



Analysis of social and decision-making relations in brazilian fish farming: study conducted at the International Fish Congress in 2021

Ijean Gomes Riedo

Universidade Federal da Grande Dourados – Dourados – MS – Brazil

ORCID: <https://orcid.org/0000-0001-9159-8703>

Humberto Rodrigues Francisco

Universidade Federal Fronteira Sul – Laranjeiras do Sul – PR – Brazil

ORCID: <https://orcid.org/0000-0003-4046-8321>

Aldi Feiden

Universidade Estadual do Oeste do Paraná – Toledo – PR – Brazil

ORCID: <https://orcid.org/0000-0002-6823-9291>

Abstract

The objective of this study was to understand the social relations present in Brazilian fish farming. To this end, the following theories were used as theoretical frameworks: Triple Helix (TH) and Planned Behavior (PCT). The study was descriptive and cross-sectional in three moments of the International Fish Congress event, in 2021, held in the city of Foz do Iguaçu/PR. The study did not consider the evolution of the data over time. The population surveyed was 328 participants. The data collection instrument was a questionnaire with 18 questions, with the Likert agreement scale, distributed in the variables: intention, attitude, subjective norms, perceived behavioral control and self-identity. The data were treated using three analyses: 1) Analysis of Social Relations; 2) scree plot test; and 3) Decision-Based Theory. Data collection was carried out through structured interviews, with representatives from the dimensions of the University, Government and Industry. The managerial contribution of the study was the identification of fundamental methods for the construction of agile, plural and consensual information. The social contribution consisted of synergy and democratization of solutions for problems related to the sector. The theoretical contribution is the intersection of the TH with the PCT. The main results revealed the existence of a relationship between industry, university and government, which allows the transfer of technologies, the development of effective regulatory and development policies and encourages the resolution of market needs and environmental sustainability.

Keywords: Triple Helix. Planned Behavior. Strategic Planning. Synergies. Brazilian Fish Farming.

Análise das relações sociais e decisórias na piscicultura brasileira: estudo realizado no International Fish Congress em 2021

Resumo

O objetivo deste estudo foi compreender as relações sociais presentes na piscicultura brasileira. Para tanto, utilizou-se como referencial teórico as teorias: Tríplice Hélice (TH) e Comportamento Planejado (TCP). O estudo foi descritivo com corte transversal em três momentos do evento *International Fish Congress*, em 2021, realizado na cidade de Foz do Iguaçu/PR. O estudo não considerou a evolução dos dados no tempo. A população pesquisada foram 328 participantes. O instrumento de coleta de dados foi um questionário com 18 questões, com a escala de concordância de Likert, distribuídas nas variáveis: intenção, atitude, normas subjetivas, controle comportamental percebido e identidade própria. Os dados foram tratados pelo emprego de três análises: 1) Análise das Relações Sociais; 2) teste scree plot; e a 3) Teoria baseada nas decisões. A coleta de dados foi realizada por meio de entrevistas estruturadas, com representantes das dimensões da Universidade, do Governo e da Indústria. A contribuição gerencial do estudo, foi a identificação de métodos fundamentais para construção de informações ágeis, plurais e consensuadas. A contribuição social consistiu na sinergia e democratização solutiva para problemas relacionados ao setor. A contribuição teórica é o cruzamento da TH com a TCP. Os principais resultados revelaram a existência da relação entre a indústria, universidade e governo, o que permite a transferência de tecnologias, a elaboração de políticas normativas e de fomento efetivas e instiga a resoluções de necessidades de mercado e sustentabilidade ambiental.

Palavras-chaves: Tríplice Hélice. Comportamento Planejado. Planejamento estratégico. Sinergias. Piscicultura brasileira.

Análisis de las relaciones sociales y de toma de decisiones en la piscicultura brasileña: estudio realizado en el Congreso Internacional de Pesca en 2021

Resumen

El objetivo de este estudio fue comprender las relaciones sociales presentes en la piscicultura brasileña. Para ello se utilizó como marco teórico las siguientes teorías: Triple Hélice (TH) y Comportamiento Planificado (TCP). El estudio fue descriptivo con corte transversal en tres momentos del evento Congreso Internacional de Pesca, en 2021, realizado en la ciudad de Foz do Iguaçu/PR. El estudio no consideró la evolución de los datos a lo largo del tiempo. La población encuestada estuvo conformada por 328 participantes. El instrumento de recolección de datos fue un cuestionario con 18 preguntas, con la escala de acuerdo de Likert, distribuidas en las variables: intención, actitud, normas subjetivas, control conductual percibido e identidad propia. Los datos fueron tratados mediante tres análisis: 1) Análisis de Relaciones Sociales; 2) prueba de trama de pantalla; y 3) Teoría basada en decisiones. La recolección de datos se realizó a través de entrevistas estructuradas con representantes de las dimensiones Universidad, Gobierno e Industria. El aporte empresarial del estudio fue la identificación de métodos fundamentales para la construcción de información ágil, plural y consensuada. La contribución social consistió en la sinergia y democratización de soluciones para problemas relacionados con el sector. El aporte teórico es el cruce de TH con la TCP. Los principales resultados revelaron la existencia de la relación entre industria, universidad y gobierno, que permite la transferencia de tecnologías, la elaboración de políticas normativas y de promoción efectivas e instiga a la resolución de necesidades de mercado y sostenibilidad ambiental.

Palabras clave: Triple Hélice. Comportamiento planeado. Planificación estratégica. Sinergias. Piscicultura brasileña.

1 Introduction

Systemic plans must be explored in behavioral articulations, towards institutional organizations, and considering factor that is inseparable for the sustainable concern in organizations.

In the global economy, the growth of fish farming is highlighted as a social factor, as it is the fastest growing protein food production sector in the world. The sector showed an average annual growth of 4.9% between 2018 and 2019 (FAO, 2020).

In 2019, the continent Asiatic was responsible for more de 4 million tons of Tilapia production, through countries like China, Indonesia and Egypt, with 1.93 million tons, 1.35 million tons and 900 thousand tons, respectively. Already in 2020, Asian countries once again stood out in tilapia production, for more than 4.5 million tons of global type Tilapia production (PEIXE-BR, 2020).

In the Peixe-BR Yearbook (2019), it is noted that Brazilian fish farming production in 2014 was over 578 thousand tons, represented, mainly, by the production of the Tilapia fish species.

For 2019, production exceeded 722 thousand tons (PEIXE-BR, 2020). Furthermore, the Peixe-BR (2020) explained that Brazil preferred and to concentrated on producing type Tilapia fish. This choice is due to the fact that the species is highly adaptable to the local Brazilian climate.

There are other fish species produced in Brazil and around the world (round fish and leather fish), but Tilapia is the main production in Brazil.

However, Brazil is in fourth place in this Tilapia production global ranking, with more than 432 thousand tons in 2019 (PEIXE-BR, 2020).

The research problem is that Brazil has several potentials for sustainable development in the sector (OSTRENSKY, 2007; FAO, 2018). However, in Brazilian regional scenarios, Peixe-BR (2019) reported that, among the productions of Brazilian states in 2018, only state of Paraná, had 129.9 thousand tons, and state of São Paulo, which had 73.2 thousand tons, are exponents in fish production in Brazil.

Among the numbers presented, many Brazilian productions are concentrated in small rural properties (BARROSO et al., 2018) as is the case of states of Paraná and Paraíba (PEIXE-BR, 2020, p. 90).

It is emphasized that intellectual resources are endogenous aspects of the Triple Helix (TH) and are vital for sustainable innovation (ETZKOWITZ and KLOFSTEN, 2005).

Triple Helix consists of an innovative productive paradigm, which no longer relies solely on industry, and begins to dynamically interrelate between industry, universities and the government (RIEDO et al., 2023). For Champenois and Etzkowitz (2018), innovation will be sustainable when there are concerns about economic, social and environmental performance.

The sustainable approach advocated here means that, in addition to ensuring economic development, it is also essential to be concerned with social aspects and environmental preservation for present and future generations (BOFF, 2015; FAO, 2018b).

It is worth noting that, despite not being the central theme of this study, the 17 Sustainable Development Objectives (SDOs) will always be implicit in the actions of organizations that seek environmental and human sustainability in a democratic way.

These interinstitutions (North, 1991) are articulated, considering their norms and rules, which contribute, directly and indirectly, to the development of rural activities, specific to their organizational characteristics (RIEDO et al., 2023). In summary, interinstitutional relationships allow synergistic relationships, especially for the elaboration of joint organizational strategies (RIEDO and FEIDEN, 2021).

In this sense, the aim of this work is to understand the social relations of Brazilian fish farming. It is also justified that, for the development of fish farming (in addition to other aspects not addressed here), strategies (BRESSER-PEREIRA, 2009), institutional relations (ETZKOWITZ, 2008), planned behaviors (AJZEN, 1991) are necessary from the parties that integrate/compose the sector.

The structure of this study is divided into five parts: the first, in this introduction, presents the research problem, the objectives and the relevance of the research for science; the second, presents a panoramic context on aspects of development within Brazilian fish farming; then, in the third, the scientific methodology is presented, which proposes an exploratory analysis, based on facts and evidence; the fourth, the results and discussions, which portray through critical and propositional analysis of the information collected; and, finally, the final considerations, with conclusive notes and limitations of the study carried out.

2 Development and Brazilian Fish Farming

The idea of development dates back to the origin of human beings, when analyzed from a social perspective. For Bottomore (1975, p. 138) “the word development needs to evolve in its application to social phenomena”. In common usage, development means a gradual unfolding; a further elaboration of the details of anything; the growth of what is in the germ (BOTTOMORE, 1975).

In line with growth, as a goal for development, Rostow (1961), in book *The Stages of Economic Growth: A Non-Communist*, published in 1960, established that society should go through five stages to reach development, namely: traditional society, transitional stage, the take-off, the drive to maturity, and the high mass consumption.

It was understood that, by following these steps, development would happen naturally. Given this, it is clear that the term development was often confused with growth (ROSTOW, 1961).

However, within the scope of the social context, Amartya Sen, in his Nobel Prize-winning work “Development as Freedom”, analyzed the social factor as a vector of development, in which he pointed out that “development requires” the removal of the main sources of deprivation of freedom: poverty and tyranny, lack of economic opportunity and systematic social destitution, neglect of public services and intolerance or excessive interference from repressive States (SEN, 2017, p. 18).

In the context of contributions from economic sociology, we revisit the work of Karl Polanyi (1977, apud SCHNEIDER; SCHER, 2011), who highlighted that “liberal capitalism was in effect man's initial response to the challenge of the Industrial Revolution”, and from it came the great difficulties and new confrontations between the political and economic spheres.

For this reason, Schneider and Scher (2011) assert that the contemporaneity of Polanyi's views is timely and pertinent to the discussion about development. As such, it highlights the central importance of social regulation over the economy and the role of institutions as mediating bodies between socioeconomic structures and individuals as social actors.

In the 1970s, the term development moved away somewhat from the vision of growth, technology and production, and began to be analyzed in a way that included concern with non-renewable resources, taking as a point the work, the “myth” of Furtado (1981), which stated that if the original idea of development was conceived, the “non-renewable resources of the earth would be exhausted, culminating in a social and environmental collapse” (FURTADO, 1981, p. 17).

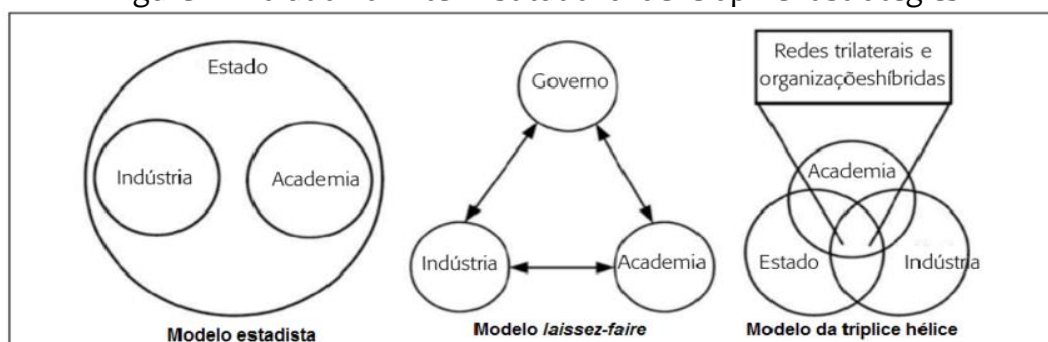
It can be seen that the definitions or perceptions about development were influenced by the institutional context of their respective eras, in constant interrelation with the public policies of each era. Table 1 and Figure 1 illustrate this argument.

Table 1: Institutional development in the Brazilian historical context

1950 to 1960	1960 to 1970	1980 to 1990
The national alliance Combining Market-Based Pure Economic Theories with Political Economy Theories Assignment to the State and institutions as auxiliary coordinator of the economy.	Industrial underdevelopment model Protection of national industry, focus on the market and reduction of the economy's openness coefficient Economies of scale.	Dependence on rich nations The great foreign debt crisis The Washington Agreement: The Decline of the Brazilian Economy.

Source: Riedo (2023).

Figure 1: Evolution of inter-institutional development strategies



Source: Etzkowitz and Leydesdorff (1995).

It is worth highlighting what North (1991) already said, and which is still valid, that institutions represent the maintenance of order and the reduction of uncertainties in societies, as they define the set of alternatives and opportunities to which economic agents are subject, favoring, or not, the increase in transaction costs, transformation and profitability existing in the economic system. They are the ones who develop the rules of the game and guide the directions to be taken so that the problems related to interactions between agents are resolved, and exchange agreements are established and fulfilled.

Sustainable development obeys the double ethical imperative of solidarity, with present and future generations, and requires the explanation of criteria of social and environmental performance and economic viability (NAVARRO, 2001).

The standard model of sustainable development, described in the tripod called Triple Bottom Line (three pillars of sustainability), must guarantee positive economic, social and environmental performance. Furthermore, “to be sustainable, development must be economically viable, socially fair and environmentally correct” (BOFF, 2015, p. 43).

Thus, it is in this context that Brazilian Postgraduate Programs (Professional/Professional Master's, Master's and Doctorate) have been focusing their efforts on strategic research and the formation of synergistic intellectual capital. The results of Riedo and Feiden (2021) showed that from 2010 onwards there was a significant growth in scientific works on TH theory, to provide alternatives for institutional interactions for the development of national society.

Among the research on TH, two doctoral theses stand out: that of Silva (2015), who researched the use of TH in the processes adopted by the Brazilian Ministry of Defense, and that of Brustolin (2014), who compared the same processes between Brazil and the United States. Dalmarco's master's research (2012), in turn, analyzed horticulture in the Netherlands and Brazil. The authors' conclusions were about the incidence of financial and intellectual resources for the promotion of Science and Technology in the United States and the Netherlands. However, in the authors' view, Brazil does little to create environments for strategies and social and technological innovation for interinstitutional development.

In this context, Riedo and Feiden (2021) also stated that researchers are interested in analyzing knowledge factors, in light of TH, that influence institutional development, sparked by society's interest.

In Brazil, the TH, as a proposal for the development of innovation for society, is still in the development phase (ETZKOWITZ and ZHOU, 2017). Innovation appears as the driving force of HT, which can be understood as a strategy for sustainable development, anchored in the proposed strengths of each segment/organization (GARCÍA and VELÁSQUEZ, 2013; RIEDO et al., 2023).

It is emphasized that TH, in developed countries, acts as an engine of economic development for innovation; and in peripheral countries, such as Brazil, TH can be the device for building relationships for organizational development (RIEDO et al., 2023).

The Triple Helix's focus on institutional links plays a key role in accessing knowledge and technology, improving innovation and organizational learning (ETZKOWITZ and LEYDESDORFF, 1995; CHAMPENOIS and ETZKOWITZ, 2018). Furthermore, in the analysis of the work of Dutrénit and Sutz (2014), whose focus was on Science, Technology and Innovation Systems and Policies in Latin American countries, the authors discussed the benefits of a consolidated structure of actors and links for innovation, in terms of synergistic and structured strategies.

Government behavior has the role of promoting, assisting and regulating activity (SILVA et al., 2020). It is a central body that formulates policies and normative rules to establish public strategic planning (ETZKOWITZ, 2012). In addition, the government's role is crucial in offering technical and financial assistance incentives (ETZKOWITZ and KLOFSTEN, 2005).

The industry's contribution to institutional relations, with its formal and informal behavioral environments (RIEDO, 2023), is the responsibility for applying and transforming ideas, technologies and scientific knowledge into products and/or services for the market (ETZKOWITZ and ZHOU, 2017).

The behavior of universities is based on the search for innovative solutions for the market, in training producers/transformers and in the formation of intellectual capital, promoting technology transfers (BRASIL, 2016a; ETZKOWITZ, 2012; ETZKOWITZ and ZHOU, 2017).

Therefore, this study demonstrates the importance of this integration with the PCT variables (AZJEN, 1991; EAST, 1993) and the TH dimensions (ETZKOWITZ, 2008), in an attempt to provide national strategies (BRESSER-PEREIRA, 2009) for interinstitutional behaviors in Brazilian fish farming (LOPERA-BARRERO et al., 2011; RIEDO, 2023; FEIDEN et al., 2018). It is noteworthy that the PCT is investigated by several researchers around the world (SILVA et al., 2020).

Looking at the year 2012, there were more than 1,200 research bibliographies on TCP in academic databases (AL-LOZI and PAPAZAFEIROPOULOU, 2012). The studies demonstrate the theory 's ability to predict intention and behavior, and to carry out interventions in order to demonstrate the changes caused by control beliefs, norms and attitudes, in relation to intention, of how behavior will be.

In view of this, understanding the behavioral relationships of Brazilian fish farming means expanding knowledge and understanding of how decisions within the industry, university and government are articulated.

3 Methodology

The study was descriptive, a method that, according to Richardson (2012), aims to establish relationships between variables, to seek their influence on the phenomenon, with the aim of articulating more effective actions. The research was cross-sectional, in three moments: before (at registrations), between July 1st and November 23rd, 2021; during the III *International Fish Congress* event, held between November 24th and 26th, 2021, in the city of Foz do Iguaçu/PR; and post-event, held between November 27th and December 14th, 2021.

The selection criteria were by invitation. A total of 328 participants agreed to participate in the survey, of which 135 were representatives of the Industry segment, 82 were representatives of the Government segment and 111 were representatives of the University. This result represents 21% of the total of 1,561 participants present at the event. The event participants covered the regions of western Paraná, northern Paraná, regions of the interior of the State of São Paulo, and the Central-West and Northeast regions of Brazil.

After applying the 328 questionnaires, the study was divided into three parts:

The first proposed a descriptive analysis of social relations. The analysis was carried out based on the outcome variables, with the insertion of the questionnaire results into the software Johnson's Ucinet/NetDraw® (1987). The objective of this analysis was to graphically present the existing relationships of the results in the TH dimensions.

This analysis was based on two studies: The first by Alejandro and Norman (2005), which offer an instruction manual for using the software; and the second by Silva, Fialho and Saragoça (2013), which present the use of social relationships for decision-making.

Ucinet /NetDraw requires values to be binary (0 and 1). Therefore, Silva, Fialho and Saragoça (2013) were used in their interpretations of data values, such as: 1- when the values were below the median value, they were considered as 0 (no relationship); 2- when the values were above the median value, they were considered as 1 (existence of relationship). It is emphasized that the median value in this study was 4.

The second, the screen test plot was used to graphically visualize the number of factors that can be extracted before the amount of unique variance begins to dominate the common variance structure (HAIR JR et al., 2009).

And the third, decision concepts were applied to the data:

a) Evidence-based decision-making (ABNT, 2015): Information and data are used as a basis for choices. Thus, it is possible to make a logical and orderly analysis to define the best path;

b) Decision-making based on planned behaviors (AZJEN, 1991; EAST, 1993): This method is based on personal principles and beliefs. In this case, principles must be selected and communicated and applied to the current situation.

In time, it is worth highlighting that the study was approved by the Research Ethics Committee (PEC) of the State University of Western Paraná (UNIOESTE), by Brazil Platform (CAAE registration 48105621.1.0000.0107 and opinion number 4,802,951, on June 24, 2021). Furthermore, this study guaranteed the anonymity of the respondents, a right agreed upon in the study consent form.

4 Results and discussions

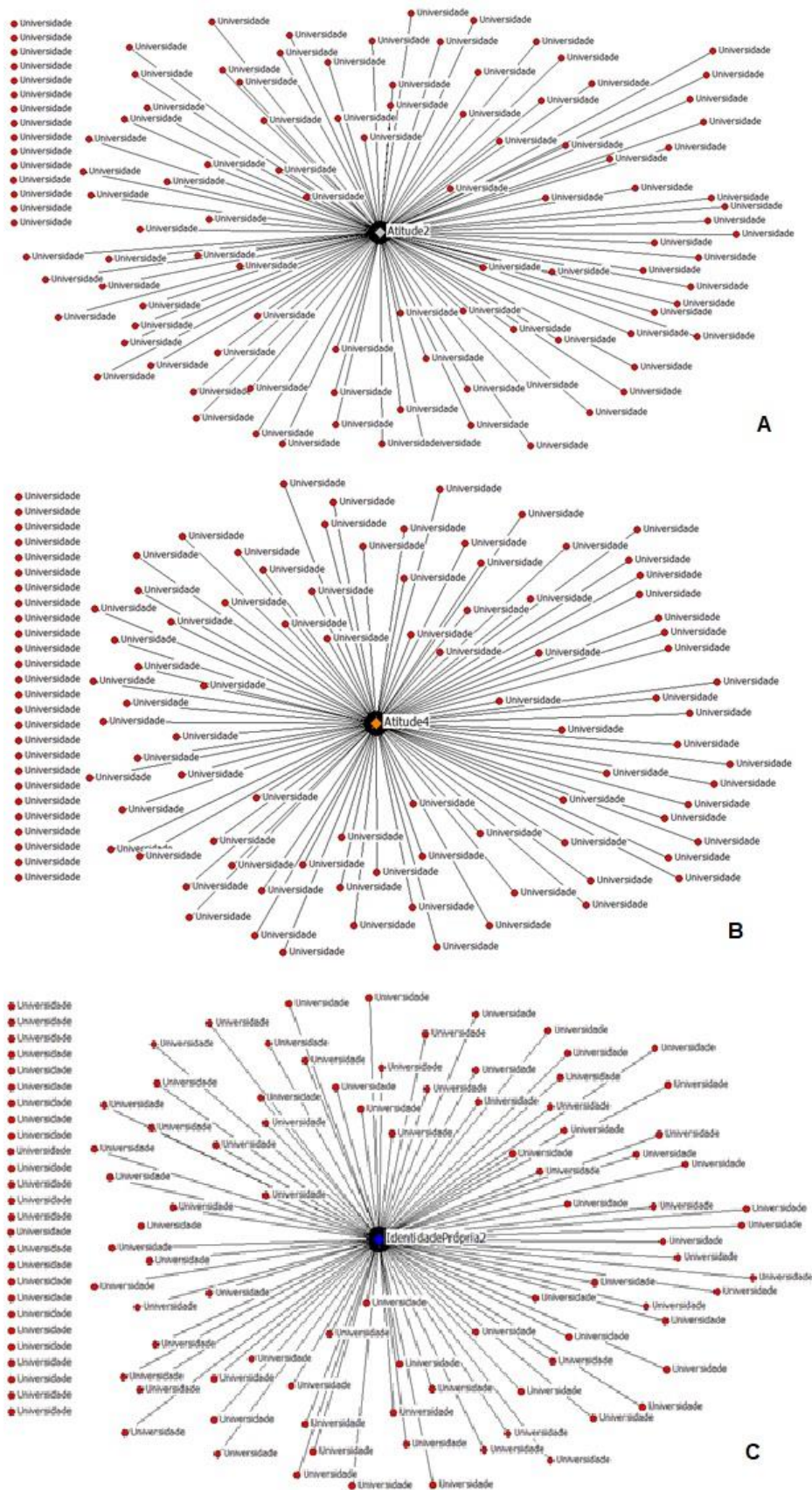
Inference under Social Relations Analysis (SRA) can result in several interpretations, such as the analysis of ties, analysis of the environment, among others (RIEDO et al., 2023). The concept of density is translated by the quotient of interactions/links effectively existing between the actors, by the total of potential or possible links (ALEJANDRO and NORMAN, 2005; SILVA; FIALHO and SARAGOÇA, 2013).

In Figure 2, it can be seen that 75.5% of the university dimension wants to be involved in relationships for joint decision-making (Figure 2c). This understanding can be seen by the difficulties in understanding the role and limited access to market demands. However, it can be seen that the respondents, in Figures 2a and 2b, considered these relationships important (86.5%) and necessary (76.5%) for the development of common strategies in Brazilian fish farming.

Figure 3 shows that 89% of the government considers mutual relations important (Figure 3a), but 67% consider interactions unnecessary (Figure 3b). This issue raises reflections on the effectiveness of regulations and policies for the sector. Furthermore, 69.5% considered involvement in joint relations (Figure 3c). However, it is understood that the government should be a partner in joint strategies, fostering research, encouraging new markets and innovations and, where possible, reducing taxes for organizations, while safeguarding progress and sustainable national development.

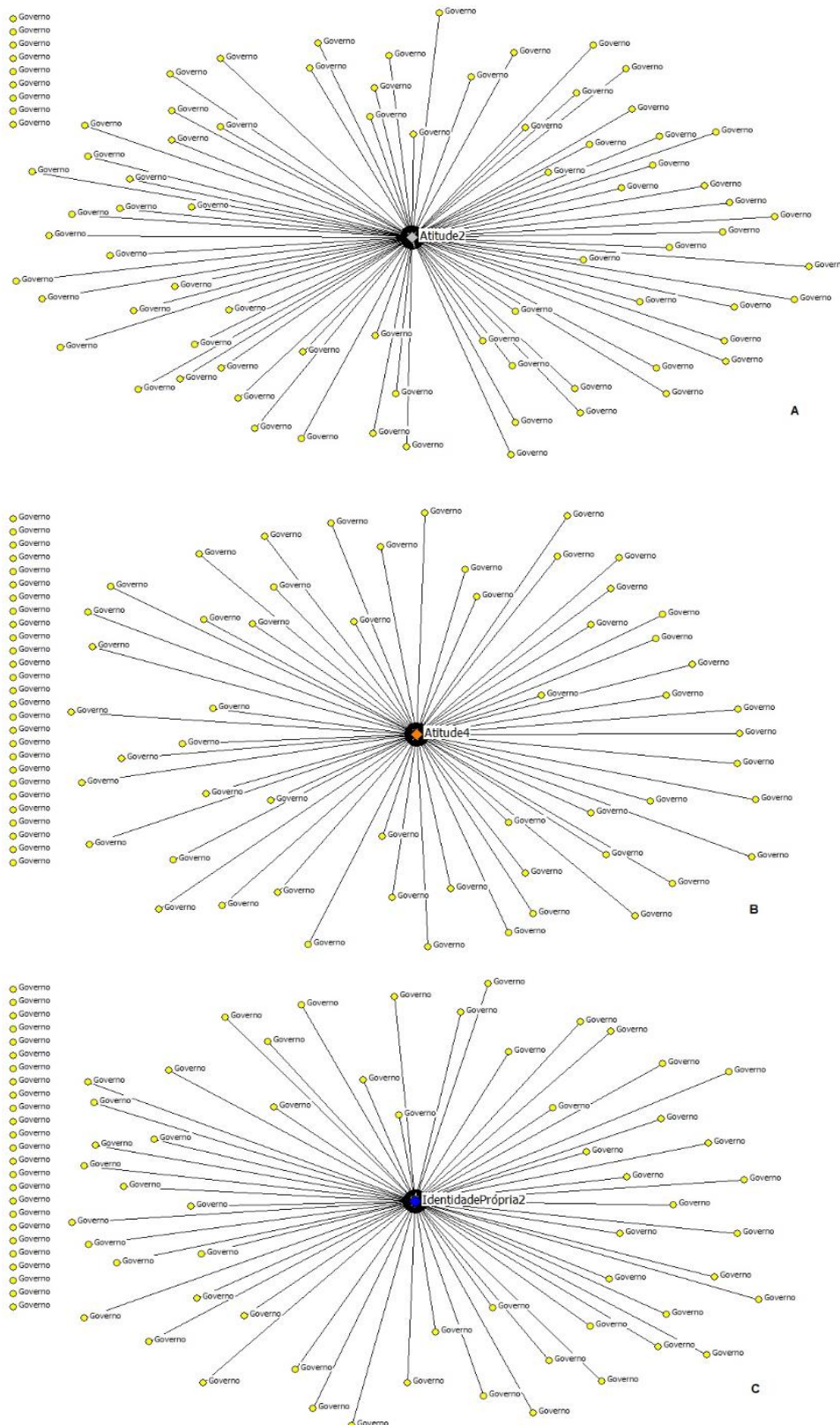
In Figure 4, it can be seen that 90% of the Industry dimension considered joint relationships important (Figure 4a) and 75% considered them necessary (Figure 4b). The results also showed that 78% of Brazilian fish farming industries (Figure 4c) want to be involved in the development of joint strategies, especially those that lack incentives for the production and adoption of new products for new and existing markets.

Figure 2: Relationships between the University dimension (red circles) and the resulting PCT variables (blue circle)



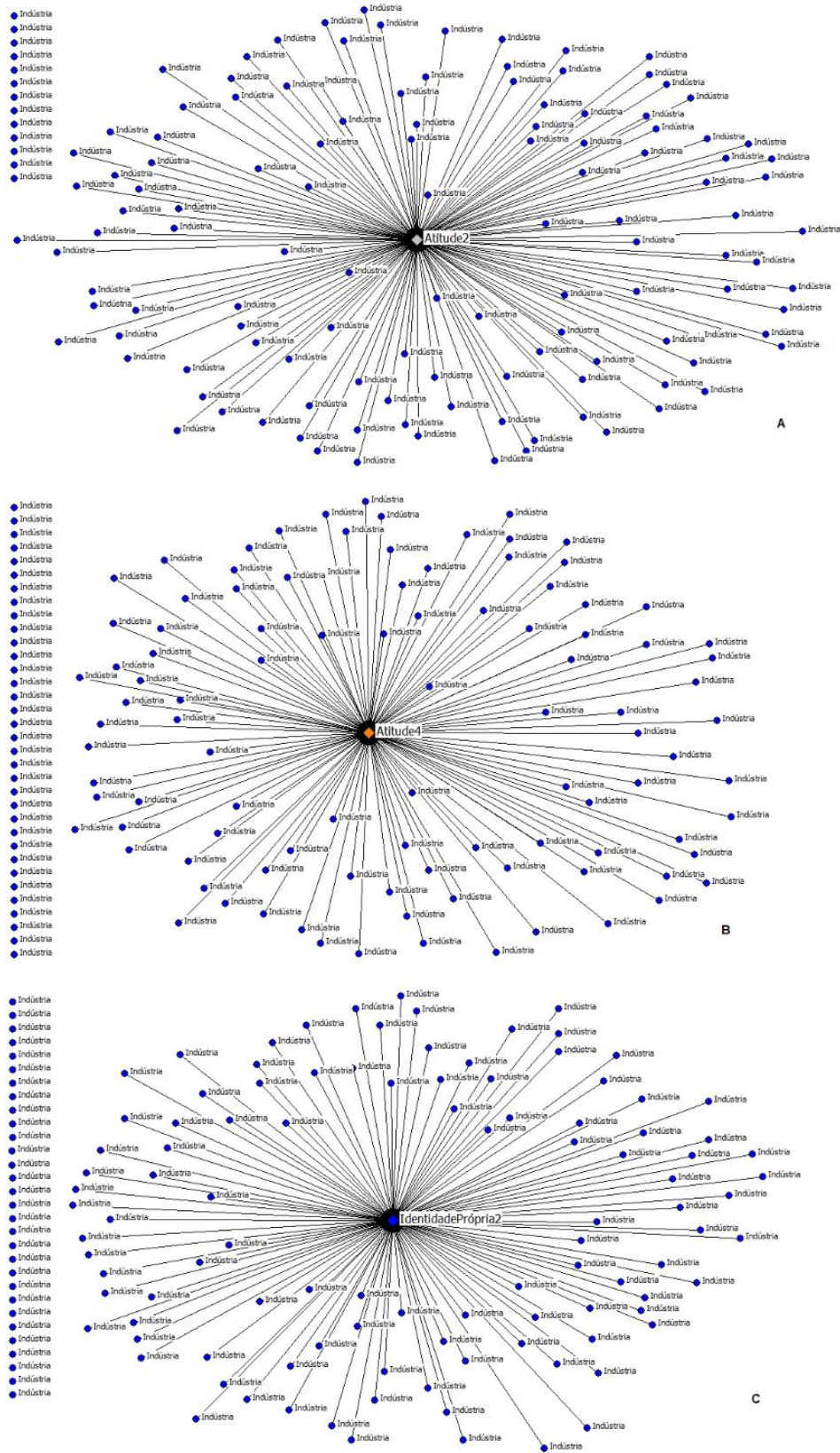
Source: Prepared by the authors.

Figure 3: Relations between the Government dimension (yellow circles) and the resulting PCT variables (blue circle)



Source: Prepared by the authors.

Figure 4: Relationships between the Industry dimension (blue circles) and the resulting PCT variables (blue circle)

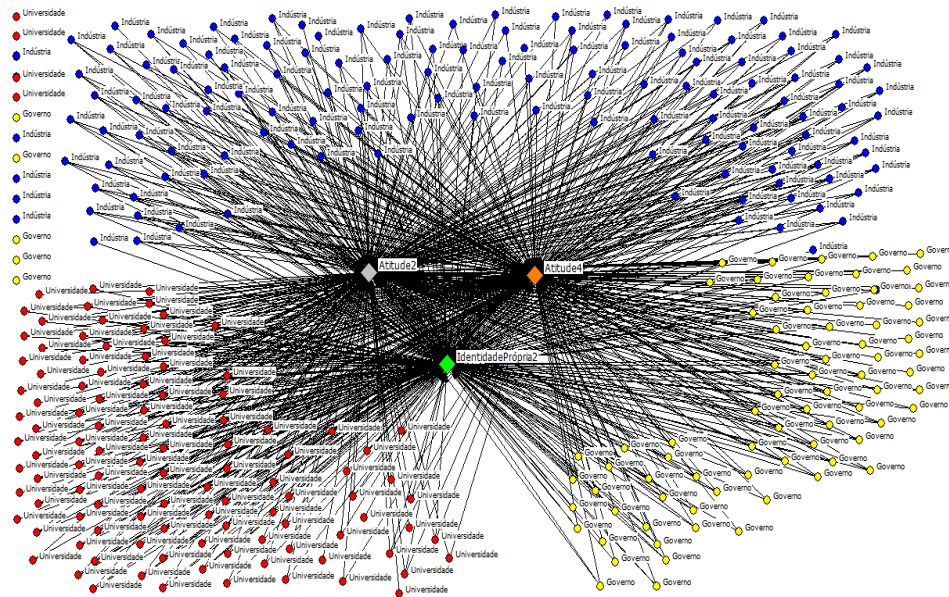


Source: Prepared by the authors.

Figures 5 and 6 present the intertwining of the analyses, that is, the total relationships of the resulting PCT variables in the TH dimensions. It can be seen that the University dimension represented the greatest relational disconnection (63.9%) when compared between its TCP variables. The values for the Government dimension were 65.8% and the Industry dimension was 69%. It can be assumed that the possibility of interinstitutional interaction was favored, since the result was an absolute majority positive for solving problems together.

Furthermore, the research results allow us to understand that individuals are not isolated, but interrelated within a society. Businesspeople, industrialists, researchers, government officials and citizens need to understand that strategies and synergies impact the organizational strengthening of productive sectors.

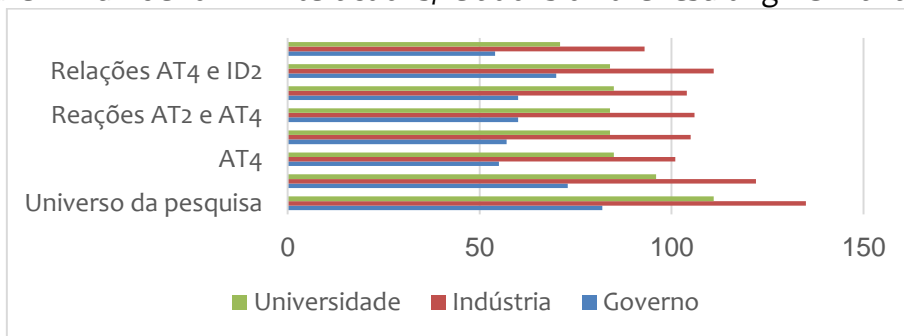
Figure 5: Relationships of the TH dimensions in the resulting PCT variables



Source: Prepared by the authors.

Caption: Blue circles represent respondents who identified themselves as Industry; Red circles as University; Yellow circles as Government.

Figure 6: Number of TH interactions/relations on the resulting PCT variables.



Source: Prepared by the authors.

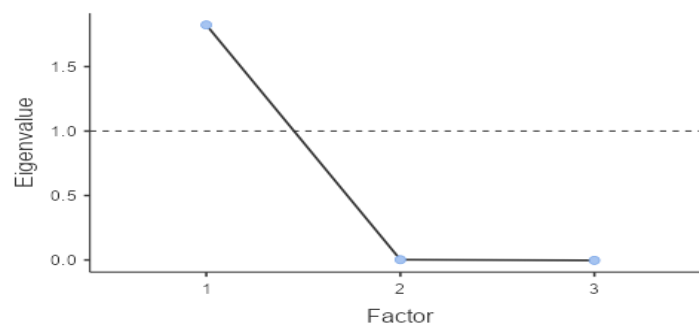
Legend: AT2 – Attitude2 variable; AT4 – Attitude4 variable; ID2 – Self-Identity2 variable; Research universe – Total number of participants in each dimension.

Caption: Green represent as University; Red as Industry; Blue as Government.

Given the facts presented, the variables analyzed allow for the use of factors consistent with the fish farming environment, which favors the construction of strategic planning for the sector.

The scree plot presents a slope graph that demonstrates a visual analysis of the variance of the principal components (Figure 7).

Figure 7: Scree plot of the resulting variables

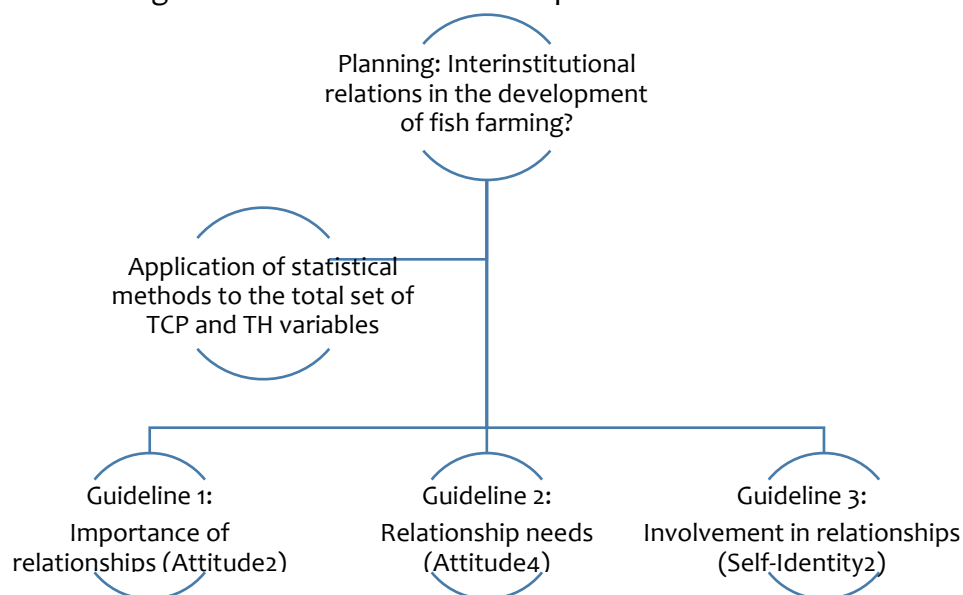


Source: Prepared by the authors.

This is a useful way to visualize the number of resulting variables to be maintained in the construct. This construct can provide decision makers with quick responses for corrective and assertive actions and also the possibility of building a structured plan for the Brazilian fish farming scenario.

In the study by Ayroza et al. (2021), fish farming organizations must make decisions according to structural importance, considering the involvement of stakeholders and the need for institutional interventions. It is worth noting that in the research universe, the resulting variables trigger structural intervention, through the elaboration of guidelines for the development of Brazilian fish farming (Figure 8).

Figure 8: Flowchart of research processes and results

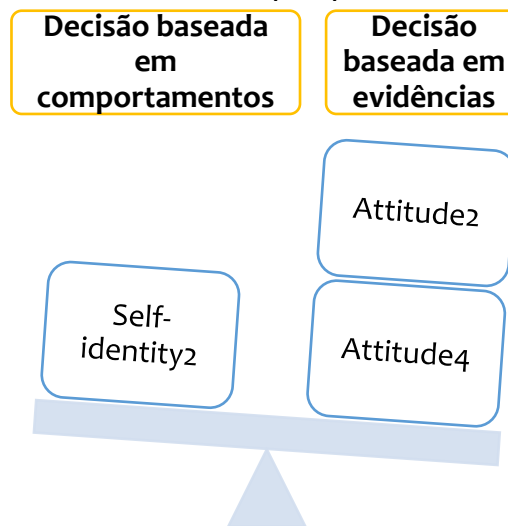


Source: Prepared by the authors.

At this point, it was necessary to go back and observe the proposed model, as the reduction of variables in statistical analyses gave organizations the possibility of making quick decisions about the global context in which they operate (Figure 9).

The final result of the model enabled the crossing of theories, contributed to the identification of the importance of the construct, emphasized the need for joint strategies and highlighted the interests of involvement in synergistic solutions to difficulties in Brazilian fish farming.

Figure 9: Variables collected from the perspective of decision typologies



Source: Prepared by the authors.

Legend: Decision based on behaviors – informal relationships (beliefs and institutions); Decision based on evidence – Concrete observations of scenarios (facts and legal relationships); Attitude2 – Importance; Attitude4 – Need; Self-identity2 – Involvement.

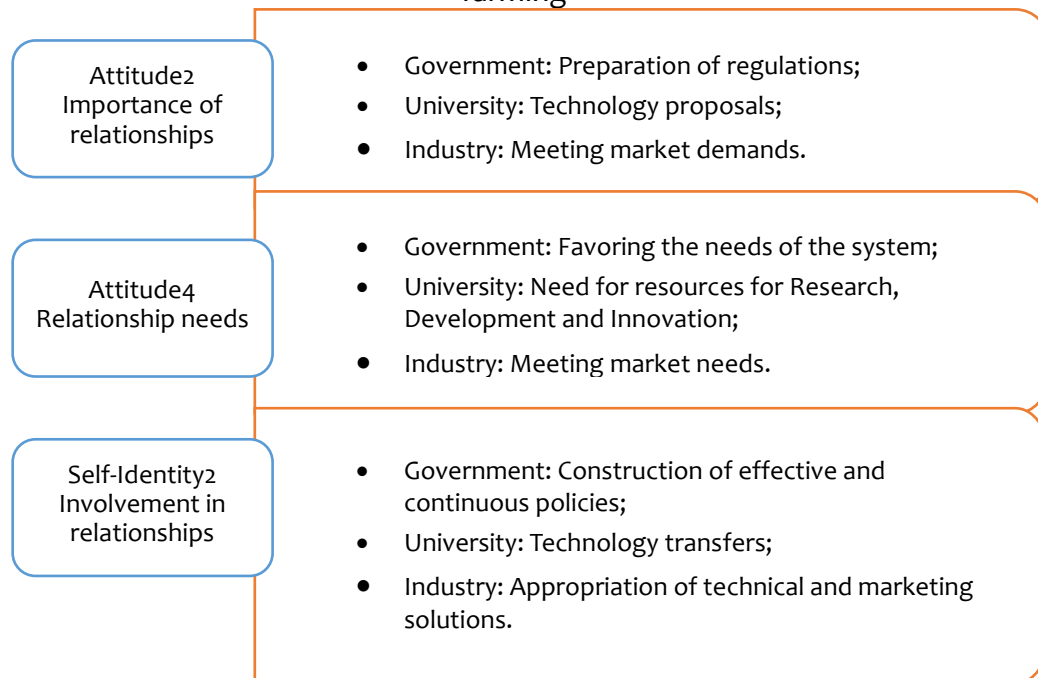
When the proposed model is tested using another research lens, such as the theory of evidence-based and behavioral decisions, it is clear that together, the variables resulting from the model make it clear that the dimensions can build strategic plans of common interest. This statement is corroborated by the studies of Pedroza Filho and Castilho (2021) and Ribeiro and Pedroza Filho (2022), in which the decision of the best path to follow encompasses all of an organization's processes, from the extraction of raw materials to the distribution of the product, differing from the production chain by the concept of value attributed per stage, involving uncertainties and market risks.

Furthermore, the propositional model can be applied in other Brazilian productive sectors, because as Bresser-Pereira (2020) said, development goes beyond short-term assumptions, stating that medium and long-term strategies are essential for national development, since this is how all problems are aligned and organizations in the sector suffer fewer threats.

This is why the analyses were conducted, to understand how much relationships favor the development of Brazilian fish farming. The study allowed us to suggest a strategic plan. It is emphasized that strategic plans are used as a guiding thread for decision-making by inter-institutional agents of Brazilian fish farming. In analogy with human anatomy, the development of the strategic plan is a product of the individual's brain.

Therefore, to construct this model/plan, guidelines were suggested for the Brazilian fish farming environment (Figure 10).

Figure 10: Proposal guidelines for developing synergistic strategic planning for fish farming



Source: Prepared by the authors.

It is important to note that strategic actions are structured by means of norms, and are understood by North (1991) as the rules of the game. This is because the decision to take a specific action requires that the information in the plan be revisited in order to define which changes in the strategy should be adopted.

From this perspective, in order to structure the inter-institutional strategic plan for Brazilian fish farming, it is necessary to return to the norms and policies of Brazilian rural development, as set out in Article 187 of the Brazilian Federal Constitution (BRAZIL, 1988). The text deals with rural production policies, which must be planned and implemented with the effective participation of stakeholders – including producers and rural workers, as well as the marketing, storage and transport sectors. Furthermore, it states that State policies must act:

- a) In the instrumentalization of credits and inspections;
- b) In designing prices compatible with production costs and ensuring commercialization;
- c) In encouraging research and technology;
- d) In promoting technical assistance and rural extension;
- e) In the construction of insurance against losses of rural production;
- f) In cooperativism as a form of market management organization;

In order to comply with the provisions of the Federal Constitution regarding fish farming, a Sustainable Development Plan was created in July 2008, called Fishing and Aquaculture More Program, and later published by Federal Law n. 11.959, in 2009 (BRASIL, 2009), which provides, among other aspects, for the viability of Brazilian fishing and aquaculture production chains.

Among the intrinsic guidelines of the law, the following stand out:

- a) The management concept that articulates all activity, from production, through transformation to marketing;
- b) The synergistic articulation and involvement of actors in the production chain, in the production process and in the implementation of promotion and development policies.

However, Barroso et al. (2018) expressed, among other aspects, difficulties in achieving the effectiveness of the so-called development of Brazilian fish farming:

- a) The lack of organization of the technology transfer system and the lack of applied research in the development of the sector;
- b) The difficulty of industrialization due to the product's life cycle and the lack of quality standards and health controls, allowing the exploration of more significant markets.

In this context, when analyzing the guidelines and difficulties, the directions for Brazilian fish farming are perceived. However, fish farming requires practices related to policies and legislation, improvement of infrastructure and marketing, environmental preservation with social responsibility, rural extension and participation of the scientific community and the promotion of competitive advantages, added value and distribution of the products offered, which truly contribute to strengthening the production chain.

These difficulties are corroborated in the strategies declared by the of Agriculture and Livestock Brazilian Confederation (CNA, 2021) and in those expressed by the researchers, Feiden et al. (2018), Lopera-Barrero et al. (2011), Ostrenky (2007), Schulter and Vieira Filho (2017), Pedroza Filho and Castilho (2021), Ribeiro and Pedroza Filho (2022) and Rodrigues et al. (2021).

- a) Define public policies that allow for improvements in the aquaculture sector, prioritizing social and productive investments and resources, with efficient licensing measures and effective inspection (CNA, 2021; FEIDEN et al., 2018; OSTRENKY, 2007; PEDROZA FILHO et al., 2020; RODRIGUES et al., 2021; SCHULTER & VIEIRA FILHO, 2017);
- b) Create technical cooperation agreements that promote partnerships for the sustainable development of the sector (OSTRENKY, 2007; PEDROZA FILHO et al., 2020; SCHULTER & VIEIRA FILHO, 2017);
- c) Create conditions for the development of profitable and innovative production, based on the pillars of social, economic and environmental sustainability (CNA, 2021; PEDROZA FILHO et al., 2020; RODRIGUES et al., 2021);
- d) Create and strengthen associations between fishermen, aquaculturists, rural producers, researchers, members of public and private bodies with an interest in the sector and that allow a constant communication channel (LOPERA-BARRERO et al., 2011; SCHULTER & VIEIRA FILHO, 2017);
- e) Strengthen and promote sectoral democratic chambers at local, regional and national levels, to structure strategic plans for the sector (CNA, 2021; LOPERA-BARRERO et al., 2011);
- f) Define promotion strategies that enable research, scientific articles and bulletins, manuals, technologies, field work and technical assistance by organizations in the sector (FEIDEN et al., 2017; PEDROZA FILHO et al., 2020);

g) Create competitive advantages for the sector, which offer new conditions for sustainable growth and maximum guarantees of quality assessment, such as certification and traceability of the product to the consumer (PEDROZA FILHO and CASTILHO, 2021; RIBEIRO and PEDROZA FILHO, 2022).

Given the facts described, the study promoted the structural suggestion for thinking about Brazilian fish farming, presented in Table 2.

Other devices also stand out, which can be subsidies for the inter-institutional development of Brazilian fish farming, such as:

a) For the Government and Industry relationship: Formation in cooperatives (BRASIL, 1971), access to and protection of industrial property (BRASIL, 1996), tax incentives for organizations, the release and licensing of aquaculture practices in union waters (BRASIL, 2020) and the legalization and encouragement for the use of productive lands (BRASIL, 2007);

b) For the relationship between the University and the Government: The promotion and conditions for training in cooperativism (BRASIL, 1971), the stimulus to intellectual production and industrial property (BRASIL, 1996), the promotion of scientific development, research, scientific and technological training for innovation (BRASIL, 2016a) and the stimulus for the insertion of academics and junior companies in the market (BRASIL, 2016b);

c) For the University and Industry relationship: Professional training in cooperativism for society (BRASIL, 1971), innovative intellectual production of goods and services (BRASIL, 1996), the development of management technologies and industrial capabilities (BRASIL, 2016a) and the insertion of academics and junior companies in the market environment (BRASIL, 2016b);

d) For the relational connection between University, Government and Industry: The encouragement of partnerships and public-private integration contracts in aquaculture (BRASIL, 2016c).

Therefore, it is clear that planned behaviors in interinstitutional relations allow decisions to be avoided unilaterally. This is because the formulation of synergistic strategic plans needs to be the means for reciprocity in the development of Brazilian fish farming.

It is in this context that the contributions of this study emerged. The importance and need for multiple scenarios and views of the facts can promote the involvement of agents in the fish farming production chain in agile, plural and harmonized dialogues and decisions.

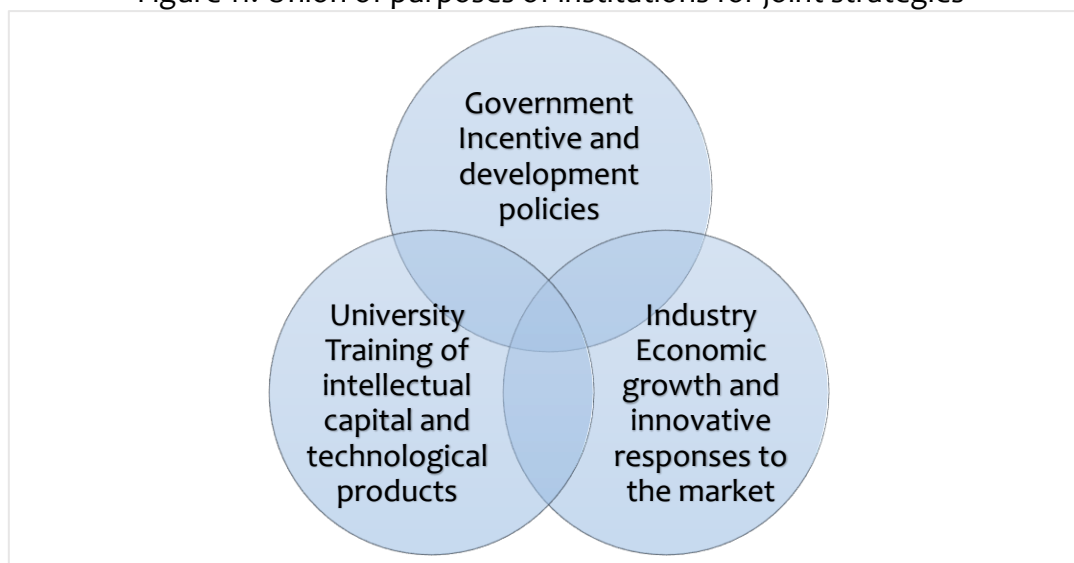
Table 2: Proposal for a plan for Brazilian fish farming

Devices	TCP Variables	TH Dimensions		
		University	Government	Industry
Article 187 of the Federal Constitution of 1988	Importance; Need; Involvement	A - Credits; C - Research and technology; D - Assistance and extension; F – cooperativism	A - Credits; B - Prices, costs and market; C - Research and technology; D - Assistance and extension; E - Safe; F - cooperativism	A - Credits; B - Prices, costs and market; C - Research and technology; D - Assistance and extension; E - Safe; F – cooperativism
Fisheries and Aquaculture Plan (Regulated by Federal Law No. 11,959, of June 29, 2009)	Importance; Necessity	A - Articulated management B – Synergies		
Difficulties of fish farming (Barroso <i>et al.</i> , 2018)	Involvement	A - Technology transfer	B - Quality standards	A - Technology transfer; B - Quality standards
Strategies by Feiden <i>et al.</i> (2018), Lopera-Barrero <i>et al.</i> (2011), Ostrenky (2007), Pedroza Filho <i>et al.</i> (2017), Schulter and Vieira Filho (2017), Pedroza Filho and Castilho (2021), Ribeiro and Pedroza Filho (2022) and Rodrigues <i>et al.</i> (2021)	Importance; Need; Involvement	A - Public policies; B - Technical cooperation; C - Sustainability and innovation; D - Partnerships and communications; E - Democratic management; F - Research and extensions	A - Public policies; B - Technical cooperation; C - Sustainability and innovation; D - Partnerships and communications; E - Democratic management	A - Public policies; B - Technical cooperation; C - Sustainability and innovation; D - Partnerships and communications; F - Research and extensions; G - Competitive differences

Source: Prepared by the authors.

This structural methodological proposition of scenarios in Brazilian fish farming becomes even more important to favor economic development, as it allows the application of strategies in the observed phenomena. It is understood that, even though institutional representations are independent, by organization, they all have or need to have the same objective (Figure 11).

Figure 11: Union of purposes of institutions for joint strategies



Source: Prepared by the authors.

Therefore, to clarify this finding, three indications were needed for each TH dimension.

As for the University helix, it is responsible for developing products/services and intellectual capital for society, promoting technology transfers;

As for the Government propeller, it must understand that its activities need to be active in a dynamic process, with public investments, regulations and proposals for new markets;

As for the Industry propeller, it must be open to proposing real situations, receiving and applying technologies, and acting in the transformation of ideas, technologies and knowledge into products and/or services.

5 Final considerations

What is answer to the initial question of the study? In the case of Brazilian fish farming, synergistic and democratic relationships have not yet provided the expected positive effects, but the focus on the joint construction of techniques and standards among institutional agents can provide changes in the methods of production, transformation and income generation in the sector.

It is also acknowledged that there are no strategies prepared to meet the locals needs of each region of Brazilian fish farming. Therefore, the formation of inter-institutional relations can favor the solution of more promising issues, as an opportunity for differentiation.

What about PCT in TH? The Government must take responsibility, with the massive presence of all those involved in the sector, directly and indirectly, to discuss and debate, from the external environment, with the establishment and implementation of effective policies, the efficient protection of natural resources, the formation of competent intellectual capital, the financial stimulus to science and technology, the support for innovative ideas and practices, to the internal environment, such as the reduction of production costs, optimization of

organizational routines and procedures, new characteristics to market products and services.

What about the research problem and the main conclusions? The industry, which represents the market, therefore, needs to be open to the application of technologies (1). The expansion of its social relations must go beyond traditional planning, transformation, organization and commercialization, reaching the assumptions of productive and marketing innovation, to acquire greater added value and systematize effective specialties and techniques of concerns with sustainable development.

The university has had little involvement in inter-institutional relations, so it is clear that it must find its role within this context. The construction of research and extensions, the transformation of technologies and the formation of intellectual capital are among its activities (2). However, it depends on financial resources from the State to make its actions viable (3).

It is worth noting that this is a two-way street between the university and industry. Both must allow themselves to engage in dialogue and debate regarding suggestions for market demands, application of products and services, promotion and support for scientific research and technical results, provision and receipt of technical assistance, among other products and services.

Therefore, problem-solving should be strongly encouraged. One reason for this is that stakeholders in general should be open to joint decision-making in Brazilian fish farming.

REFERENCES

ASSOCIAÇÃO BRASILEIRA DE NORMAS TÉCNICAS - ABNT. **ABNT NBR ISO 9001:** Sistemas de gestão da qualidade – Requisitos. 3 ed. 32 p.. 2015. Disponível em: <<https://fatecsenai.com.br/arquivos/9001-Sistema-de-Gestao-da-Qualidade-Requisitos.pdf>>. Acesso em: 26 abr. 2022.

ASSOCIAÇÃO BRASILEIRA DE PISCICULTURA – PEIXE-BR. **Anuário PeixeBR da piscicultura 2019.** 2019. Disponível em: <<http://www.peixebr.com.br>>. Acesso em: 03 mar. 2021.

ASSOCIAÇÃO BRASILEIRA DE PISCICULTURA – PEIXE-BR. **Anuário PeixeBR da piscicultura 2020.** 2020. Disponível em: <<http://www.peixebr.com.br>>. Acesso em: 04 mar. 2021.

AJZEN, I. The theory of planned behavior. **Organizational Behavior and Human Decision Processes**, v. 50, n. 2, p. 179-211. 1991. Disponível em: <<http://goo.gl/495fE>>. Acesso em: 18 nov. 2021.

ALEJANDRO, V. A. O.; NORMAN, A. G. **Manual Introdutório à Análise de Relações Sociais.** Trad.: Aires, M. L. L.; Laranjeiro, J. B.; Silva, S. C. A. p. 41. 2005. Disponível em:

<https://www2.unicentro.br/lmqqa/files/2016/05/Manualintrodutorio_ex_ucinet.pdf>. Acesso em: 27 dez. 2021.

AL-LOZI, E.; PAPAZAFEIROPOULOU, A. Intention-based models: the theory of planned behaviour within the contexto of IS. **Integrated Series in Information Systems**, v. 2, p. 219-239. 2012. Disponível em: <http://doi.org/10.1007/978-1-4419-9707-4_12>. Acesso em: 20 abr. 2022.

AYORZA, I. F. L.; RODRIGUES, W.; PEDROZA FILHO, M. X.; CARNEIRO, L. de A. Intervenção comportamental nas políticas públicas brasileiras: o caso da lei 12.618/2012. **Research, Society and Development**, v. 10, n. 1, e0610110979. 2021. Disponível em: <<https://doi.org/10.33448/rsd-v10i1.10979>>. Acesso em: 14 mar. 2022.

BARROSO, R. M.; MUÑOZ, A. E. P.; TAHIM, E. F.; WEBBER, D. C.; ALBUQUERQUE FILHO, A. C.; PEDROZA FILHO, M. F.; TENORIO, R. A.; CARMO, F. J.; BARRETO, L. E. G. S.; MUEHLMANN, L. D.; SILVA, F. M.; HEIN, G. **Diagnóstico da cadeia de valor da tilapicultura no Brasil**. Embrapa – 1 ed. Brasília/DF, v. 1. 2018. Disponível em: . Acesso em: 10 jan. 2021.

BOFF, L. **Ecologia social em face da pobreza e da exclusão, em ética da vida**. Brasília, DF: Letraativa, 2000.

BOFF, L. **Sustentabilidade: O que é - O que não é?** 4 ed. Rio de Janeiro: Vozes, 2015.

BOTTOMORE, T. B. **Introdução à sociologia**. 6 ed. Rio de Janeiro: Zahar Editores, 1975.

BRASIL. **Lei nº 5.764, de 16 de dezembro de 1971**. Brasília, DF: Senado Federal. 1971. Disponível em: <<http://www.planalto.gov.br>>. Acesso em: 06 mar. 2022.

BRASIL. [Constituição (1988)]. Constituição da República Federativa do Brasil. Brasília, DF: Senado Federal. 1988. Disponível em: <<http://www.planalto.gov.br>>. Acesso em: 21 fev. 2021.

BRASIL. **Decreto nº 10.576, de 14 de dezembro de 2020**. Brasília, DF: Senado Federal. 2020. Disponível em: <<http://www.planalto.gov.br>>. Acesso em: 06 mar. 2022.

BRASIL. **Lei nº 9.729, de 14 de maio de 1996**. Brasília, DF: Senado Federal. 1996. Disponível em: <<http://www.planalto.gov.br>>. Acesso em: 06 mar. 2022.

BRASIL. **Lei nº 11.443, de 06 de janeiro de 2007**. Brasília, DF: Senado Federal. 2007. Disponível em: <<http://www.planalto.gov.br>>. Acesso em: 06 mar. 2022.

BRASIL. **Lei Federal nº 11.959, de 29 de junho de 2009**. Brasília, DF: Senado Federal. 2009. Disponível em: <<http://www.planalto.gov.br>>. Acesso em: 21 fev. 2022.

BRASIL. **Lei nº 13.243, de 11 de janeiro de 2016**. Brasília, DF: Senado Federal. 2016a. Disponível em: <<http://www.planalto.gov.br>>. Acesso em: 06 mar. 2022.

BRASIL. **Lei nº 13.267, de 06 de abril de 2016**. Brasília, DF: Senado Federal. 2016b. Disponível em: <<http://www.planalto.gov.br>>. Acesso em: 06 mar. 2022.

BRASIL. **Lei nº 13.288, de 06 de abril de 2016**. Brasília, DF: Senado Federal. 2016c. Disponível em: <<http://www.planalto.gov.br>>. Acesso em: 06 mar. 2022.

BRESSER-PEREIRA, L. C. **Globalização e Competição**. Rio de Janeiro: Elsevier. 2009.

BRUSTOLIN, V. M. **Inovação e desenvolvimento via defesa nacional nos EUA e no Brasil**. Tese (Doutorado) – Universidade Federal do Rio de Janeiro. 2014. Disponível em: <<https://www.ie.ufrj.br/images/IE/PPED/Teses/2014/VITELIO%20MARCOS%20BRUSTOLIN.pdf>>. Acesso em: 03 fev. 2022.

CHAMPENOIS, C.; ETZKOWITZ, H. From Boundary Line to Boundary Space: The Creation of Hybrid Organizations as a Triple Helix Micro-Foundation. **Technovation**, v. 76-77, n. 1, p. 28-39. 2018. Disponível em: <<https://doi.org/10.1016/j.technovation.2017.11.002>>. Acesso em: 30 set. 2020.

CONFEDERAÇÃO DA AGRICULTURA E PECUÁRIA DO BRASIL – CNA. Pesquisa pecuária municipal 2020. **Comunicado CNA**. 2021. Disponível em: <https://www.cnabrasil.org.br/assets/arquivos/boletins/Comunicado-Tecnico-CNA-ed-30_2021.pdf>. Acesso em: 25 mar. 2022.

DALMARCO, G. **Fluxo de Conhecimento na Interação Universidade-Empresa: uma nova visão em setores tradicionais e de alta tecnologia no Brasil e na Holanda**. Tese (doutorado) – Universidade Federal do Rio Grande do Sul. 2012. Disponível em: <<https://lume.ufrgs.br/handle/10183/38849>>. Acesso em: 03 fev. 2022.

DUTRÉNIT, G.; SUTZ, J. **Sistemas de Innovación para um Desarrollo Inclusivo: La experiencia latino-americana**. Editora LALICS. 2014.

EAST, R. Investment decisions and the theory of planned behaviour. **Journal of Economic Psychology**. v. 14. p. 337-375. 1993. Disponível em: <[https://doi.org/10.1016/0167-4870\(93\)90006-7](https://doi.org/10.1016/0167-4870(93)90006-7)>. Acesso em: 03 mar. 2021.

ETZKOWITZ, H. **The Triple Helix: University-Industry-Government innovation in action**. Ed. Routledge: New York and London. 2008.

ETZKOWITZ, H. Triple Helix clusters: boundary permeability at university-industry-government interfaces as a regional innovation strategy. **Environment and Planning C: Government and Policy**, v. 30, n. 5, p. 766–779. 2012. Disponível em: <http://www.triplehelix.net/images/Triple_helix_clusters_-1.pdf>. Acesso em: 30 set. 2019.

ETZKOWITZ, H.; LEYDESDORFF, L. The Triple Helix: university-industry-government relations: a laboratory forknowledge-based economic development. **EASST Review**, v. 14, p. 14–19. 1995. Disponível em: <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2480085>. Acesso em: 30 set. 2019.

ETZKOWITZ, H., ZHOU, C. Hélice Tríplice: inovação e empreendedorismo universidade-indústria-governo. **Estudos Avançados**. v. 31 n. 90, p. 23–48. 2017. Disponível em: <<https://doi.org/10.1590/s0103-40142017.3190003>>. Acesso em: 30 set. 2019.

ORGANIZACIÓN DE LAS NACIONES UNIDAS PARA LA ALIMENTACIÓN Y LA AGRICULTURA – FAO. **Takeling Poverty and hunger through Digital Innovation**. 2018. Disponível em: <<http://www.fao.org/3/ca1040en/CA1040EN.pdf>>. Acesso em: 25 maio 2020.

ORGANIZACIÓN DE LAS NACIONES UNIDAS PARA LA ALIMENTACIÓN Y LA AGRICULTURA – FAO. QeA: COVID-19 pandemic - impact on fisheries and aquaculture. 2020. Disponível em: <<http://www.fao.org/2019-ncov/q-and-a/impact-on-fisheries-and-aquaculture/en/>>. Acesso em: 21 jun. 2020.

FEIDEN, A.; RAMOS, M. R.; CHIDICHIMA, A. C.; SCHIMIDT, C. M.; FIORESE, M. L.; COLDEBELLA, A. A cadeia produtiva da tilápia no oeste do Paraná: uma análise sobre a formação de um arranjo produtivo local. **Redes**, v. 23, n. 2, p. 238-263. 2018. Disponível em: <<https://doi.org/10.17058/redes.v23i2.8992>>. Acesso em: 15 mar. 2021.

FURTADO, C. **O mito do desenvolvimento econômico**. 5 ed. Rio de Janeiro: Paz e terra. 1981.

HAIR JUNIOR, J. F.; BABIN, B. J.; ANDERSON, R. E.; TATHAM, R. L.; BLACK, W. C. **Análise multivariada de dados**. 6 ed. Porto Alegre: Bookman. 2009.

JOHNSON, J. D. UCINET: A software tool for network analysis. **Communication Education**. v. 36, n. 1, p. 92-94. 1987. Disponível em: <<https://doi.org/10.1080/03634528709378647>>. Acesso em: 22 out. 2021.

LEYDESDORFF, L. The mutual information of university-industry-government relations: an indicator of the Triple Helix dynamics. **Scientometrics**, v. 58, p. 445–467. 2003. Disponível em: <<https://doi.org/10.1023/A:1026253130577>>. Acesso em: 30 set. 2019.

LOPERA-BARRERO, N. M.; RIBEIRO, R. P.; POVH, J. A.; VARGAS MENDEZ, L. D.; POVEDA-PARRA, A. R. Dificuldades e prioridades da aquicultura no Brasil. In: Lopera-Barrero, N. M.; Ribeiro, R. P.; Povh, J. A.; Vargas Mendez, L. D.; Poveda-Parra, A. R. **Produção de organismos aquáticos: uma visão geral no Brasil e no mundo**. Guaíba: Agrolivros. p. 143-206. 2011.

NAVARRO, Z. Desenvolvimento rural no Brasil: os limites do passado e os caminhos do futuro. **Estudos Avançados**, v. 15, n. 43, p. 83-100. 2001. Disponível em: <<https://doi.org/10.1590/S0103-40142001000300009>>. Acesso em: 25 set. 2019.

NORTH, D. C. Institutions. **The Journal of Economic Perspectives**, v. 5, n. 1, p. 97-112. 1991. Disponível em: <<https://www.jstor.org/stable/1942704>>. Acesso em: 03 mar. 2020.

OSTRENSKY, A. Potencial para o desenvolvimento da aquicultura no Brasil. In: Ostrensky, A.; Borghetti, J. R.; e Soto, D. (editores). **Estudo setorial para consolidação de uma aquicultura sustentável no Brasil**. Curitiba. 2007. Disponível em: <https://www.researchgate.net/publication/258100019_Potencial_para_o_desenvolvimento_da_Aquicultura_no_Brasil>. Acesso em: 22 jan. 2021.

PEDROZA FILHO, M. X.; RIBEIRO, V. S.; ROCHA, H. S.; UMMUS, M. E.; VALE, T. M. **Caracterização da cadeia produtiva da tilápia nos principais polos de produção do Brasil**. Documentos / Embrapa Pesca e Aquicultura, v. 1, p. 1-50. 2020. Disponível em: <<https://ainfo.cnptia.embrapa.br/digital/bitstream/item/216871/1/CNPASA-2020-bpd26-2.pdf>>. Acesso em: 04 mar. 2022.

PEDROZA FILHO, M. X.; CASTILHO, M. A. Integration of farmers and processing industry in the aquaculture value chain in Tocantins, Brazil. **Revista de economia e agronegócio**, v. 18, p. 1-17. 2021. Disponível em: <<https://doi.org/10.25070/rea.v18i2.8755>>. Acesso em: 05 mar. 2021.

QUIEZI, J. M. Estratégias de distribuição adotadas pelos agentes produtor e indústria processadora na cadeia da piscicultura. Dissertação (mestrado) - Universidade Estadual Paulista “Júlio de Mesquita Filho”. 2021. Disponível em: <<https://repositorio.unesp.br/handle/11449/215034>>. Acesso em: 26 abr. 2022.

RIBEIRO, V. S.; PEDROZA FILHO, M. X. (2022). Regional analysis of aquaculture value chain: Study of tilapia production zones in Brazil. **Aquaculture**, v. 551. 2022. Disponível em: <<https://doi.org/10.1016/j.aquaculture.2022.737948>>. Acesso em: 28 abr. 2022.

RIEDO, I. G.; FEIDEN, A. Triple Helix Theory: What does the research of the Brazilian Postgraduate Programs present?. **Research, Society and Development**, [S. l.], v. 10, n. 9, p. e14410918036, 2021. DOI: 10.33448/rsd-v10i9.18036.

RIEDO, I. G.; RAMOS, M. J.; GUBERT, F. P. P.; FEIDEN, A. Institutionalism and its relations with developmentalism: past, present and future. **Brazilian Journal of Political Economy**, [S. l.], v. 43, n. 2, p. 516-538, 2023. DOI: 10.1590/0101-31572023-3346.

RODRIGUES, W.; AYROZA, I. F. L.; PEDROZA FILHO, M. X.; CANÇADO, A. C.; PRATA, D. N. Fatores que influenciam a inovação tecnológica nos estados brasileiros: uma abordagem em 2020. **Revista tecnologia e sociedade**, v. 17, p. 89-101. 2021. Disponível em: <<https://doi.org/10.3895/rts.v17n49.14496>>. Acesso em: 18 abr. 2022.

ROSTOW, W. W. *Etapas do desenvolvimento econômico: um manifesto não comunista*. 4 ed. Rio de Janeiro: Zahar Editores, 1961.

SCHENEIDER, S.; SCHER, F. A contribuição de Karl Polanyi para a sociologia do desenvolvimento rural. **Sociologias**, v. 13, n. 27, p. 180-219. 2011. Disponível em: <<https://doi.org/10.1590/S1517-45222011000200008>>. Acesso em: 12 dez. 2021.

SCHULTER, E. P.; VIEIRA FILHO, J. E. R. Evolução da piscicultura no Brasil: Diagnóstico e desenvolvimento da cadeia produtiva de tilápia. **Texto para discussão: IPEA**. Brasília: Rio de Janeiro. 2017. Disponível em: <http://repositorio.ipea.gov.br/bitstream/11058/8043/1/td_2328.pdf>. Acesso em: 04 nov. 2021.

SEN, A. **Desenvolvimento como liberdade**. 6. ed. São Paulo: Companhia de Bolso. 2017.

SILVA, A. R. S. A cooperação técnica entre as forças armadas e o setor acadêmico: um estudo sobre os escritórios da Marinha do Brasil localizados em universidades federais. Dissertação (mestrado profissional) - Instituto Nacional Da Propriedade Industrial do Rio de Janeiro. 2015. Disponível em: <<https://www.gov.br/inpi/pt-br/servicos/a-academia/arquivo/dissertacoes/SILVAAndrRobertoDosSantos2015.pdf>>. Acesso em: 03 fev. 2022.

SILVA, C. A.; FIALHO, J. R.; SARAGOÇA, J. Iniciação à Análise de Redes Sociais. Casos Práticos e Procedimentos com UCINET. 2013. **Coleção Perspectivas sociais e práticas**. Casal de Cambra: Caleidoscópico Edição e Artes Gráficas, S.A. Disponível em: <<http://hdl.handle.net/10174/10035>>. Acesso em: 13 out. 2021.