



INNOVATION, NOVELTY, TECHNOLOGICAL SOLUTION: A CONCEPTUAL ANALYSIS THROUGH THE “RURAL LEARNING AND ENTREPRENEURSHIP” PROJECT

**INOVAÇÃO, NOVIDADE, SOLUÇÃO TECNOLÓGICA:
UMA ANÁLISE CONCEITUAL POR MEIO DO PROJETO
“APRENDER E EMPREENDER NO CAMPO”**

INNOVATION, NOVELTY, TECHNOLOGICAL SOLUTION: A CONCEPTUAL ANALYSIS THROUGH THE “RURAL LEARNING AND ENTREPRENEURSHIP” PROJECT

**INOVAÇÃO, NOVIDADE, SOLUÇÃO TECNOLÓGICA: UMA ANÁLISE CONCEITUAL
POR MEIO DO PROJETO “APRENDER E EMPREENDER NO CAMPO”**

Cidonea Machado Deponti¹

Received: 10/10/2023

Accepted: 11/01/2023

¹ PhD in Rural Development.
Professor at the University of Santa Cruz do Sul.
Santa Cruz do Sul – RS, Brazil.
Email: cidonea@unisc.br

ABSTRACT

Family farmers develop their own solutions to their production problems, a process of creating technological solutions that guarantee their reproduction as farmers. This article aims at discussing the differences between the concepts of innovation, novelty, and technological solution using as an object of analysis the “Rural Learning and Entrepreneurship” project carried out in Montenegro, RS, funded by SEBRAE/FAPERGS. In terms of methodology, a literature review was carried out, in addition to on-line and in-person workshops; active and entrepreneurial education methodologies were also used. The results obtained through the project are divided into research and extension. With regard to the former, it should be noted that although the concept of innovation is broad and allows for great flexibility, the attempt to describe the occurrence of the Schumpeterian trilogy makes it difficult to apply the concept of innovation to the rural environment. With regard to the results of the extension, it is worth noting that seven entrepreneurial projects were developed, one of which has been incubated as a start-up at ITUnisc. It was concluded that, in the interaction between scientific and contextual knowledge, initiatives that bring the University closer to schools and that challenge students to solve practical problems, based on theoretical discussions in classes and workshops, result in innovative projects and subjects who are protagonists of their development and learning process.

Keywords: innovation; regional development; entrepreneurial education; family farming; rural youth.

RESUMO

Os agricultores familiares desenvolvem soluções próprias para seus problemas produtivos, processo de criação de soluções tecnológicas que garantem a sua reprodução enquanto agricultores. O objetivo do presente artigo é discutir as diferenças entre os conceitos de inovação, novidade e solução tecnológica tendo como objeto de análise o Projeto “Aprender e empreender no campo” desenvolvido em Montenegro-RS e financiado pelo SEBRAE/FAPERGS. Em termos metodológicos utilizou-se da revisão bibliográfica, a realização de oficinas online e presenciais, o uso de metodologias ativas e da educação empreendedora. Os resultados obtidos através do projeto, dividem-se em de pesquisa e de extensão. Em relação ao primeiro destaca-se que embora o conceito de inovação seja amplo e admita grande flexibilidade, a tentativa de descrever a ocorrência da trilogia schumpeteriana torna difícil aplicar o conceito de inovação para o meio rural. Em relação aos resultados da extensão, destaca-se que foram elaborados 7 projetos empreendedores, sendo que um deles encontra-se incubado como uma start-up na ITUnisc. Concluiu-se que na interface entre o conhecimento científico e o contextual, as iniciativas que aproximem a Universidade das escolas e que desafiem os estudantes a solucionar problemas práticos, embasados em discussões teóricas trabalhadas em aulas e oficinas resultam em projetos inovadores e em sujeitos protagonistas de seu desenvolvimento e processo de aprendizagem.

Palavras-chave: inovação; desenvolvimento regional; educação empreendedora, agricultura familiar; jovens rurais.

INTRODUCTION

For Schumpeter (1988), innovation is an evolutionary system, since, for innovation to exist, production methods must be changed and new functions and forms of work organization must be incorporated. The result of these changes are new products and/or improvements to existing processes and products. In the economic sense, an innovation is only complete when there is a commercial transaction involving an invention, thus creating wealth.

Faced with the concept of Schumpeterian innovation, the question arises of how appropriate this concept is to describe existing elements in the family farming environment. The rural environment has massively incorporated technological innovations with the promise of facilitating the way of life, as well as improving the mode of production. These innovations were created within an innovation production system that is in line with the Schumpeterian innovation concept. However, it is possible to notice that family farmers create new and relevant knowledge for society in an extremely competitive market environment. It is necessary to create alternatives, as either farmers are often unable to access technologies created by the industry or the industry does not even seek to create technologies for these farmers, given their low investment capacity (Deponti, Teixeira e Mengel, 2019; Mengel *et al.* 2020).



In literature, the concept of novelty means “a continuous process of solving daily problems and creating new and better ways of optimizing the use of production factors and practicing agriculture” (Oliveira *et al.* 2011, p, 98). Novelty is considered a break with the dominant modernization regime for the rural development paradigm.

Thus, this article aims at discussing the differences between the concepts of innovation, novelty, and technological solution, having as its object of analysis the “Rural Learning and Entrepreneurship” project, carried out in Montenegro, RS, and financed by SEBRAE, FAPERGS, UNISC, and CNPq. This project is linked to the “Development of Entrepreneurial Education Methodologies as a Way of Finding Technological Solutions for Agriculture in Montenegro-RS” project, Announcement 03/2021, modality A, PROEDU-SEBRAE/FAPERGS.

The innovations and technologies implemented in agricultural activities in Brazil have been essentially carried out by renowned research institutions — such as the Brazilian Agricultural Research Corporation (EMBRAPA) — since the period called by Delgado (2005) as Conservative Modernization, from the 1960s on. In general, research and innovations carried out in large academic research centers and even in the industry related to the agricultural sector are not always in harmony with the reality of family-based farmers, who essentially require innovations related to improving the efficiency of their activities, ensuring social reproduction (Mengel *et.al*, 2016).

Some works discuss this topic. According to the results of the research project by Mengel *et. al* (2016), these technological solutions are related to the creation or modification of techniques, as well as improving work instruments and the quality of agricultural products. Mengel and Aquino (2019) identified technological solutions based on research carried out in Vale do Rio Pardo, RS, in Brazil. These solutions aimed to: 1) reduce the burden of work; 2) reduce the time to perform an activity; 3) improve the quality of agricultural products; 4) automate processes; 5) modify or create new production methods.

This “new way of doing things”, based on existing practices that have been tried out by producers, consists of practical knowledge that can guide the production of incremental innovations and solutions for real production and process demands of family farming (Deponti, Teixeira e Mengel, 2019).

This article is relevant to the field of Regional Development as it stimulates an analysis of the interactions between rural and urban, countryside and city, agriculture and industry, radical innovation



and incremental innovation, scientific knowledge and contextual knowledge, entrepreneurial education and formal education. Discussing the possibility of family farmers creating technological solutions suited to their needs refers to the transformation of these subjects into protagonists of their own development. To this end, in terms of methodology, bibliographic review, online and in-person workshops, active methodologies, and entrepreneurial education were used.

The article is divided into three sections, in addition to this introduction and final considerations. The first section deals with the theoretical basis on Schumpeterian innovation, novelty and technological solutions, and an attempt was made to define these terms conceptually. The second section presents the methodology and empirical evidence. The third section discusses the results obtained in both research and extension, with the differences between the concepts being addressed, and presents three technological solutions developed within the scope of the project. Subsequently, there are final considerations.

SCHUMPETERIAN INNOVATION, NOVELTY, AND TECHNOLOGICAL SOLUTION

Schumpeter says that innovations lead to discontinuities in the economic system, which, in turn, lead to development processes. The economic system — more specifically, the capitalist system — is characterized by the constancy of disturbances created by the introduction of innovations, which produces a dynamic motion of replacement of old products and forms of production (i.e., creative destruction), and removes the possibility of a lasting balance (Schumpeter, 2006). In this sense, the concept of creative destruction is disconnected from the idea that says that structures reach an optimal or equilibrium state, but rather that structures are in a continuous movement of replacing existing structures with new structures (Hospers, 2005).

It is worth remembering that the reproduction of capital, based on innovation related to the transformation of past conditions of production, was explored by Marx (2011), who associated the dynamization of capital rotation with permanent technological innovation. Marx perceived capital as dynamic, grounded on constant destruction. This reference guides the debate about the constant renewal of capital and its forms of reproduction.



In general terms, innovation is seen as any “doing things differently” in the realm of economic life (Schumpeter, 2005). Innovation constitutes “new combinations”, in five different forms or types: (i) New product or improvement of an existing product; (ii) New production or sales method; (iii) New market; (iv) New source of raw material; (v) New market structure (Schumpeter, 1983).

Several works explain and classify innovation (Godin, 2008), but, in general, these works are based on what was explained by Schumpeter. For example, the Organization for Economic Co-operation and Development (OECD) suggests that innovation be recognized as the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations (OECD, 2005). Even with several definitions, the concept of innovation has two distinctive aspects: first, it incites change; and second, it has some degree of novelty (Cooper, 1998; Gopalakrishnan; Damanpour, 1997).

The effect of innovation, in turn, would not result solely from the creation of something new with the capacity to lead to changes. The effect of innovation results from the “Schumpeterian trilogy” (Stoneman, 1995), characterized by invention, innovation, and diffusion. First, the innovation process begins with the invention of something that has the potential to create impact; second, it is necessary for the idea to be materialized into new products or processes with potential for introduction into the market; finally, the innovation process ends with the introduction, diffusion, and adoption of innovations by potential markets (Ferguson, 1988; Stoneman, 1995). In fact, inventions and innovations are distinct phenomena and do not have any mandatory correlation or causality. “Innovation is possible without anything we should identify as invention and invention does not necessarily induce innovation” (Schumpeter, 2005, p. 81).

In general terms, innovation can be seen as the conjunction of the materialization of an invention with the diffusion and adoption of that same invention (Freeman, 1991; Garcia; Calantone, 2002). In fact, an invention is considered an innovation when its value is perceived and a process of diffusion, and adoption occurs among agents (Garcia; Calantone, 2002; Smith; Barfield, 1996).

Garcia and Calantone’s (2002) innovation idea models different types of innovation according to the degree of discontinuity among adopters (i.e., markets) and the technology used. From a “micro” perspective, innovation influences changes in existing markets and technologies; from a “macro” perspective, innovation causes the emergence of new markets and technologies (Garcia; Calantone, 2002).



Radical innovations are innovations that cause marketing *and* technological discontinuities on *both* a macro *and* micro level. Incremental innovations occur only at a microlevel and cause either a marketing *or* technological discontinuity but *not* both. Really new innovations cover the combinations in between these two extremes (Garcia; Calantone, 2002, p. 120).

Even if the broad interpretation of innovation — any “doing things differently” in the realm of economic life (Schumpeter, 2005) — has great flexibility, the attempt to describe the occurrence of the Schumpeterian trilogy (Stoneman, 1995) and its consequent discontinuities in the market and technology at the micro and macro levels (Garcia; Calantone, 2002) does not happen so easily. The ideas of technological improvement and extension of diffusion make it difficult to apply the concept of innovation to rural areas when those ideas come from the farmers themselves.

Part of that difficulty arises from the idea of innovation in rural areas through “agricultural modernization” (Oliveira *et al.*, 2011). Based on theories such as “induced innovation” (Hayami; Ruttan, 1985) and “technological efficiency” (Schultz, 1983), the agricultural modernization paradigm suggests that work in the “Schumpeterian trilogy” is divided between specific agents and occurs in a stable manner. Such a specialized and inflexible format is explained by Oliveira *et al.* (2011, p. 91) as a “linear perspective of innovations”, in which invention is created and materialized by science, disseminated by technicians, and adopted by farmers (Oliveira *et al.*, 2011; Stuiver, 2008).

Although agricultural modernization boosts productivity, such expansion is increasingly induced by external forces in relation to the local systems (Oliveira *et al.*, 2011). Agricultural modernization encourages a division of labor in the innovation process that reinforces and expands the effects of commodification (agents specialize in a few activities and negotiate these specialties), scientification (the production of inventions is a monopoly of scientists), and integration (only large integrated complexes can mobilize sufficient resources to tolerate the risks inherent to innovation) of agricultural production (Oliveira *et al.*, 2011). In short, under the expectation of greater gains in productivity, agents in local systems become progressively disconnected from productive knowledge.

By giving up productive knowledge, local systems also remove the possibility of engendering their own search for adequate solutions to their particular problems, since knowledge is something built upon past knowledge, when a local system gives up certain knowledge, it also gives up of the trajectories that could be built based on this knowledge (Hassink, 2005).



Alternatively, Oliveira *et al.* (2011) suggest the novelty production approach in the rural environment. This concept is recognized as “a continuous process of solving daily problems and creating new and better ways to optimize the use of production factors and practice agriculture”, which is based on local practices and knowledge and the integration of scientific knowledge with traditional knowledge (Oliveira *et al.*, 2011, p. 98). Novelty reinforces the concepts of agency and autonomy of farmers, and is guided by grass-root processes.

Although the objective of innovation is the same regardless of the paradigm, innovation, from the perspective of producing new things, is driven by internal forces and customized by local resources and needs (Oliveira *et al.*, 2011; Ploeg *et al.*, 2004). Therefore, the production of novelties corresponds to an adaptation of the concept of innovation to rural areas by circumscribing technological and marketing discontinuities for each local system and its socio-technical regime (Ploeg *et al.*, 2004).

According to (Oliveira *et al.*, 2011), the approach to novelties has three important characteristics:

a) Contextualization — types of knowledge and skills that are used by farmers to create and build novelties. Farmers mobilize contextual knowledge, which results from the socioeconomic, cultural and institutional context, generally resulting from the fusion of horizons between the world of farmers and other worlds and projects of other social parties;

b) Internalization — the resources used in the production of novelties are mostly internal resources of the location/territory or even the agricultural production unit, called endogeneity of practices. Endogeneity means a way of organizing resources from within the territories (endogenous), as a means of circumventing constraints, using diversification strategies and creating internal and external synergies;

c) Territorialization — novelties are born immersed in a space, in relationships, and in social networks. It is a process located in a territory and which depends on time, local ecosystems, and cultural repertoires. A recurring characteristic of a novelty is its rupture in relation to the dominant regime and its ability to reconnect production units with the territory through the use of hidden resources and/or resources that are little used by the dominant regime.

Thus, novelties are radical because they disconnect themselves from the rules and trajectories of technological modernization, because they are made outside the linear pattern of production of



knowledge and technologies, and because every novelty, when disconnected from dominant rules and standards, carries with it the potential for creating broader changes in different areas of productive activities (Oliveira *et al.*, 2011).

Another concept to be analyzed is that of a technological solution, which, in turn, aims to guarantee the permanence of farmers in the production process in which they are inserted, enabling their maintenance and survival in the rural context. A technological solution may be understood as any process, technique, policy, and/or practice derived from the concrete experience lived by territorial parties, enriched by the scientific resources of universities and research centers, through interdisciplinary and transdisciplinary dialogues.

[...] the creation of their own technological solutions is a characteristic and defining element of family farmers as a category, since they establish and are clear about the objectives of their socioeconomic activity at the same time that they carry out each of the tasks existing in their production unit. This characteristic allows family farmers to identify problems in each process and think of ways to solve them, whether by modifying a production method or creating a new machine or piece of equipment (Mengel *et al.*, 2020, p. 84).

The creation of technological solutions is a characteristic of the family farming social category, mainly because farmers carry out all the productive activities on their property, which allows them to identify and solve problems that hinder their production process. The technological solutions found by farmers aim to meet the technological demands existing on their properties (whether by modifying a production method or creating agricultural equipment or implements), making it possible to improve the efficiency of what is produced (Mengel, *et al.*, 2020).

These technological solutions, in addition to producing knowledge translated into products, processes or practices, allow family farmers to have resilience and find ways to support themselves in rural areas. Despite being subject to an increasingly competitive and exclusive market, they are able to adapt and establish relationships with other parties in their locations, reusing materials and increasing their connection with nature. Even though there are some technologies available in the market, generally, in addition to being expensive, they are not suitable for the small properties where family farmers are located, which requires the creation of these technological solutions (Mengel, *et al.*, 2020).

Table 1 shows some relationships and/or contradictions between the concept of Schumpeterian innovation, novelty, and technological solution, seeking to clarify the differences between these three concepts.



Table 1 | Comparison between Schumpeterian innovation, novelty, and technological solution

Innovation	Novelty	Technological Solution
The tasks of the Schumpeterian trilogly (invention, innovation, and diffusion) performed by fixed agents.	The tasks of the Schumpeterian trilogly are neither performed nor considered by the agents.	The tasks of the Schumpeterian trilogly are performed by specific agents.
Innovations are externalized, standardized and globalized.	Solutions are internalized (in the production unit or location), contextualized and territorialized.	Solutions are internalized (in the production unit or location), contextualized and territorialized, but in certain contexts they can be standardized and disseminated.
Created by scientific knowledge whose trajectory is less flexible and is externally defined.	Created by contextualized knowledge, which has a more flexible trajectory.	Created by the interaction between scientific technical knowledge and popular knowledge.
Recognized by the degree of discontinuities at a global level in technology and the market.	Recognized by the degree of discontinuity in local systems in technology and the market.	Recognized for the meeting between local systems, technology and the market.
It seeks to replace limiting production factors with artifacts manufactured by the industry.	It organizes itself with endogenous resources and creates internal and external synergies.	It organizes itself with endogenous resources, internal in relation to the property, but it can access external resources.
It can be radical or incremental.	It is radical.	Generally incremental.
Modernization paradigm.	It breaks with the modernization paradigm and focuses on the Rural Development Paradigm.	They move between the paradigm of modernization and the paradigm of rural development.

Source: The author, based on literature (2023).

The technological solution, seen as a new technique or technology to be developed and inserted into the production process, changes the way in which farmers relate to nature, that is, they change their way of working and living. In this context, a technological solution does not transform into innovation in the Schumpeterian sense. However, it is not characterized as a novelty that causes a break with the dominant system.

The concept of technological solutions adapts to the regional reality in which family farmers aim to survive in rural areas, but in which they are not yet in a transition from their agricultural activity, as, for example, in the case of agroecology. In this case, the concept of transition can be understood as a gradual and continuous process of changes, in which the transformation of a society occurs (Oliveira, 2014). The main differences between the concepts of technological solution and production of novelties are that, in

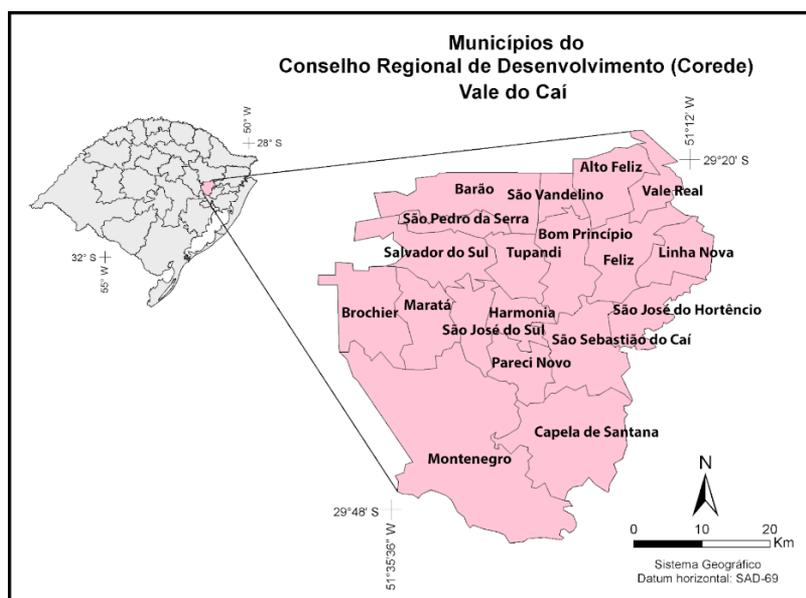
the production of novelties, local parties, in addition to resisting the system, are fully aware of their role; in the technological solution, in turn, the objective is to guarantee the permanence of farmers in the production process in which they are inserted, enabling their maintenance and survival in the rural context.

METHODOLOGICAL PATH TAKEN

In this section, the methodological procedures used in this article are presented. First, it is worth highlighting the fact that the project is linked to the Graduate Program in Regional Development of UNISC and has a partnership with the following institutions: Technical Assistance and Rural Extension Company (EMATER/RS), Council of Rural Development of Montenegro (COMDER), the Business Administration Program of UNISC, the Training Center of EMATER-RS–CETAM, Office of Education, Office of Rural Development, and São José do Maratá State School, in São José do Sul. The project was financed by SEBRAE/FAPERGS, Announcement PROEDU/2021, and by UNISC and CNPq, through technological grants and productivity grants.

For empirical analysis, two municipalities that are part of COREDE — Vale do Caí were chosen: Montenegro and São José do Sul.

Image 1 | Map with the location of Vale do Caí



Fonte: IBGE Cartographic Base 2016.

The flyer included a link to a survey to identify participants — mentor teachers and high school students living in rural Montenegro, RS. This survey was conducted via Google Forms, with 22 education professionals and 21 students signing up, totaling 43 people registered. The students and educators come from two municipalities and seven locations in the region, with 60.5% of participants living on rural properties. The survey can be seen at <https://forms.gle/8bnXXSGaWzo2Ddvp9>.

Once the participants were gathered, a group was started on WhatsApp for communication and an Instagram account (<https://www.instagram.com/aprendereemprendernocampo/>) was created for communication and dissemination of all the material produced. Thus, online and in-person interactions began to be carried out.

The first in-person activity was an Engagement Meeting between the members, and it included a mystical hour, carried out by Escola Família Agrícola (“Agricultural Family School”) of Santa Cruz do Sul, with participation of Antônio Gomes and Bruna Richter Eichler, and a lecture, delivered by social extension agent Elizângela Mainardi Teixeira, from EMATER (from Lajeado, RS), about “rural youth”, which took place at UNISC’s Montenegro Campus.

After the first in-person workshop, there were four online workshops — 1st Module: Innovation and Technologies in a Rural Environment; 2nd Module: Entrepreneurship in a Rural Environment; 3rd Module: Learning based on Entrepreneurship Projects. In the 4th Module, the participants were divided by project, and a discussion was held about the project to be carried out with each group. For each module, an online leaflet was prepared with specific information, which can be accessed at <https://linktr.ee/aprendereemprendernocampo>. Teachers from public schools and selected students participated in these activities, and the workshops were based on entrepreneurial education methodologies, focusing on solving problems identified by rural young people. In the workshops, the students were challenged to create a solution to a problem on their rural properties. On this occasion, technological demands were identified to improve properties based on the perception of rural young people to solve infrastructure or management problems. The workshops enabled young people to find technological solutions through seven projects using the project-based approach: 1) hydraulic ram; 2) educational market garden; 3) beekeeping; 4) aviary folder; 5) sustainable fashion; 6) aquaponics; and 7) organic compost.



Field visits were carried out to monitor the innovations developed by the students. At São José do Maratá School, an activity was carried out that included discussion of the projects. Furthermore, the school held the “Country School Day”, in which entrepreneurship and scientific initiation projects carried out in the context of the Rural Learning and Entrepreneurship project were promoted.

Along with the entrepreneurial projects, a booklet was prepared, which will be released at the Family Agriculture Fair of Montenegro, RS, to be held in mid-October 2023, in which the project will have a kiosk where the technological solutions will be exhibited. It should be noted that the booklet will be published in digital and printed media and distributed in participating schools and local institutions.

Three more workshops were held: one in which all students were invited to present their technological solutions to the project team and discuss them; another in which the PIBITI/CNPq scholarship holder and member of the project, Magnus Pilger, participated of the panel which dealt with opportunities in the countryside, poultry farming, and family succession, and talked about his experiences; and another in which Dr. Fernando Fontoura and Dr. Cidonea Machado Deponti addressed pricing. In this last workshop, spreadsheets were given to students so that they could learn how to calculate the production cost and market price of the technological solutions created.

Throughout the duration of the Project, the PROBITI scholarship holder and the coordinator participated in INPI-POA’s mentorship through courses and meetings addressing the progress of the project and the actions necessary to patent an innovation. The course carried out was “Use of Intellectual Property in Technology-Based Businesses”, by INPI.

Among the projects developed, the aviary folder was the technological solution that advanced the most in terms of seeking incubation and patenting. The prototype was developed by the scholarship holder. It is an efficient piece of equipment for turning the poultry “bedding” between the first and tenth day of the chicks’ life. This causes bumblefoot in chickens, making it impossible to sell these feet to the Chinese market. The proposed solution is the creation of a compact folder, and the development of this prototype was called the Compact Folder Project.

The scholarship holder was instructed to present his innovation to the coordination of ITUnisc (UNISC’s technological incubator). After an interview and subsequent analysis, the Compact Folder Project was accepted by the incubator to join the group of start-ups admitted in 2023 for assistance. Within



ITUnisc, several activities take place, including a workshop aimed at accelerating start-ups carried out by SebraeX and Semente. At the moment, the search for priorities at the INPI is underway, aiming for protection through a patent, so that the prototype can become a product and, in this way, be produced and commercialized, to make the work of other poultry farmers easier.

TECHNOLOGICAL SOLUTIONS FOUND

Considering the technological solutions found, as already explained, three solutions were analyzed: aviary folder, aquaponics, and the hydraulic ram.

Creator	Production Activity	Problem	Solution Found	Benefit	Similar Solution in the Market
M.P.	Poultry Farming	Calluses on chicks' feet due to compact poultry bedding	Aviary Folder	The folder stirs the soil, making it soft, and the poultry house or feed container is not damaged	Similar
A. J. H, A. B., L. F. H.	Horticulture	Lack of space for growing vegetables	Aquaponics	Growing vegetables inside PVC pipes in small, semi-open environments	Yes
J. R. de P., P. S. and G. K.	Water	Lack of water in higher areas of rural properties	Hydraulic Ram	Displacement of water using a PVC system and an energy-free pump	Yes

Source: Field research (2023)

In the solutions selected for analysis, it is possible to notice that the trilogy of Schumpeterian innovation — invention, innovation, and diffusion — can be seen in the first solution. Analyzing each one of the stages, it can be seen that the innovation process that begins with the invention of something that has the potential to have impact is present in the idea of a technological solution, as they arise from an everyday problem and have an impact on the farmer's reality, since they solve the problem for which they were produced. Furthermore, this technological solution has characteristics that are close to Schumpeter's concept of technological innovation. The tasks of the Schumpeterian trilogy are performed



by fixed agents; in the case of the technological solution, family farmers are the agents who produce the entire process, and in some situations, they talk to other farmers or get in touch with blacksmiths and carpenters. Thus, farmers, in most cases, dominate the production process of the technological solution.

Innovation is an invention with a potential market, and this market can be explored through the standardization of a product. In the case of a technological solution, it is the identification of a customized solution using a technique known to a farmer. Thus, an innovation solves something for the farmer “alienating” him from the applied knowledge. In the technological solution, the farmer solves the problem by mastering knowledge (the technique).

In the case of family farming, farmers, while coordinating activities, also carry out all of them. Therefore, they have detailed technical knowledge of each process, knowing what needs to be modified to achieve the objectives. Unlike factory workers or workers in large agricultural companies, who only know how to perform the activities for which they are hired, family farmers see each procedure from the point of view of their social function, that is, generating economic resources for the maintenance of their families.

In the second stage, this idea materialized into new products or processes with potential for introduction into the market. This situation occurs in practice, as the solution developed by farmers may be commercialized. In fact, in this case, the solution was incubated as a start-up at ITUnisc, and the possibility of a patent being created has been discussed.

The third stage of the innovation process ends with the adoption of innovations by potential markets, which may occur if the technological solution is recognized as a technology in the market. Therefore, this technological solution can be called “incremental innovation”, since there are already folders in the market, although not with the specific characteristics present in this solution. However, it should be noted that this process is quite time-consuming and costly for farmers, requiring contributions from the University and specific agents with specialized knowledge on the subject. Thus, it is possible to see that family farmers carrying out the Schumpeterian trilogy (invention, innovation, and adoption) in rural areas is an exception.



For the second and third cases (aquaponics and hydraulic ram), patenting is more difficult due to the existence of similar products on the market and which are sold on a large scale. Thus, due to the social position of farmers and the lack of resources, the solution is not disseminated on the market, and is generally used by their neighbors. The solutions are internalized (in the production unit or location), contextualized and territorialized, making homogenization and dissemination in the market difficult. The diffusion of the technological solution is done in part through “technique socialization”, which leads to slowness and difficulties to the commercial exploitation of the technological solution along the same lines as a Schumpeterian innovation.

The third stage of the innovation process ends with the adoption of the innovation by potential markets, which does not happen, as technological solutions are recognized by a degree of discontinuity in local systems in technology and the market. The technological solution has limited diffusion power, since it is essentially a process of transmitting knowledge, while Schumpeterian innovation is characterized by “knowledge embedded in a product”, which facilitates its diffusion. Thus, the two technological solutions can be sold and/or shared among neighbors.

None of the three cases is characterized by being a novelty, because the essence of the concept lies in the fact that it constitutes something that breaks with the modernization approach and is characterized by radical innovation.

In order to understand the process of building technological solutions developed by rural young people, children of family farmers, the starting point was the completion of steps that constitute the dynamic process of creating technological solutions, made up of the following steps according to Brum, Deponti and Mengel (2021):

- 1) A problem is identified on the rural property, methods to solve it are analyzed, and it is verified whether the necessary equipment, materials, and knowledge for its proper construction are available;
- 2) If not, a blacksmith, a metalworker or a carpenter from the community/locality is consulted; after explaining the existing problem to this professional, together they will try to find the best way to solve it;
- 3) After the consultation, the professional develops the new solution as requested by the farmer;



- 4) The farmer, after receiving the solution built by the blacksmith, carpenter or metalworker, tests the equipment and, if there is a problem, if he has the necessary equipment himself, he will make the necessary adaptations; if does not, the solution goes back to the professional;
- 5) After the solution has been tested and approved, the dynamics of creating technological solutions ends. After that, the solution is generally lent to friends and neighbors, who will contribute to the dissemination of this new know-how among local farmers.

When analyzing the case of family farming, by observing the entire process of building technological solutions, it was possible to note that what enabled family farmers to detect the need to produce a technological solution was the fact that, at the same time in which they coordinate the work, they also carry out all activities on their properties. This provides them with a broad and privileged view, which makes the farmers identify the existing problem and look for the best ways to solve it, thus creating a new technological solution (Brum, Deponti e Mengel, 2021).

According to Mengel *et al.* (2020), the creation of their own technological solutions is a characteristic and defining element of family farmers as a social category, as the management of the rural establishment and the execution of field activities are the characteristics that allow them to create their own technologies. In the authors' opinion, the challenge, from an academic point of view, is the possibility for the University to be part of this process, expanding it and using it in experiments in the construction of scientific knowledge.

FINAL CONSIDERATIONS

It was concluded that the concept of innovation is broad and allows great flexibility, with the occurrence of the Schumpeterian trilogy being difficult and/or an exception for understanding innovation in rural areas, because it applies to or comes close to understanding the concept of technological solution.

A technological solution is not the technology itself, but its application; it is the application of technology or know-how in the creation/modification/improvement of products or processes. Thus, the technological solution is an application of knowledge embedded in an object (technology) or subject (know-how), which aims to create or modify a product or process. For the cases under analysis, a technological solution is understood as new techniques or technologies that, when developed and



inserted into the production process, change the way farmers relate to nature, that is, change their way of working and living.

The concept of novelty is similar to that of technological solution, due to the interaction between scientific knowledge and farmers' knowledge, however, providing a more comprehensive vision, as it breaks with the paradigm of modernization (dominant) and approaches the paradigm of rural development.

In relation to the "Rural Learning and Entrepreneurship" project, it was concluded that initiatives that bring the University closer to schools and that challenge students to solve practical problems, based on theoretical discussions conducted in classes and workshops, result in innovative projects and subjects who are protagonists of their development and learning process. This project became essential in the case of Montenegro and the rural youth, precisely because it allowed students to learn to identify and evaluate problems, as well as plan and implement solutions identified as necessary in their social and productive context.

A theoretical/conceptual deepening of the issue of technological solutions is suggested, since the literature lacks research that addresses and expands the discussion on this topic. Carrying out additional empirical research is also suggested, so that it is possible to verify whether the results found in this article can be used to analyze other activities in rural areas.

The challenge that still persists is the use and dissemination of technological solutions found by these young family farmers, both in the academic, social and regional spheres. Patenting the innovations would guarantee the recognition produced by these territorial subjects.

¹ The research project, on which this article was based, is funded by SEBRAE, FAPERGS, UNISC, and CNPq.

² Created by Law No. 10,283, of October 17, 1994, the COREDES aim to promote harmonious and sustainable regional development through the integration of resources and government actions in a region, focusing on the improvement of the population's quality of life, the equitable distribution of the wealth produced, encouraging people to remain in their regions, and the preservation and recovery of the environment. The municipalities in the Vale do Caí region which are included in it are: Alto Feliz, Barão, Bom Princípio, Brochier, Capela de Santana, Feliz, Harmonia, Linha Nova, Maratá, Montenegro, Pareci Novo, Salvador do Sul, São José do Hortêncio, São José do Sul, São Pedro da Serra, São Sebastião do Caí, São Vendelino, Tupandi, and Vale Real.

REFERENCES

BNDES. **BNDES Soluções Tecnológicas. O que é uma solução tecnológica?** BNDES - O Banco Nacional do Desenvolvimento. 2018. Disponível em: <https://www.bndes.gov.br/wps/portal/site/home/resultado-da-busca?q=solu%C3%A7%C3%A3o%20tecnol%C3%B3gica>. Acesso em: 13 out. 2023.

BRUM, C. P.; DEPONTI, C. M.; MENGEL, A. A. Compreendendo a dinâmica de produção de soluções tecnológicas pela agricultura familiar. **Revista Terceira Margem Amazônia**, v. 7, n. 17, p. 225-241, 2021. DOI: <http://dx.doi.org/10.36882/2525-4812.2021v7i17.p225-241>. Disponível em: <https://www.revistaterceiramargem.com/index.php/terceiramargem/article/view/427/321>. Acesso em: 13 out. 2023.

COOPER, J. R. A multidimensional approach to the adoption of innovation. **Management Decision**, v. 36, n. 8, 493–493. 1998.

DELGADO, G. A questão agrária no Brasil: 1950- 2003. In: RAMOS FILHO, L. O.; ALY JÚNIOR, O. (Orgs.). **Questão agrária no Brasil: perspectiva histórica e configuração atual**. São Paulo: INCRA, 2005. Disponível em: <https://www.embrapa.br/busca-de-publicacoes/-/publicacao/14281/questao-agraria-no-brasil-perspectiva-historica-e-configuracao-atual>. Acesso em: 13 out. 2023.

DEPONTI, C. M.; TEIXEIRA, E. K.; MENGEL, A. A. Inovações Schumpeterianas e Soluções Tecnológicas para a Agricultura Familiar no Vale Do Rio Pardo-Rs-Brasil: Uma análise das contradições. In: XXXII Congresso Internacional da Associação Latino Americana de Sociologia. 2019. Peru. **Anais...Peru: ALAS**, 2019.

FERGUSON, P. R. **Industrial Economics: Issues and Perspectives**. London, England: Macmillan Education UK. 1998. DOI: 10.1007/978-1-349-19211-3.

FREEMAN, C. The nature of innovation and the evolution of the productive system. In: OECD (Org.), **Technology and productivity: the challenge for economic policy**. Paris: Washington, D.C, p. 303-314, 1991.

GARCIA, R.; CALANTONE, R. A critical look at technological innovation typology and innovativeness terminology: A literature review. **The Journal of Product Innovation Management**, 19 (2), p. 110–132. 2002. Disponível em: https://www.researchgate.net/publication/271009122_A_critical_look_at_technological_innovation_typology_and_innovativeness_terminology_A_literature_review. Acesso em: 13 out. 2023.

GODIN, B. Innovation: the History of a Category. **Project on the Intellectual History of Innovation Working Paper**, 1 (S/N), p. 1–67. 2008. Disponível em: https://www.academia.edu/9810463/Innovation_The_History_of_A_Category_Benoit_Godin_Summary_and_Notes. Acesso em: 13 out. 2023.

GOPALAKRISHNAN, S.; DAMANPOUR, F. A review of innovation research in economics, sociology and technology management. **Omega**, 25 (1), p. 15–28.1997. Disponível em: https://www.researchgate.net/publication/223231371_A_Review_of_Innovation_Research_in_Economics_Sociology_and_Technology_Management. Acesso em: 13 out. 2023.

HASSINK, R. How to unlock regional economies from path dependency? From learning region to learning cluster. **European Planning Studies**, 13 (4), p. 521–535. 2005. DOI: 10.1080/09654310500107134. Disponível em: https://www.researchgate.net/publication/233086859_How_to_unlock_regional_economies_from_path_dependency_From_learning_region_to_learning_cluster. Acesso em: 13 out. 2023.

HAYAMI, Y.; RUTTAN, V. W. **Agricultural development: an international perspective**. Baltimore, MD: Johns Hopkins University Press. 506 p. 1995.

HOSPERS, G. J. Joseph schumpeter and his legacy in innovation studies. **Knowledge, Technology & Policy**, 18 (3), p. 20 - 37. 2005. DOI: 10.1007/s12130-005-1003-1.

MARX, K. **O Capital: O processo de produção do capital**. São Paulo. Editora: Boitempo. 2ª edição, 2011.



MENGEL, A.; AQUINO, S. L. A criação de um método para pesquisar, sistematizar e catalogar soluções tecnológicas na agricultura familiar. X Congresso da Associação Latino Americana de Sociologia Rural. 2018. Montevideo **Anais...** Montevideo: ALASRU, 2018. Disponível em: <https://sociologia-alas.org/2018/11/13/x-congresso-alasru/>. Acesso em: 13 de out. 2023.

MENGEL, A.; DEPONTI, C. M.; RODRIGUES, J. E. Soluções Tecnológicas e Agricultores Familiares: atores locais como protagonistas na geração de conhecimento. 19º Congresso Brasileiro de Sociologia. GT 6: Inovação Social e Economias Alternativas. 2019. Florianópolis, 2019. **Anais...** Florianópolis, 2019. Disponível em: https://www.congresso.sbsociologia.com.br/atividade/w?q=YToyOntzOjY6InBhcmFtcyl7czozNToiYToxOntzOjEyOiJJRF9BVElWSURBREUiO3M6MjoiMTYiO3O3M6MToiaCl7czozMjoiYzA5ZTM2ZjJhNDE4ZjI0MmUwNzliZDYyN2UwNjAwNjkiO30%3D&ID_ATIVIDADE=16. Acesso em 13 de out. 2023.

MENGEL, A., AQUINO, S., DEPONTI, C.M., AREND, S. Agricultura Familiar e Soluções Tecnológicas: agentes locais como protagonistas na geração de conhecimento. **REDES**, Santa Cruz do Sul, v. 25, n. 1, jan. 2020. DOI: <https://doi.org/10.17058/redes.v25i1.14679>. Disponível em: <https://online.unisc.br/seer/index.php/redes/article/view/14679>. Acesso em: 10 de out. 2023.

OECD. **Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data**. 3ª ed. Luxembourg: OECD Publishing. 2005. Disponível em: <https://www.oecd.org/science/oslo-manual-2018-9789264304604-en.htm>. Acesso em 10 de out. 2023.

OLIVEIRA, D. *et al.* A produção de novidades: como os agricultores fazem para fazer diferente. In: SCHNEIDER, S. & GAZOLLA, M. (Orgs.). **Os atores do desenvolvimento rural**: perspectivas teóricas e práticas sociais. 2011. Porto Alegre, Brasil: Editora da UFRGS. [s.l.]: [s.n.]. Disponível em: <https://lume.ufrgs.br/handle/10183/232567>. Acesso em: 13 de out. 2023.

PLOEG, J. D. Van der et al. On regimes, novelties, niches and co-production. In: WISKERKE, J. S. C.; PLOEG, J. D. Van der (Orgs.). **Seeds of transition**: essays on novelty production, niches and regimes in agriculture. 2004. Assen, Netherlands: Royal Van Gorcum, p. 57- 92. 2004. Disponível em: <https://research.wur.nl/en/publications/on-regimes-novelties-niches-and-co-production>. Acesso em: 13 de out. 2023.

SCHUMPETER, J. A. **The theory of economic development**: an inquiry into profits, capital, credit, interest, and the business cycle. New Brunswick, N.J: Transaction Books.1983. 255 p.

_____. **Business cycles**: a theoretical, historical, and statistical analysis of the capitalist process. 1ª ed. Chevy Chase, MD.: Bartleby's Books [u.a.], 2005.

_____. **Capitalism, socialism and democracy**. Harper colophon ed., [Nachdr.] ed. New York, NY: Harper Perennial, 2006. 431 p.

SMITH, B. L. R.; BARFIELD, C. E. **Technology, R&D, and the economy**. Washington, D.C: Brookings Institution and American Enterprise Institute. 1996. 222 p.

STONEMAN, P. **Handbook of the economics of innovation and technological change**. [s.l.]: Blackwell. 1995.

