operate by identifying who might know something specific on the team that responds to the group. However, in this case, it is not a question of sharing specific information on a particular topic, but rather the predisposition of the holistic competencies of the team to be able to align with a particular project within the organization.

Matches would be found with Salas, Sims and Burke (2005) [56], regarding the efficiency of teamwork would depend on five major aspects including leadership, mutual monitoring, backup behavior, adaptability, and team guidance. However, the fundamental aspect would be the "shared mental modes" that, together with the "circuit communication" and "mutual trust", could demonstrate the importance of the holistic competencies of the team in productivity. Likewise, Chiao and Blizinsky (2013) [57] state that according to evolutionary theory cultural values have evolved, are adaptive, and influence social and physical environments in which genetic selection operates. According to Rauhut and Lorenz (2011) [58] in the human brain we can access different areas of knowledge and

planet by quantifying the wisdom of multitudes in one mind. He states that the wisdom of joint membership can outweigh that of experts. However, according to Marodiev, Tessone and Schweitzer (2012) [59], we should first raise the difference between collective wisdom in which the members who would enter the organization would impact their transformation as opposed to the members who enter the group as aggregate sum and do not seek to make any changes, but adapt to the environment of the organization, in this case, no effect would be provided on the collective wisdom of the crowds. In this same way Cook and Iliopoulos (2016) [60] identify that agro-industrial cooperatives would present inefficiencies due mostly to the lack of standardization in the individual management of their members that would coincide with the concept of collective intelligence that would often be presented in some cooperatives, according to Marodiev, Tessone and Schweitzer (2012).

The scope of the study is specifically limited to the provinces of Jaen and Tocache, taking as research objects the members of the agro-industrial cooperatives CENFROCAFE that grow coffee and ACEPAT that grow oil palm. Both cooperatives would have similar characteristics as they were formed by small producers and would be dedicated to collecting raw material from alternative crops, and then industrializing and marketing in coherence with the strategy of vertical integration that it proposes to succeed in American cooperatives [59]. In the provinces of Jaen and Tocache, since 2017, the change in the pattern of coca cultivation to alternative crops such as oil palm, coffee, and cocoa, among others, was consolidated by the intervention of a joint strategy of the Government, the United Nations, and USAID, which could stimulate individual and collective entrepreneurship in farmers (Sexton and Iskow, 1998) [61]. This would be an opportunity to compare the values of entrepreneurship considering the cultural differences that would be found in different alternative crops, respectively (Hofstede, 2011) [62]. To further study each cooperative we detail below:

ACEPAT was founded in 1998 as an association as a collective entrepreneurial response of its members to the problems of extreme poverty, terrorism, and drug trafficking suffered by its members in the province of Tocache being related to coca cultivation (Cooperativa ACEPAT, 2020) [25]. The entrepreneurship factor is very important in the competencies of Peruvian entrepreneurs according to the results [63] (Bosman and Kelley, 2019). Likewise, organizational innovation according to (Colom, 2004) [34] shows the adaptation of the structure to the environment becoming cooperative in 2013 and the first shareholder of the industrial plant Oleaginosas del Peru S.A. forming a hybrid model that has allowed the transformation of oil palm, soap production and utilization of palm wastewater in the power plant (Cooperativa ACEPAT, 2021).

CENFROCAFE, the multi-service cooperative CENFROCAFE Peru, was founded in 1999 in the small village of Palla Peña, District of Tabaconas—San Ignacio, as Central of Associations, has its scope of action in the provinces of Jaen and San Ignacio in the department of Cajamarca and the province of Bagua in the department of Amazonas. A group of more than 3000 families, associated in 84 bases, in 11 networks. Initially formed by 11 associations that were composed of 220 small producers. In 2001, they began training and technical, financial, and marketing assistance for coffee. They also join CEPICAFÉ in allowing them to export coffee to the US and Europe in 2003. In 2006, they exported 60 containers. In 2007, they achieved the certification of fair trade and thus began export management independently. Due to their growth at both commercial and social levels, the assembly decided to adopt the cooperative model in 2009. In 2010, the agreement for the transformation from Central Fronteriza del Norte de Cafetaleros to Cooperativa de Servicios Múltiples CENFROCAFE Peru, a first-level organization, was registered in Public Records and a business restructuring process was initiated to adapt to the cooperative management model (Cooperativa CENFROCAFE, 2021) [26].

At the end of 2020, the boards of agro-industrial cooperatives faced the possibility of adapting their business model to the virtual model in the face of the accelerated changes of the post-COVID-19 reality that was presented as an alternative to continue operating in confinement recommended by the World Health Organization (WHO, 2020) [13]. In the

case of CENFROCAFE, the general management proposed the development of a virtual shop and in the case of ACEPAT the general management proposed the construction of a website.

With the implementation of the digitalization project in both cooperatives, the aim is to measure the impact on the correlation of holistic innovation competencies of the members of these intelligent organizations when they operate as collective businesses and manage to impact their structure.

The context of implementing a project of change of business model from physical to virtual in cooperatives facing a new reality could be the propitious scenario to explain how the organizational memory is formed. It is important to consider that a greater correlation of holistic innovation competencies could lead to a greater predisposition to change among the members of the organization. In other words, in the face of the need to adapt the organization to accelerated changes, perhaps projects of change could be implemented not by appealing to a rational process of the learning abilities of its members, but rather in an emotional process based on the capacity of emotional alignment of the holistic competencies of innovation of the members of the organization that would be located in the neocortex and would lay the basis for the project of change to be implemented successfully in the face of the new reality. By identifying the holistic innovation competencies of the members of the organization, the holistic innovation coefficient could be calculated accordingly by applying the Holistic Innovation Methodology (Zúñiga, 2020) [24]. The high correlation in the holistic competencies of innovation between the members of the organization with its leader would indicate the high level of organizational memory that could be the basis to implement digitization projects in the face of the new reality and obtain greater involvement of its members, greater support of the bases without this process being rational but emotional. This methodology identifies that all people can innovate and go through three stages in their learning process. The first stage: inspiration, which points out that the ability to innovate has an indirect relationship with stress (Hunter and Thatcher, 2007) [22] can block the creative process when the person has not reached the mastery of what they are learning. The second stage: control, which notes that stress would have a direct relationship to incentivizing creative learning abilities that would be enhanced when competition is encouraged. The third stage is a conceptual design, which assesses the level of the innovative proposal that would be produced in the learning process. Analyzing the learning process in the cooperatives CENFROCAFE and ACEPAT as intelligent organizations (Sengue, 1998), it was considered to evaluate the predisposition to change of each of the cooperatives, mapping their learning process in the face of the accelerated change of reality. Members of cooperatives would have made collective decisions to implement digitalization projects and adapt to the new reality.

To measure the situational status of each cooperative's post-COVID-19 learning process and analyze the collective decisions they made to face the adaptation and learning of their business model. Throughout the research study, indicators such as holistic competency coefficient of innovation (it measures the predisposition to change of its members), organizational memory (it measures the correlation between the holistic competencies of innovation of its producer managers, with the base partner producers and the employees), corporate risk (it measures the probability of loss due to the lack of sustainability of the business), digital operational risk (it measures the probability of loss due to the lack of digital operating structure) and the desired digital operational risk [64].

2.4. Phases of the Organizational Memory Methodology

The phases of the organizational memory methodology to be evaluated in the post-COVID-19 learning process in each cooperative are the inspiration phase, the learning phase, and the adaptation phase detailed (Figure 3).

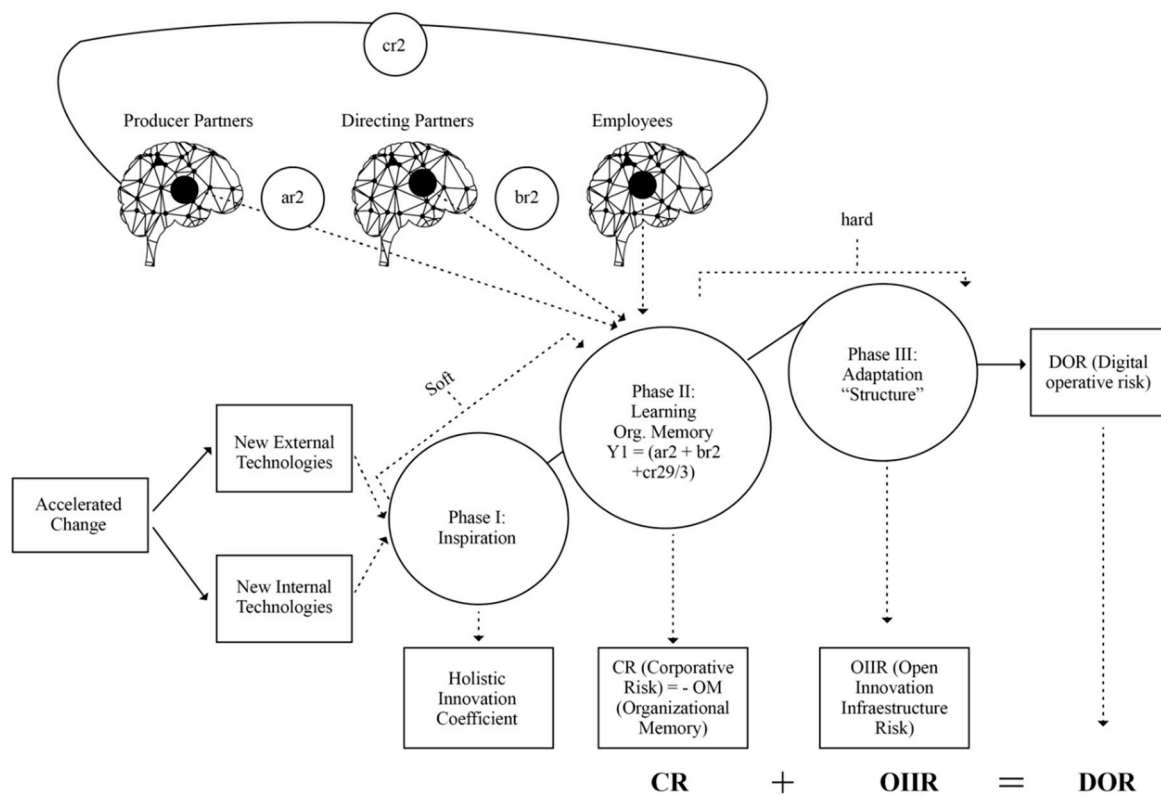


Figure 3. Organizational memory methodology.

Phase I: Inspiration:

In this phase, the willingness to innovate of the team of directing producers and employees at an individual and collective level will be measured considering the sixteen holistic competencies mentioned in the holistic innovation methodology (Zúñiga, 2020) [24], which in turn takes as reference thirteen holistic innovation competencies identified by Ferrás and Ponti (2008) [2], which are detailed as (1) stress management, (2) self-knowledge, (3) belief in being creative, (4) introspection, (5) logical—lateral thinking, (6) intuition—reason, (7) elevated self-motivation, (8) ease of problem-solving, (9) search for ideas, (10) transgressive attitude, (11) adventurous attitude, (12) creative leadership, and (13) knowing how to think naively. At the same time, it added two holistic competencies that are based on the search for extrinsic rewards according to Robbins (2013: Pg.259) [23] as (14) search for recognition and (15) search for life improvement that was identified in the behavior of associations. Finally, it was identified that the impact of the fifteen holistic competencies would determine the level of (16) holistic innovation. Considering the sixteen holistic innovation competencies to be measured, a holistic innovation coefficient test (Zúñiga, 2020) was developed [24].

Likewise, the individual entrepreneurship capacities of small products in their microworlds are evaluated and the correlation with the holistic innovation competencies of small producers as directing producers of the cooperative will be evaluated to evaluate the emotional alignment and to identify the factors that remain in the time between the small producer as individual entrepreneurship (bases) and the small producer as directing producers of the cooperative.

Inspiration for new technologies from the outside: Considering the willingness to innovate of the employees, they will be open to new technologies and apply their systems, generating value in the organization.

Inspiration for new technologies from the inside: Considering the willingness to innovate of the employees, regarding the level of openness to error as an input for the strengthening of culture from within the organization.

As a deliverable for this first phase, it would be necessary to calculate the holistic innovation coefficient of the members of each organization structure as committee producer partners, directing producers, employees, and their willingness to innovate with new technologies from outside and inside.

Phase II: Learning:

This level examines the organization's level of learning as an intelligent system (Senge, 1998), considering the correlation of holistic competencies of innovation in the various teams of its structure, such as producer partners of sectoral committees (base), directing producers, and employees in charge of management. It is essential to make organizations competitive by having a management team that is trained and willing to collaborate and work together. To the extent that cooperative members are efficiently interrelated, a greater impact on productivity should be achieved in line with Matuska and Landowska (2015) [65].

The high level of correlation of holistic innovation competencies between teams could ensure the business model's long-term viability by driving changes that necessitate the support of the foundations, which can be strengthened by the common aspects that they share and have remained in time as organizational memory.

As a deliverable of this second phase, it would be required to measure the impact on corporate risk (CR) taking into account the lifelong learning of cooperatives [33] in the members of the organization according to the level of correlation of holistic innovation competencies in each of its structures, which is a fundamental factor to show alignment in the decision-making process in projects of change with base supports.

Phase III: Adaptation:

This phase determines whether the organization's structure has been adapted to the virtual model, allowing it to operate its intelligent system with technology both internally and externally through the adaptation of its business model to the digital environment. This stage analyzes the range of potential losses and their likelihood of occurrence that could be generated by the failure to adapt the business model to the virtual model, taking into account the operational risk calculation phase that arises in Comprehensive Operational Risk Management in Fuentes and Zúñiga (2010) [66], with the difference that process mapping begins in the organization's learning process.

As a deliverable of this third phase, the open innovation infrastructure risk (OIIR) (HARD Aspect) will be calculated as technologies to facilitate teleworking, capture new knowledge and adapt its structure.

Finally, to calculate the digital operational risk ($DOR = CR + OIIR$), it would be necessary to consider the risks identified and calculated in the three phases of the holistic open innovation methodology, which begins with mapping the learning process, as opposed to the comprehensive management of operational risks proposed in Integral Management of Operational Risk in Fuentes and Zúñiga (2010).

If we compare the learning and adaptation process of the brain of the organization with that of the human brain, we can find the main similarity in the principle of singularity that processes with optimization the components that compose it and with which it organizes an inference or decision of change. According to Stefan, H.T. [67], the organization would reach maturity in terms of experimentation and change by first becoming aware that experiments matter, secondly believing and adopting the necessary frameworks as new technologies, thirdly committing to allocate resources and change the organization, fourthly expanding reach and access, and finally democratizing, allowing all members of the organization to participate in the experiment. The implementation of a new project in the organization could depend on many of these phases and perhaps the way to measure commitment would not only go through the allocation of resources, but the alignment of holistic innovation competencies that are found at the unconscious level in all members of the organization.

In the case of the components that make up the biological brain, the recognition neurons interact in the memory of the neocortex, and in the same way, the members that

make up the brain of the organization interact based on the recognition of the holistic competencies of innovation that are stored in the organizational memory.

The organizational brain would function through a set of organizational neurons that are the result of the emotional alignment of each of its members' holistic innovation competencies, which come from different levels of the company yet share information flows. According to the hierarchical method of the Hierarchical Model of Temporal Memory (George, 2008) [17], the brain maintains flows of information between neurons of the biological brain via dendrites in a hierarchical order between perceptions, and concepts until they come to infer and predict via established opinions or judgments about something. In the case of organizations, they may be able to infer and predict jointly by manifesting themselves in collective decisions, based on the hierarchical order of their members' learning processes. Just as each neuron in the brain is independent but interacts collectively, each member of an organization is independent in their microworlds, but interacts collectively when they are part of an organization.

The organization's behavior would be a reflection of the individual's behavior, which in turn would be a reflection of the behavior of neurons at the biological brain level. To predict organizational behavior, it is sufficient to identify the learning process in a hierarchical path from the bottom up with the correlation of holistic integrated innovation competencies of each small producer in each of its microworlds facing individual entrepreneurship decisions developing competencies that would then allow him to make collective decisions at the managerial level in an organization. According to Mavrodiev, P.; Schweitzer (2021) [68] collective wisdom could establish that the average of all opinions is closer to the truth, but groups would make decisions to maintain their initial decision if no more information is available, but if they had more information they could change their initial decision as small cocoa producers who preferred to maintain their status as individual entrepreneurs even when they did not achieve the expected results in Zúñiga (2021) [9].

On the other hand, the learning process in the hierarchical path from top to bottom would allow the manager to correlate at the level of holistic competencies of innovation with its employees [64].

These connectors of competencies, also called in the study hierarchical emotional alignment of organizational neural patterns (Figure 1), would communicate at the emotional level to the three groups of the research study that would correlate their holistic competencies of innovation functioning as (organizational neurons) that would simulate the action of a biological neuron. This emotional alignment, called organizational memory, would allow projects driven by the directors of the organization to have the support of the bases and employees even in situations of accelerated change (Figure 3).

The configuration of the many patterns that control the functioning of a pattern recognition system in the biological brain is called "god parameters", as they are configured before the self-organizing method that determines the topology of the hidden models of Markov [20,21] (or, in the biological case before the person learns lessons by creating similar connections in his cortical hierarchy (Markov, 1971)). The holistic competencies of innovation associated amongst the members of the organization referred to as organizational memory would be at the level of the configuration of the producer patterns of the organizations. Managers could use the comprehensive competencies identified in the organizational memory to help them implement change programs with the help of the bases.

When analyzing the results of the behavior of collective entrepreneurship of small producers of alternative organic cocoa crops and fair trade comparing it with the behavior of individual entrepreneurship of small producers, it was identified that productivity was higher in collective entrepreneurship considering that prices were the same in both groups (Zúñiga, 2021) [9].

Likewise, the process of the fast track (emotional aspect) and slow track (rational aspect) of the neocortex of small collective producers could identify coherence between both processes of collective decision-making that were denominated in the article "Neuroe-

conomic Decision in cocoa producers” as a decision of cooperative strengthening, unlike the incoherence that could be observed in the small individual producers who identified themselves as an opportunist decision of an association of the individual entrepreneur (Zúñiga, 2021) [9]. According to Gowdy, Dollimore, Wilson and Witt (2013) [69], cosmology and economics have been trying to understand hierarchical processes in man and cooperative behaviors from a more complete focus in neuroscience-based on the analysis of man in his configuration as a self-sufficient being and being selfish, the competence of individuals would motivate them to function well considering that there would be an ideal optimal natural state.

3. Materials and Methods

The study plans experimental, probabilistic, transactional, correlational, analytical, and descriptive research. For this purpose, the research was considered as an object of the members of the agro-industrial cooperatives ACEPAT and CENFROCAFE that have faced the accelerated change of the COVID-19 pandemic with a digital project as a possible solution.

3.1. Determination of the Population and Sample

Data were collected using two online questionnaires using the population convenience sampling method. The participants were 90 volunteer member respondents of a total of understood ages that are distributed according to the hierarchical structure of each of the two cooperatives in 24 small producer partners, 14 directing producers, and 7 employees of the Agro-industrial Cooperative ACEPAT and CENFROCAFE (Table 1).

Table 1. Characteristics of the control group and experimental group.

Control Group (CENFROCAFE)	Experimental Group (ACEPAT)
- The agro-industrial cooperative was founded in 1999 by small producers.	- The agro-industrial cooperative was founded in 1998 by small producers.
- It has 3100 members from small producers [70].	- It has 624 partners from small producers [71].
- A sample of $n = 45$ members of the cooperative was taken (24 small producer partners, 14 directing partners, and 7 employees).	- A sample of $n = 45$ members of the cooperative was taken (24 small producer partners, 14 directing partners, and 7 employees).
- Acopia, process coffee.	- Acopia, process oil palm.
- COVID-19 affected the business.	- COVID-19 affected the business.
- The managing partners proposed a post-COVID-19 digital project.	- The managing partners proposed a post-COVID-19 digital project.
- The post-COVID-19 digital project was not implemented.	- The post-COVID-19 digital project was implemented.

Source: CENFROCAFE and ACEPAT, 2020.

Research question:

Which cooperative presented the largest organizational memory for the implementation of digitization projects in a context of accelerated changes?

Hypothesis 1. We identified a greater organizational memory or a greater correlation of holistic innovation competencies in the learning process of ACEPAT members who implemented a digital project after COVID-19 concerning CENFROCAFE.

Hypothesis 0. We identified a greater organizational memory or a greater correlation of holistic innovation competencies in the learning process of the members of CENFROCAFE who did not implement a digital project after COVID-19 concerning ACEPAT.

3.2. Measuring Instruments

Instrument 1: “Holistic Innovation Coefficient” <https://coih.nlcode.com> (accessed on 1 August 2021), which was validated in the publication of “Impact of the Holistic Innovation Methodology on the Creativity”. Questionnaires of 72 questions on the Likert scale were conducted.

Instrument 2: “Small Producer Partners Entrepreneurship Ratio”. Questionnaires of 30 questions on the Likert scale were conducted.

3.3. Measures

3.3.1. Holistic Competencies of Innovation and Entrepreneurship

They are competencies that are in the right hemisphere of the neocortex of the biological brain of each member of the organization. Generally, the creative qualities are centered in the right hemisphere that is more related to the fast track (emotional aspect, holistic, intuitive, concrete, global aspect of the whole to the part, random, fantastic, nonverbal, timeless, literal, qualitative), in contrast to the left hemisphere that relates to slow track (rational aspect, logical, analytical, abstract, sequential part to the whole, linear, abstract, realistic, verbal, temporal, symbolic, quantitative) [2–36].

3.3.2. Holistic Innovation Coefficient

It is scoring that is calculated and measures sixteen holistic competencies of innovation such as stress management, belief in being creative, self-knowledge, introspection, logical thinking, and lateral thinking, intuition and reason, high self-motivation, ease of formulating problems, a constant search for ideas, transgressive attitude, adventurous attitude, creative leadership, knowing how to think naively, search for recognition, search for improvement of life, and level of holistic innovation.

3.3.3. Organizational Memory (OM)

It is the interrelation and emotional alienation that are measured by the level of correlation of the holistic competencies of innovation that reflects the hidden plots that are shared unconsciously among the members of an organization at all levels and allows its leaders to implement proposals for change with the support of their base, even in crises, and adapt their structure [9].

3.3.4. Risks

It is the potential loss within a process and can arise from various sources, internal or external, grouped into various types [66].

3.3.5. Corporate Risk (CR)

It is the potential loss due to the lack of sustainability and alignment with the objectives, linked to the vision and the business mission [33].

3.3.6. Open Innovation Infrastructure Risk (OIIR)

It is the potential loss in the organization due to the lack of processes in the structure to capture technology from outside and promote the creation of technology inside [35]. Likewise, it is also a potential loss in the organization due to the lack of processes in the structure to interact with the client and offer the value proposition [66].

3.3.7. Digital Operational Risk (DOR)

It is the potential loss in the organization due to the lack of adaptation of structure (hard) and organizational memory (soft) to the digital environment [28].

3.4. Procedure and Data Analyzed

3.4.1. Analysis of Pattern Hierarchy in Formal Interrelation

This phase analyzes the interrelations of the members of the cooperative, considering the order of the hierarchical structure formed by partners (small producer partners), directing producers (small producers who were chosen to run the cooperative and are with the small producers as partners), and employees (who were hired to perform functional positions and are under the order of the managers).

Formal hierarchical interrelation in the cooperative between partners and managers:

Where partners (small producer partners) are under directing producers (small producers they represent).

First, the microworlds of small producer partners in their communities are analyzed to identify which competencies promote their entrepreneurship at the individual level (CP). For this purpose, a questionnaire of 30 questions on the Likert scale was applied to 24 agricultural partners of ACEPAT (experimental group) and 24 agricultural partners of CENFROCAFE (control group).

Secondly, the microworlds of small producers are analyzed as managers of the organization to identify that holistic competencies of innovation (CD) are present when they lead enterprises at a collective level and what is their level of scoring regarding the predisposition to innovate. For this purpose, a questionnaire of 72 questions on the Likert scale was applied to 14 (directing producers) of ACEPAT (experimental group) and 14 (directing producers) of CENFROCAFE (control group).

Third, the entrepreneurship competencies of small producers are correlated with the holistic innovation competencies of small producers as managers, and holistic innovation competencies are identified as integrated with the entrepreneurship competencies of the bases (CP) in ACEPAT (experimental group) and CENFROCAFE (control group) in $ar2 = (CP) (CD)$.

The formal hierarchical interrelationship between managers and employees:

Where managers (small producers who run) are above employees (staff hired to perform a function).

Fourthly, the microworlds of the employees of the organization will be analyzed to identify the holistic competencies of innovation with which they collaborate, promoting instead in the organization (CE). For this purpose, a questionnaire with 72 questions in-depth with a Likert scale will be applied to an experimental group of 7 employees of ACEPAT (Experimental Group) and 7 employees of CENFROCAFE (Control Group)

Fifthly, holistic managerial innovation competencies are correlated with holistic employee innovation competencies and holistic innovation competencies are identified with the bases (SCC) in ACEPAT (Experimental Group) and CENFROCAFE (Control Group) in $br2 = (CD) (CE)$.

3.4.2. Analysis of Pattern Hierarchy in Informal Interrelation

This phase examines the interrelationships among cooperative members, considering the informal hierarchical structure formed by partners (small producer partners) and employees (who were hired to perform functional positions), although they are not functionally dependent on the partners.

Informal hierarchical interrelation in the cooperative between partners and employees:

Where employees are found in the interrelationships below partners (small producers).

Sixth, the entrepreneurship competencies of the partners are correlated with the holistic innovation competencies of the employees and holistic innovation competencies are identified with the bases (CPE) in ACEPAT (experimental group) and in CENFROCAFE (control group) in $cr2 = (CP)(CE)$.

Seventh, the organizational memory resulting from the sum of averages of the formal hierarchical interrelation between (producers – managers) $ar2$, (managers – employees) $br2$, and the informal hierarchical interrelation between (producers – employees) $cr2$ with

function $Y = (ar^2 + br^2 + cr^2)/3$ for ACEPAT (experimental group) and CENFROCAFE (control group) is calculated.

The inference of organizational memory (Y) would explain how the hidden plots would result from the formal interrelation and informal interrelation as a reflection of the behavior of the temporal memory of the biological brain to achieve the interrelation of the information as an organizational neuron that integrates the information from each microworld that makes up each part of the organization, following the hierarchy of patterns exposed in the temporal memory of the neocortex (George, 2008) [17] that would configure the information shared and stored in the organization and as a product of the formal hierarchical interrelations and the informal ones of the members that make it up.

The organization's brain in the same way as the biological brain could infer and project the parameters of a future collective decision. Taking into account Markov's probability theory, the initial states of probabilities of organizational memory would be identified in: (1) organizational memory with the implementation of the digital project; and (0) organizational memory without the implementation of the digital project, with which the equations of balance and parameters for the stable state would be projected.

$$\pi_j = \sum_{i=0}^n \pi_i P_{ij}$$

Eighth, the impact of the collective decision on the learning process of the organization must be measured by the level of adaptation of the structure to the digital environment taking into account the risks that arise in the soft aspect (emotional aspect). The corporate risk of the organization should be calculated considering the level of correlation reached in the organizational memory and its indirect relationship with corporate risk in ACEPAT (Experimental Group) and CENFROCAFE (Control Group). For this purpose, each Pearson correlation range of the MO with the level of RC is taken (Table 2).

Table 2. Equivalences between organizational memory and corporate risk.

Correlation	Values	Corporate Risk	Values
Perfect correlation	$r = 1$	Very low	(1.1)
Very high correlation	$0.8 < r < 1$	Very low	(1.1)
High correlation	$0.6 < r < 0.8$	Low	(2.1);(2.2)
Moderate correlation	$0.4 < r < 0.6$	Moderate	(3.1);(3.2);(3.3)
Low correlation	$0.2 < r < 0.4$	High	(4.1);(4.2);(4.3);(4.4)
Very low correlation	$0 < r < 0.2$	Very high	(5.1);(5.2);(5.3);(5.4);(5.5)
Null correlation	$r = 0$	Very high	(5.1);(5.2);(5.3);(5.4);(5.5)

Ninth, the impact of the collective decision on the learning process of the organization must be measured by the level of adaptation of the organization to the digital environment taking into account the level of loss of risks arising in the hard aspect (rational aspect) taking into account the evidence of the *adaptation of the structure* provided by the general management of ACEPAT (Experimental Group) and CENFROCAFE (Control Group) (Table 3).

Table 3. Impact matrix.

Level	Rating	Impact
1	Insignificant	Less than \$5000
2	Mild	From \$5000 to \$20,000
3	Moderate	From \$20,001 to \$50,000
4	High	From \$50,001 to \$300,000
5	Catastrophic	More than \$300,000

Tenth, the probability of the occurrence of the collective decision in the learning process of the organization should be measured by the level of adaptation of the organization to

the digital environment considering the level of loss of the risks that arise in the hard aspect (rational aspect) taking into account the evidence of the adaptation of the structure in ACEPAT (experimental group) and CENFROCAFE (control group) (Table 4).

Table 4. Probability matrix.

Level	Rating	Probability	Ranges
1	Rare	1 every 6 months or more	Less than 5%
2	Unlikely	1 time every 3 months	From 0.5% to 1%
3	Possible	1 time to 3 times a month	From 1% to 10%
4	Likely	4–5 times a month	From 10% to 16%
5	Almost true	Greater than 5 times a month	Greater than 16%

Eleventh, the impact of the collective decision on the learning process of the organization should be measured by the level of adaptation of its structure to the digital environment, considering the risks that arise in the hard aspect (rational aspect). The open innovation infrastructure risk (OIIR), the evidence of the adaptation of the structure in ACEPAT (experimental group) and CENFROCAFE (control group) should be calculated considering the probability ranges of occurrence and on the other hand the ranges of impact on potential loss.

Twelfth, the impact of the collective decision on the learning process of the organization should be measured by the level of adaptation of the organization to the digital environment considering the digital operating risk resulting from the sum of the risks in the emotional aspect and the rational aspect in $DOR = CR + OIIR$ in ACEPAT (experimental group) and CENFROCAFE (control group).

4. Results

4.1. CENFROCAFE Control Group

CENFROCAFE (control group) investigates the systemic thinking of the cooperative, taking into account its level of adaptation to the digital environment against gross change after COVID-19 in which SOFT and HARD indicators are analyzed [28] (Figure 3). In the first stage SOFT aspect, we analyze the holistic competencies of entrepreneurship and innovation of (24 producer partners, 14 directing producers, and 7 employees) that interrelate in the creative process of collective entrepreneurship that aims to implement after the pandemic the digitization project (virtual shop) in the organization. The competencies that interrelate with the emotional aspect through the Pearson correlation index are analyzed to detect the “hidden plots of the organization” [1] that could be organized hierarchically through sensations and then in acts [27] that are remaining in the temporal memory of the neocortex of each member from each subgroup that make it and generate an approach from each microworld.

To measure the organizational memory in the control group, formal and informal interrelations should be included, considering the hierarchical configurations established in the temporal memory of the neocortex of the members that make up the organization. The formal hierarchy interrelation (Producer Partners—Directing Producers) resulted in $ar^2 = 0.28$, that is, “low correlation” in this frame of the organization. The formal hierarchical interrelation (Directing Producers – Employees) resulted in $br^2 = 0.61$, that is, “high correlation” in this frame of the organization. The informal hierarchical interrelation (Employees – Producers) resulted in $cr^2 = 0.06$, that is, a “very low correlation” in this frame of the organization. Finally, the formula with which the organizational memory is calculated in the equation $Y0 = (0.28 + 0.61 + 0.06)/3$ and resulted in $Y0 = 0.32$ (Figure 4).

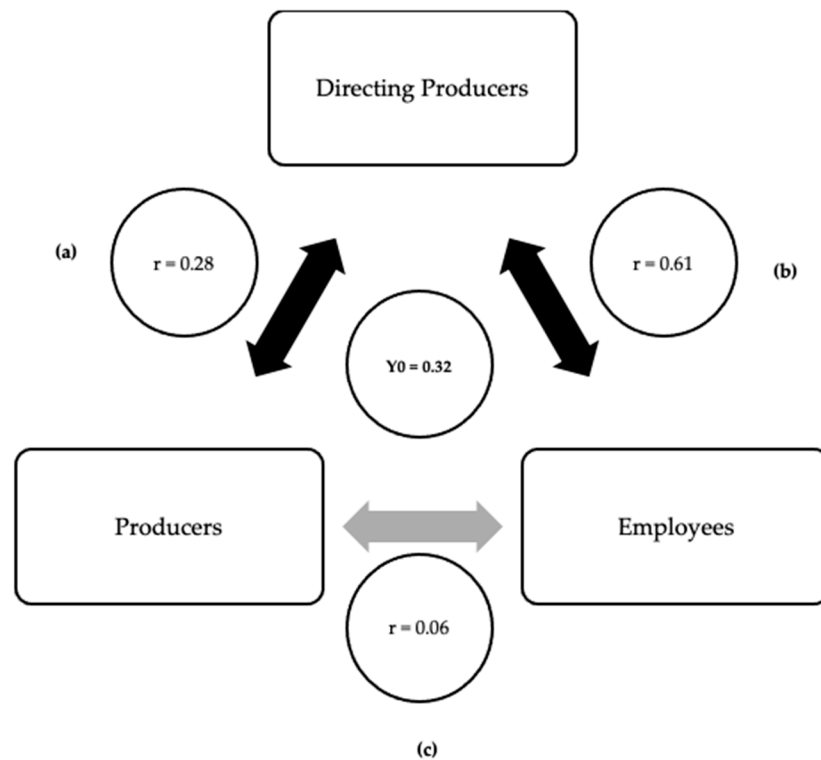


Figure 4. Organizational memorial and hidden plots of systemic thought in the CENFROCAFE control group. (a) The interrelation formal hierarchy (Producer Partners—Directing Producers); (b) The formal hierarchical interrelation (Directing Producers – Employees); (c) The informal hierarchical interrelation (Employees – Producers).

4.1.1. SOFT Aspects Indicators in the Results of the CENFROCAFE Control Group

Hidden plots could be analyzed in the formal hierarchical interrelation of the subgroup of small producers (CENFROCAFE partners), identifying the entrepreneurship competencies related at the individual level to undertaking new projects such as innovation (1.53), product quality (3.90), entrepreneurship (3.79), access to financing (2.80), control (4.40), family influence (4.92) and associativity (4.83) (Table 5). The hidden plots of the subgroup of small producers (CENFROCAFE directors), identify the innovation competencies related to collective entrepreneurship that would be activated with new projects in order to analyze the interrelation with other sub-groups at external level when interrelated with small producers (partners) and at internal level with (employees), these are identified as: belief of being creative (3.00), high self-motivation (4.00), ease of problem-making (3.69), constant search of ideas (3.21), search for recognition (3.69), and search for improvement of life (3.45). The hidden plots of the sub-group of employees (CENFROCAFE officers) identify the innovation competencies related to the collective entrepreneurship that would be activated with new projects in order to analyze the interrelation with other sub-groups at the external level to interrelate small producers and small partners (internal level) with small producers (directors), and these are identified as: belief to be creative, (3.36), elevated automotive (4.10), ease to formulate problems (4.20), constant search of ideas (3.86), search for recognition (3.81), search for improvement of life (3.71) (Table 5). The competencies that stand out most at the level of small producers as partners are “level of influence of the family” (4.92) while in producer managers stand “high automotive” (4.00) with a level of predisposition to holistic innovation in 258/360 “High” and employees highlight “ease to formulate problems” (4.20) with a level of predisposition to holistic innovation in 280/360 “High” that analyze the holistic competencies of innovation of collective entrepreneurs. The hidden plots could be analyzed in the informal hierarchical interrelation of the subgroup of

small producers (CENFROCAFE partners) with the employees (CENFROCAFE officers) (Table 5).

Table 5. Formal hierarchical interrelation of holistic innovation and entrepreneurship competencies in control group CENFROCAFE.

Competencies of Entrepreneurship of (Producers)	Corr.	Competencies of Holistic Innovation (Managers)	Corr.	Competencies of Holistic Innovation (Employees)	Corr.
g. innovation	1.53	B. belief in being creative	3.00	B. belief in being creative	3.36
c. product quality	3.90	G. elevated self-motivation	4.00	G. elevated self-motivation	4.10
k. entrepreneurship	3.79	G. elevated self-motivation	4.00	G. elevated self-motivation	4.10
b. access to financing	2.80	H. ease to formulate problems	3.69	H. ease to formulate problems	4.20
e. control	4.40	H. ease to formulate problems	3.69	H. ease to formulate problems	4.20
g. innovation	1.53	I. constant search for ideas	3.21	I. constant search for ideas	3.86
k. entrepreneurship	3.79	M. search for recognition	3.69	M. search for recognition	3.81
c. product quality	3.90	M. search for recognition	3.69	M. search for recognition	3.81
k. entrepreneurship	3.79	N. search for life improvement	3.45	N. search for life improvement	3.71
i. influence of the family	4.92	N. search for life improvement	3.45	N. search for life improvement	3.71
h. associativity	4.83	N. search for life improvement	3.45	N. search for life improvement	3.71

4.1.2. HARD Aspects Indicators in Control Group Results

The mapping of the learning process of the cooperative identifies and measures the level of adaptation of the organizational structure to the digital environment through the identification and calculation of the digital operational risk (DOR) of the organization (HARD aspect) considering that the digital project was not implemented. For this purpose, the one responsible for the process, Teodoro Meléndez Ojeda, general manager of CENFROCAFE (control group) [70], who is an agronomic engineer with 17 years of running the organization and has been in the organization since its beginning, promoting associativity, said: “The cooperative has achieved a regional, national and international positioning with the collection, production and export of specialty coffee in parchment mode to different markets and at the national level is produced and marketed with roasted coffee for companies such as Nestlé, Macro on other clients. Similarly, it has diversified with 25 coffee shops in Jaen since 2008. However, he said that the COVID-19 pandemic and confinement as a preventive measure affected the organization from the field in March 2020 that faced the lack of labor for the coffee harvest caused 30% of the coffee (not harvested) to dry and lost in the field.” To understand the level of impact of loss on the emotional level, it is important to identify that one of the entrepreneurship skills that are present in the small producers of CENFROCAFE is the “influence of the family” that could have been the impetus of the associativity and the origin of the formation of the cooperative that, as mentioned in the history on the website, was a collective enterprise to combat intermediaries who paid low prices. In addition, if we analyze the purpose of changing the pattern of cultivation from coca to coffee, there is a transcendent message of “search for life improvement” that was identified in the decisions of small producers when they are (directing) and who adopt the purpose of improving their standard of living through collective entrepreneurship, but taking into account the values of sustainability and principles of ‘cooperativism’ that turn the cooperative into a family of families [42]. Analyzing the cooperative’s business model, the sales in coffee shops and distribution were also affected by the confinement in front of it. The general management resumed the implementation of the virtual shop project that had been initiated years ago with the Belgian cooperation and had been a project that had been postponed to give impetus to physical stores in Lima.

Teodoro Meléndez Ojeda, stated: “The virtual store project has had the acceptance of partners and employees showed interest perhaps in the desire to be recognized as is the case with other companies. However, its implementation has not been achieved to date. It is likely to be achieved in the year 2022.” Perhaps, one of the factors that could strengthen

its implementation would be to appeal to the “search for recognition” of the employee who is a holistic innovation competition that presents a high average in its configuration. On the other hand, progress has been made with the collection of field information through tablets to systematize productivity indicators. It was shown that the cooperative does not have a platform for virtual work, but it uses other digital platforms for public use. The staff did receive different pieces of training through RootCapital. At the innovation level, an ERP is being developed to systematize information. Still, no patents have been purchased. Finally, he said that not implementing the virtual store project would have had an impact on small producers at a moderate loss level, with a frequency of probability of occurrence possible. However, calculating the loss for not having harvested 30% of the coffee campaign in March 2020 the impact on the cooperative could be placed in the range of catastrophic and possible with the frequency being 1 to 3 times in the campaign (Table 6).

Table 6. Results of the control group CENFROCAFE.

	Measures	Indicators
(1)	Corporate Risk (CR) (SOFT)	(4.3)
(2)	Open Innovation Infrastructure Risk OIIR (HARD)	(3.5)
(3)	Digital operational risk (DOR = CR + OIIR)	(3.4)

4.1.3. Digital Operational Risk (DOR) in Control Group Results

In CENFROCAFE (control group) a “High” digital operational risk DOR of (3.4) was obtained by measuring the impact on the cooperative learning process against the post-COVID-19 gross change, which is calculated by taking into account the SOFT and HARD indicators in the process of adapting its structure [28] (Figure 5).

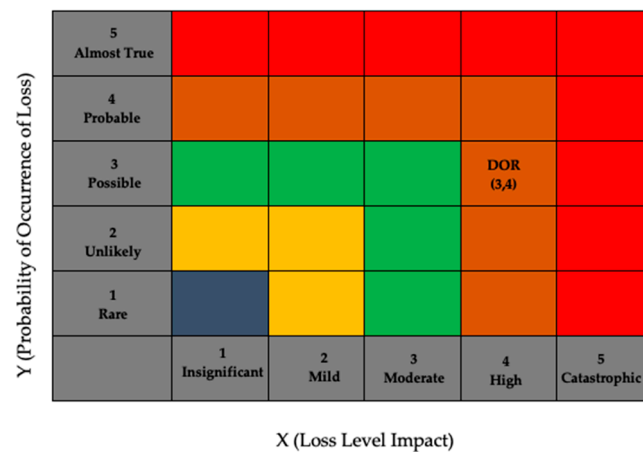


Figure 5. CENFROCAFE DOR map digital operational risk of the control group.

4.2. ACEPAT Experimental Group

In ACEPAT (experimental group) the systemic thinking [17,18] of the cooperative is investigated taking into account its level of adaptation to the digital environment against the post-COVID-19 gross change in which SOFT and HARD indicators are analyzed [28] (Figure 3). In the first stage SOFT aspect, we analyze the holistic entrepreneurship and innovation competencies of (24 producer partners, 14 directing producers, and 7 employees), which are interrelated in the creative process of collective entrepreneurship that has the purpose of implementing the digitalization project (Website) in the organization post-pandemic. The competencies that are interrelated with the emotional aspect through the Pearson correlation index are analyzed to detect the “hidden plots of the organization” [1] that are generated at the level of sensations and then in acts [27] that remain in the temporal

memory of the neocortex of each member from different subgroups that make it and generate an approach from each microworld (Figure 4).

To measure the organizational memory (OM) in the control group, formal and informal interrelations should be included, taking into account the hierarchical configurations established in the temporal memory of the neocortex of the members that make up the organization. The formal hierarchical interrelation (Producer Partners—Directing Producers) resulted in $ar^2 = 0.65$, i.e., “high correlation” in this organization plot. The informal hierarchical interrelation (Directing Producers—Employees) resulted in $br^2 = 0.81$, i.e., “very high correlation” in this organization plot. The formal hierarchical interrelation (Employees—Producer Partners) resulted in $cr^2 = 0.30$, i.e., “low correlation” in this organization plot. Finally, the formula with which the organizational memory (OM) is calculated in equation $Y0 = (0.65 + 0.81 + 0.30)/3$ and resulted in $Y0 = 0.59$ that is assigned a “Moderate” corporate risk (Figure 6).

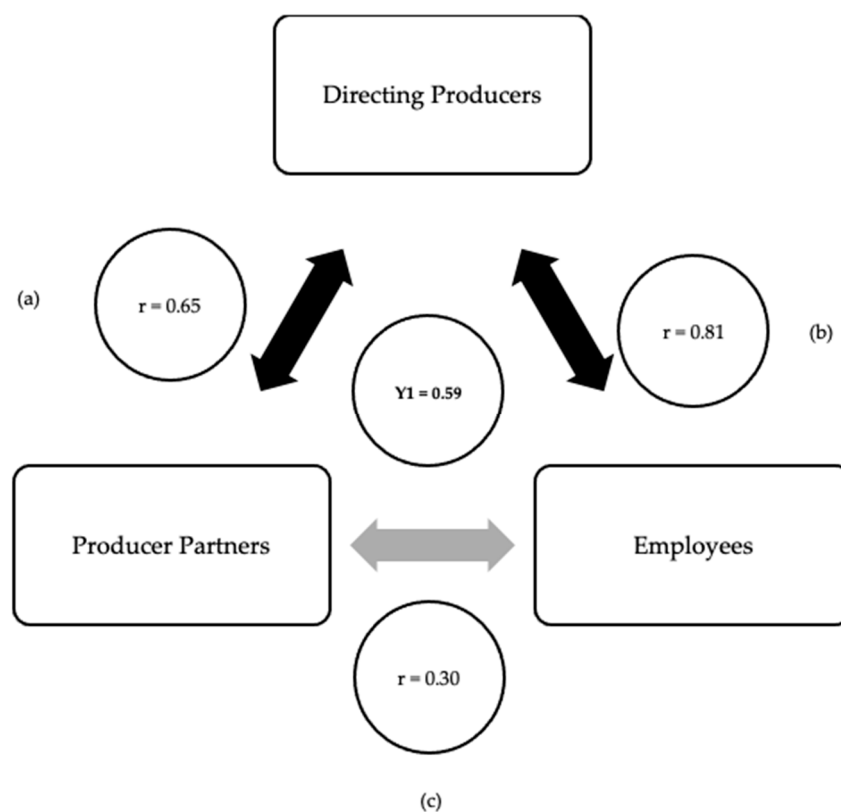


Figure 6. Organizational memory (OM) and hidden plots of systemic thinking in an experimental group ACEPAT. (a) The interrelation formal hierarchy (Producer Partners—Directing Producers); (b) The formal hierarchical interrelation (Directing Producers – Employees); (c) The informal hierarchical interrelation (Employees – Producers).

4.2.1. SOFT Aspects Indicators in the Experimental Group ACEPAT

The hidden plots of the sub-group of small producers (ACEPAT partners), the entrepreneurial competencies related at the individual level to undertake new projects, are identified to analyze the interrelation with other sub-groups, and these are identified as: innovation (1.83), product quality (3.90), entrepreneurship (4.04), access to finance (2.88), control (3.08), family influence (4.64) and partnership (4.92) (Table 5). The hidden plots of the sub-group of small producers (directing of ACEPAT) are identified as the innovation competencies related to collective entrepreneurship that would be activated with new projects to analyze the interrelation with other sub-groups at the external level when interrelated with small producers (partners) and internally with (employees), and

these are identified as belief in being creative, (3.05), high self-motivation (3.58), ease of formulating problems (3.39), the constant search for ideas (3.19), search for recognition (3.52), and search for life improvement (3.65) (Table 5). The hidden plots of the sub-group of employees (ACEPAT officers) identified innovation competencies related to collective entrepreneurship that would be activated with new projects to analyze the interrelation with other sub-groups at the external level by interrelating with small producers (partners) and internally with small producers (managers), and these are identified as belief in being creative, (3.00), high self-motivation (4.00), ease of formulating problems (3.88), the constant search for ideas (3.33), search for recognition (4.07), and search for life improvement (3.60) (Table 5).

The competencies that stand out most in the level of small producers as partners are “level of associativity” (4.72) while the directing producers stand out as “constant search for ideas” (3.8) with a level of willingness to holistic innovation in 261/360 “High” and employees stands out “search for recognition” (3.81) with a level of willingness to holistic innovation in 251/360 “High” that analyze holistic innovation competencies of collective entrepreneurs. Hidden plots could be analyzed in the informal hierarchical interrelation of the sub-group of small producers (ACEPAT partners) with employees (ACEPAT officers) (Table 7).

Table 7. Formal hierarchical interrelation of holistic innovation and entrepreneurship skills in experimental group ACEPAT.

Competencies of Entrepreneurship of (Producers)	Corr.	Competencies of Holistic Innovation (Managers)	Corr.	Competencies of Holistic Innovation (Employees)	Corr.
g. innovation	1.77	B. belief in being creative	3.18	B. belief in being creative	2.89
c. product quality	3.78	G. elevated self-motivation	3.59	G. elevated self-motivation	3.76
k. entrepreneurship	3.94	G. elevated self-motivation	3.59	G. elevated self-motivation	3.76
b. access to financing	2.73	H. ease to formulate problems	3.59	H. ease to formulate problems	3.74
e. control	2.88	H. ease to formulate problems	3.59	H. ease to formulate problems	3.74
g. innovation	1.77	I. constant search for ideas	3.28	I. constant search for ideas	3.05
k. entrepreneurship	3.94	M. search for recognition	3.69	M. search for recognition	3.81
c. product quality	3.78	M. search for recognition	3.69	M. search for recognition	3.81
k. entrepreneurship	3.94	N. search for life improvement	3.59	N. search for life improvement	3.43
i. influence of the family	4.44	N. search for life improvement	3.59	N. search for life improvement	3.43
h. associativity	4.72	N. search for life improvement	3.59	N. search for life improvement	3.43

4.2.2. HARD Aspects Indicators in the Experimental Group ACEPAT

The mapping of the learning process of the cooperative identifies and measures the level of adaptation of the organizational structure to the digital environment through the identification and calculation of the digital operational risk (DOR) of the organization (HARD aspect) considering that the digital project was not implemented. To this end, Gustavo Sigarrostegui Ruiz, general manager of ACEPAT (experimental group) [71], is an economist with a master’s degree in social management with 5 years of running the organization, was interviewed. He said: “ACEPAT is a different cooperative that focuses on strengthening social values and corporate governance leaving the industrial model to the company Oleaginosoas del Peru of which they are main shareholders.” In other words, they constitute a hybrid cooperative model in which they have not lost their associative nature and are constituted as a supplier of oil palm for its transformation into oil with higher added value.

When analyzing the emotional process of the subgroup of small producers (partners), it was identified that the entrepreneurship competition that is with the highest average is: “associativity” (4.72) with what could be deduced before the decision to undertake the collective decision would be a present value in small producers. In this sense, the openness and flexibility could be made noticeable by interrelating in its management profile where

it is identified that at the level of management the small producer is fundamentally characterized by the “search for recognition” (3.69), which shows that this value is prioritized when looking to undertake, which demonstrates flexible thinking and openness to adopt new business models before personal interest. Likewise, the ability to “seek recognition” (3.81) to find its role in this structure marks the strengths of a hybrid organization with the respect to each of the competencies that they have to perform as ACEPAT from the associativity and Oleaginosas del Peru S.A from the business model. He said that the COVID-19 pandemic affected the cooperative’s business model, because “oil palm is a product that is an input of several products in the food sector that was not affected too much during the pandemic.” However, he acknowledged that it affected the cooperative’s operations. To continue the activities in the cooperative, he proposed a digitization project with the *website* [25].

Gustavo Sigarrostegui Ruiz said: “The implementation of this project aims to generate greater communication with the co-operative’s partners, with customers and to raise awareness of the co-operative in a wider scope. This project has been implemented with the support of partners and employees” [71]. He also said that the organization implemented technology in its field processes to increase productivity in palm oil crops. On the other hand, employees of the cooperative received innovation training. He considered that if the website project was not implemented, the cooperative would have had a mean range of loss, with an average frequency of probability. The economic manifestation of the impact of the hierarchy of patterns in its learning process from the emotional aspect in collective decisions (soft) is manifested in the adaptation of its structure (hard) as a response to digitalization in the face of changes through the risks of open innovation and market risk. Finally, he said that not implementing the virtual store project would have had an impact on small producers at a moderate loss level, with a frequency of probability of occurrence being possible. However, we calculated the loss in Table 8.

Table 8. Results of the experimental group ACEPAT.

Measures	Indicators
(1) Corporate Risk CR (SOFT)	(3.1)
(2) Open Innovation Infrastructure Risk OIIR (HARD)	(3.5)
(3) Digital operational risk (DOR = CR + OIIR)	(3.3)

4.2.3. DOR Digital Operational Risk in Control Group Results

In ACEPAT (experimental group), a DOR digital operational risk “Moderate” of (3.3) was obtained by measuring the impact on the learning process of the cooperative against the gross change after COVID-19, which is calculated considering the SOFT and HARD indicators in the process of adapting its structure [28] (Figure 7).

The interrelation of the organizational brain in the experimental and the control group is the result of the average of the structural interrelations (that present a hierarchical relationship within the functional structure between producers, managers, and employees) and the non-structural relationships that occur in the hierarchical relationship outside the functional structure between (producer partners and employees).

Applying the theory of probabilities of Markov to find the projection of stable states in the inference of the organizational brain against the collective decision to implement digital projects for which would take into account the information of the organizational memory (OM) and its effect on the initial states with the project (1) and without project (0) of what is obtained as a result; P_i with the project (1) = 0.59 and P_i without project (0) = 0.32 (Table 9).

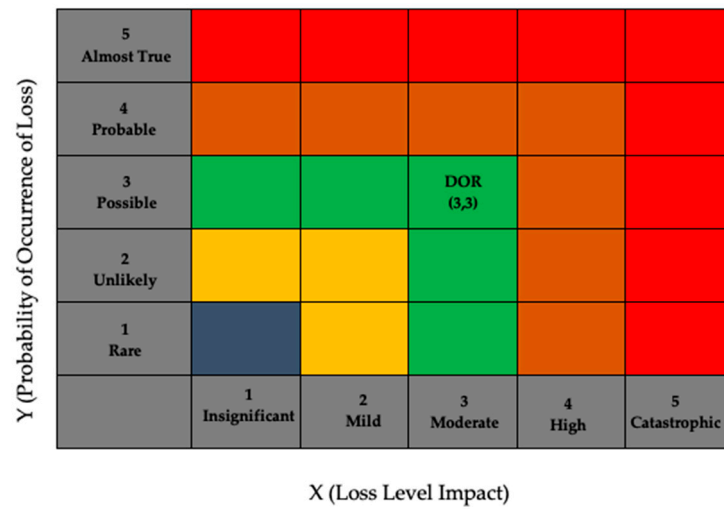


Figure 7. ACEPAT DOR map digital operational risk of the experimental group.

Table 9. Markov initial state matrix.

P(0) =	1	Exit State (t)	
	0		
Initial states (t-1)	States	With digital project (1)	Without digital project (1)
	With digital project (1)	0.59	0.41
	Without digital project (1)	0.32	0.68

The effect on the arrival states with the project (1) and without project (0) of what is obtained as a result; π_1 with the project (1) = 0.44 and π_0 without project (0) = 0.56 (Table 10).

$$\pi_j = \sum_{i=0}^{n=4} \pi_i P_{ij}$$

$$\pi_1 = 0.59 \pi_1 + 0.41 \pi_0 \tag{1}$$

$$\pi_0 = 0.44 \pi_1 + 0.56 \pi_0 \tag{2}$$

$$\pi_1 + \pi_0 = 1$$

$$\begin{aligned} \pi_1 &= 0.44 \text{ Organizational Memory (with digital project)} \\ \pi_0 &= 0.56 \text{ Organizational Memory (without digital project)} \end{aligned} \tag{3}$$

Table 10. Markov arrival state matrix.

P^4 =	1	Exit State (t)	
	0		
Arrival states (t)	States	With digital project (1)	Without digital project (1)
	With digital project (1)	0.44	0.56
	Without digital project (1)	0.44	0.56

5. Discussion

The ability to infer and establish thoughts is attributed to a function in the human biological brain [7,8]; however, cooperative organizations could configure systemic thinking following the hierarchy of emotional patterns [17,18] by interrelating the holistic competencies [24] of the individual minds that make it up by moving from sensation to action [27].

The Theory of Learning according to Sengue, 1998 [1], states that intelligent organizations apprehend as well as people under systemic thought, and that they are invisible plots or acts that unconsciously interrelate [1], demonstrating that the learning process is in a team and requires an adaptation of the mental models of their workers. Learning in this context would require a systemic response [1] to permanent changes where values could originate in individual acts that are presented daily as a permanent response in their microworlds. Then, these entrepreneurial skills would be communicated and manifested unconsciously in the interpersonal relationships of small producers who took the position of directors within the cooperative and who would have the mission to direct this time in the collective enterprises of the organization, as in the case of the cooperatives ACEPAT (experimental group) and CENFROCAFE (control group), which were formed as a response of collective entrepreneurship of its members to face the poverty and violence with which they lived with the cultivation of coca in the areas of Tocache and Jaen [4]. According to Gowdy, J.M.; Dollimore, D.E.; Wilson, D.S.; and Witt, U [69], it would identify the evolutionary thinking of the human being in the understanding of its hierarchical processes and cooperative behavior. Evolutionary thinking begins by analyzing the human being as a rational, self-sufficient, and selfish being who would approach the behavior of the small producer in his entrepreneurship before forming the cooperative. Subsequently, the competitiveness approach could seek to migrate to a cooperative position depending on its level of evolution, what happened in 1998 in the formation of ACEPAT and 1999 with the conformation of CENFROCAFE that could evidence the evolutionary thinking in small producers who passed from individual entrepreneurship to collective entrepreneurship, and in this process could analyze the motivations from the point of view of emotional process that remains consistent with rational thinking when small producers face challenges, this time collectively [9]. Perhaps the small producers that formed ACEPAT and CENFROCAFE were aware that their ventures with cocoa crops could not make greater changes in their lives and communities that faced common problems such as poverty and violence that existed around both Tocache and Jaen. The change involved learning from the microworlds with alternative crops, such as coffee and oil palm, and from collective management of the whole business chain.

If we analyze the decision process of the small producer from the fast track process (emotional aspect), that would have generated a positive impulse to start with a new crop that involved a change of life and that predisposed all the holistic competencies of small producers to change and to learn the new cultivation techniques. This change decision would demonstrate consistency between the fast track (emotional aspect) and slow track (rational aspect) processes, as mentioned in neuroeconomic decisions in cocoa producers [9] (Zúñiga, 2021). However, in accelerated change scenarios such as the change of reality and the new digitalization process [14], it could be more complex for the learning process to run permanently from the rational because stress [22] could block the cognitive aspect [1] in the members of the organization that would face the crisis seeking to adapt to the new digital environment. The emotional alignment at the level of holistic competencies of innovation that is the SOFT process in the organization would manifest itself unconsciously as the grassroots support to the proposals of the leader almost as a vote of faith with which they would continue the process of structural adaptation and seek to diminish the digital operational risk [66].

One of the ways to identify the ability to infer organizationally could be when analyzing the collective decision in the face of the need for adaptation of the organizations in the context after COVID-19, which confronted us with a change of reality and that challenged the organizations to learn and adapt to the digital environment, which led to a response of the organization taking into account first the mental adaptation (through its holistic competencies of innovation (SOFT aspect), and secondly, structural adaptation through the resources, tools, knowledge, and strategies that the organization has (HARD aspect) [28]. The adaptive capacity of the organization still in a crisis would demonstrate the level of sustainability and could be measured through the organizational memory in

the SOFT aspect and the digital operational risk (DOR) by measuring the level of structural adaptation of the organization to the digital environment [14].

In ACEPAT, agro-industrial co-operative [25], oil palm producer that has been adapting permanently since it was formed as an association and then as a cooperative, but this time the change that it faces in the pandemic COVID-19 is abrupt and contextualizes them in a new reality in which it must adapt as an organization quickly to the digital environment. When interviewing Gustavo Sigarrostegui Ruiz, general manager of the Agro-industrial Cooperative ACEPAT [71], he acknowledges that he proposed a post-pandemic digitization project consisting of the construction of an institutional website that sought to contact the organization with its interest groups and the implementation of this project was supported by the bases (small producers that are partners of the cooperative), in addition to the employees who found a first way to show their value proposal at a critical time.

In CENFROCAFE, Multiservice Cooperative CENFROCAFE Peru [26], a coffee producer is born as a collective venture of small producers who decide to change the pattern of coca cultivation for coffee as an alternative crop and to fight intermediaries who paid low prices. At first, it becomes a partnership, then it becomes a cooperative, and in the face of the COVID-19 pandemic, the proposal to implement a virtual shop has emerged, but has not yet been implemented. In interviewing Teodoro Melendez Ojeda, General Manager of the Multiservice Cooperative CENFROCAFE Peru [70], he states that he proposed the implementation of a virtual shop to achieve marketing the products as a 250 g coffee bag with the brands of the cooperative. To date, it has not been implemented for various reasons.

If we analyze the behavior after the COVID-19 pandemic of ACEPAT as an experimental group that managed to implement a digital project against the behavior of CENFROCAFE as a control group where the digital project was not implemented, we can find a direct relationship with the level of organizational memory that is found in the SOFT aspect of the organization, bringing together at this indicator level the level of interrelation between the holistic competencies of innovation among its members with the entrepreneurship competencies of small producers. In ACEPAT (experimental group), the organizational memory would be $Y1 = 0.59$ higher than the organizational memory of CENFROCAFE (control group) with an organizational memory of $Y0 = 0.32$.

When we analyze the (SOFT aspect) [28] of the organization, we consider the interrelations between the members of cooperatives that could be very similar to the interrelations in all parts of its functional structure at the formal and informal levels. Each interrelation could resemble the work of the dendrites of the biological brain [29] and generate the information that is shared following the hierarchy of neural patterns of George's temporal memory [17,18] and the principle of uniqueness present in the biological brain of the human being and that from the organization would optimize and organize as an organizational neuron. Furthermore, this alignment would have its impact on the structure and could be measured through the digital operational risk when we analyze the process of adapting to the digital environment in the (HARD aspect) [28].

The impact of the SOFT aspect on the HARD aspect of the organization could be measured by DOR level digital operating risk which was (2.3) in the experimental group smaller than the control group was of (3.4).

If we delve into the analysis of organizational behavior and compare the results of ACEPAT (experimental group) and CENFROCAFE (control group), we can identify at the level of holistic competencies of innovation in the SOFT aspect the level of emotional alignment considering the interrelations between all structures of the cooperative. In the case where ACEPAT belongs to the (experimental group) considering that it was the organization where the digitization project was implemented unlike CENFROCAFE (control group), which did not implement the digital post-pandemic project.

In the organizational brain, collective decision-making processes would follow the same structure of fast track (emotional aspect) as in the case of the organization would be measured by formal and informal structural interrelations in SOFT and slow track (rational aspect) that in the case of the organization would have an impact on the structure of the

organization with a level of digital operational risk that would measure the adaptation of the structure to the digital environment.

In the SOFT aspect, the interrelations of each formal and informal structure in an organization would resemble the function of an organizational neuron that in the case of CENFROCAFE present since organizational neuron 1 (producer partners—directing producers) in ($ar2 = 0.28$); organizational neuron 2 (directing producers—employees) in ($br2 = 0.61$); and the organizational neuron (producer partners—employees) in ($cr2 = 0.06$) that averages an organizational memory (OM) of ($Y0 = 0.32$) that corresponds to a “High” corporate risk. In the case of ACEPAT present from organizational neuron 1 (producer partners—directing producers) in ($ar2 = 0.65$); organizational neuron 2 (directing producers—employees) in ($br2 = 0.81$); and the organizational neuron (producer partners—employees) in ($cr2 = 0.30$) that averages an organizational memory of ($Y1 = 0.59$) that corresponds to a “Moderate” corporate risk (Table 11).

Table 11. Comparative between experimental group vs. control group.

Group	Variable	Corr.	Median	Average	DE	Minimum	Maximum	<i>p</i>
Control (<i>n</i> = 45)	Neuron org. 1 (Producer Partners- Directing Producers)	0.28	3.69	3.57	0.56	1.53	4.92	0.0454
	Neuron org. 2 (Directing Producers – Employees)	0.61	3.71	3.72	0.23	3.00	4.20	
	Neuron org. 3 (Producer Partners – Employees)	0.06	3.81	3.72	0.51	1.53	4.92	
Memory Organizational (OM) (Control group) CENFROCAFE		0.32	3.74	3.67	0.43	2.02	4.68	
Experimental (<i>n</i> = 45)	Neuron org. 1 (Producer Partners – Directing Producers)	0.65	3.59	3.49	0.48	1.77	4.72	
	Neuron org. 2 (Directing Producers – Employees)	0.81	3.59	3.54	0.19	2.89	3.81	
	Neuron org. 3 (Producer Partners – Employees)	0.30	3.75	3.48	0.54	1.77	4.72	
Memory Organizational (OM) (Experimental group) ACEPAT		0.59	3.64	3.50	0.40	2.14	4.42	

In the HARD aspect, the adaptation of the structure to the digital environment would be measured by the organization’s openness to innovation by capturing technology from the outside and the adaptation of its business model.

In the case of ACEPAT, there would be evidence according to the interview with its general manager of an open innovation infrastructure risk [35] (RII) would be (2.3) “Middle Risk” and (3.4) “High Risk” in CENFROCAFE (control group).

Organizations could infer a concept into a collective decision process, as is the case with the individual decision process in the biological brain [7,8].

Likewise, they would assume the same function of establishing hypotheses and questioning, as it demonstrates (Friston, 2010) [6] the inference of the brain when confronted with the known demonstrates wisdom in lifelong learning, and chaos an opportunity to learn in the face of accelerated change (Figure 1).

The organization would also have the ability to adapt from the emotional side (SOFT aspect) and question from the rational side (HARD aspect). According to (Marodiev; Tessone and Schweitzer, 2012) social influence could impact collective wisdom to the extent that it proposes and transforms the organization. When members do not influence the organization, it is called collective intelligence [59]. The COVID-19 context would demonstrate the ability of systemic thought to be configured following the hierarchy of patterns of the human biological brain [7,8] through the emotional aspect (SOFT) with the organizational memory and its effect on the rational aspect in the adaptation of its structure (HARD).

Organizations could infer from the organizational brain taking into account Markov’s theory of hidden patterns [19–21], it could be identified that in ACEPAT (experimental group), the organizational memory (OM) was $Y1 = 0.59$ and the digital project was imple-

mented instead of CENFROCAFE (control group), where the organizational memory was $Y_0 = 0.32$ and where the digital project could not be implemented.

Therefore, when analyzing the collective thinking, we could analyze the ability to infer considering the parameters that could be calculated considering the initial states ($t - 1$) and the projection that could be reached with the exit states (t) could identify that the collective decision of the organizations would identify a projection of initial states with the project (1) and without project (0) of what is obtained as a result; P_i with the project (1) = 0.59 and P_i without project = 0.32 (Table 9).

In arrival states, the organizational memory (OM) without project p (0) would be increased to $p_0 = 0.44$, and in the case of P_i with the project (1), would be increased to $p(1) = 0.44$ (Table 10).

This convergence also occurs in the biological brain when the neocortex through its singularity capacity optimizes the parameters in which the pattern hierarchy should be configured in new thinking. These results and projections would help elucidate the ability to infer systemic thought in the organizations that would follow the same pattern hierarchy structure of the human biological brain memory production model, which would play a fundamental role in placing “the puzzle pieces together.” At the fast track level, the emotional processes connected, on the one hand, with the external aspects such as experiences, acts, and sensations in each of the microworlds of each member of the cooperative would remain in the temporary memory and would be connected with the neocortex network that would come through the amygdala to print the sensations that could be stored in the long-term temporal memory that could in turn be shared with members of an organization as they share more experiences and share from the unconscious side the same holistic competencies of innovation to face a new project, or a new challenge in the organization (Pg.159, according to J. Hawkins and Blakeslee S [72]). The experiment assumes that the rational process would be blocked at the cognitive level by the stress that it would mean to face an abrupt change and it would reveal more easily the protagonist that is weaving behind the systemic thought that can prevent new events through the neocortex of the biological brain than by sharing the hidden plots that are shared in the interrelations that remain in the unconscious through the sensations that are shared in the different acts or new challenges shared by members of an organization who align themselves to the same purpose.

The first great contribution of this article is that the decision-making in cooperatives would be a collective of emotional decisions that are based on the alignment of holistic competencies of its members and that would consider risks and strategic business information in concordance with Ortiz-Teran, Diez, and Lopez-Pascual (2021) [73]: Investment choices are emotional decisions that take into account market information, individual preferences and beliefs, and the origin of these collective emotional decisions is the emotional aspect of the small producers.

The second great contribution of this article is demonstrating that organizations could jointly infer, like an organizational brain, as a response to the context as a reflection of the configuration of the human biological brain of their members. In the human biological brain, the emotional aspect impacts the rational aspect, and in the same way, in the organizational brain, the SOFT aspect impacts the HARD aspect.

6. Limitations

Perhaps future studies could obtain greater precision in the results if the sample included agro-industrial cooperative organizations that manage the same crop and present the same population dimensions. However, the research groups share similar characteristics (Table 1).

7. Conclusions

It is concluded that Hypothesis 1 is fulfilled considering that the SOFT aspect in the organization reflects a greater organizational memory (OM) or a greater correlation of the holistic competencies of innovation in the learning process of ACEPAT members who implemented a digital post-COVID-19 project being of $Y1 = 0.59$ concerning CENFROCAFE in which the organizational memory was of $Y0 = 0.32$.

The effect of the emotional process impacts the HARD aspect of the organization at the level of adaptation of its structure to the digital environment through the measurement of ACEPAT's digital operating risk DOR in (2.3) is lower compared to CENFROCAFE's digital operating risk in (3.4).

The organizational memory concatenates the systemic thought of cooperatives based on the hierarchy of patterns to infer in the learning process from the emotional process and that is processed in the neocortex at the individual level, but which could reflect when aligning a systemic thought that would be reflected in concreting when moving from feeling to action at the collective level. The ability to infer from systemic thought would be explained through Marcov's theory of hierarchy of hidden patterns that would configure the organization as the human biological brain by establishing the parameters of collective decision through the stable states that would be identified in the ranges of limit 1: $Y1 = 0.59$ (larger organizational memory with digital project implementation) and limit 2: $Y0 = 0.32$ (with less organizational memory where a digital project is not implemented) according to Table 9.

Future studies could deepen the investigation of the organizational brain by applying the methodology of organizational memory in different sectors.

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