The European Proceedings of
Social and Behavioural Sciences
EpSBS

www.europeanproceedings.com
e-ISSN: 2357-1330

DOI: 10.15405/epsbs.2021.07.4

LEASECON 2020
International Conference «Land Economy and Rural Studies Essentials»

DIFFERENTIATED APPROACH TO IMPLEMENTATION OF INNOVATION IN AGRICULTURAL ENTERPRISES ACTIVITIES

Yulia D. Mongush (a), Elena A. Ilina (b)*
*Corresponding author

(a) Irkutsk State Agrarian University named after A.A. Ezhevsky, Molodezhny 1, Irkutsk, Russian Federation,
(b) Irkutsk State Agrarian University named after A.A. Ezhevsky, Molodezhny 1, Irkutsk, Russian Federation, ielena1771@bk.ru

Abstract

Applied technologies, innovative infrastructure, the state of the agricultural industry with its multistructure level of technological developmen t lag behind industry which determines the need for innovation implementation. It should be noted that a certain combination of innovations brings the greatest effect, namely marketing, product, process and organization innovations. However, their ratio varies depending on the stage of organization development (Birth, Growth, Maturity, Transformation) and the stage of economics development as a whole (Trough, Recovery, Peak, Recession). The stage of organization development is evaluated through parameters of the coefficient of autonomy, profitability of sales, return on assets and market share of the organization based on multivariate analysis. The article presents a methodological approach to assess the needs of agricultural enterprises in innovation using fuzzy logic in Matlab taking into account these factors. Need for innovation was assessed using the example of four existing agricultural enterprises. The result of assessing the needs of agricultural enterprises in innovation allowed us to propose a differentiated approach to innovation implementation into agricultural enterprises by determining the optimal combination of innovations depending on the stage of organization development. The article gives a description of each stage of organization development and justifies the set of necessary innovations that will allow getting the maximum effect from the invested fund.

Keywords: Innovation, the need for innovation, agriculture

https://doi.org/10.15405/epsbs.2021.07.4
Corresponding Author: Elena A. Ilina
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

1. Introduction

Comprehensive development of agriculture ensuring food security of the country and competitiveness in the world market are impossible without the effective organization of innovative activities aimed at the systematic development of the potential of agricultural enterprises. In Russia, agriculture is an industry for which the transition to the market was of the most destructive nature. On the one hand, the high-tech sphere of agricultural production had difficulties in forming the sources of the innovation process and the unpreparedness of its organization in new organizational and legal forms. On the other hand, new market conditions did not contribute to the creation of an investment and innovation environment that would stimulate the introduction of new technologies. To resume the innovation activity of agricultural enterprises, it is necessary to proceed from the principle of comprehensiveness, namely, to introduce marketing, product, process and organization innovations. Moreover, one should not only determine the structure of innovations being introduced, but also the conditions (external factors) and opportunities (internal factors) for their implementation.

2. Problem Statement

Innovation implementation into agricultural enterprises is influenced by external and internal factors. External ones include the state of the economics, such as competition, legal support, tax burden, social stability, purchasing power of the population and much more, which, in turn, characterizes the phase of the economic wave (Trough, Recovery, Peak, Recession).

Opportunities for innovation implementation into enterprises depend on the financial situation, liquidity, vision of the organization's mission, market share and other parameters (Nechaev et al., 2017) by which one can judge the stage of enterprise development (Birth, Growth, Maturity, Transformation).

3. Research Questions

Among the components of assessing the need for innovation of agricultural enterprises, there were selected the state of the country's economic cycles and the stage of organization development which represent a very capacious characteristic of the functioning of economic entities (see Table 1).

Table 1. Factors of the needs of agricultural organizations in innovation and indicators characterizing them

Component	Designation	Indicators	Components
Organization Development Stage	R1	- coefficient of autonomy; - payback ratio; - capital productivity; - market share.	Birth; Growth; Maturity; Transformation.
Business cycle stage	R2	- the growth rate of gross domestic product; - the growth rate of the unemployment rate; - the growth rate of industrial production; - consumer price index; - the growth rate of investment in fixed assets; - the growth rate of the average annual income of the population.	Trough; Recovery; Peak; Recession.

https://doi.org/10.15405/epsbs.2021.07.4
Corresponding Author: Elena A. Ilina
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

The stage of organization development is evaluated through parameters of the coefficient of autonomy, profitability of sales, return on assets and market share of the organization based on multivariate analysis. The assessment methodology is described in the article (Tyapkina, 2018).

Issues of the research of economic cycle were elaborated by such scientists as Juglar (1862), Kitchin (1923), Kondratev (1922), Kuznets (1930) and others. The economic cycle phase was monitored through parameters such as the growth rate of the gross domestic product, unemployment rate growth, growth rate of industrial production, consumer price index, growth rate of investment in fixed assets and growth rate of the average annual income of population. This monitoring is described in the article (Tyapkina et al., 2019).

4. Purpose of the Study

The purpose of the work is to develop a differentiated approach to innovation implementation into agricultural enterprises based on assessing the impact of the economic cycle phase and the stage of enterprise development.

5. Research Methods

Innovation implementation into agricultural enterprises is impossible without determining the need for innovation. In this regard, a methodological approach was developed to assess the needs of agricultural organizations in innovation which takes into account the identified external and internal factors, therefore, the fuzzy Mamdani knowledge base in Matlab was used, the advantage of which is that the rules of this knowledge base are transparent and intuitive.

Within methodological approach, it is supposed to determine the ratio needs to innovate (RNI - the ratio needs to innovate) as a function in which the main factors are the arguments: RNI = f (R_1, R_2), where R_1 is the stage of organization development, R_2 is economic cycle phase. To build a system for assessing the need for innovation, production rules for fuzzy inference are formulated (Table 02).

Table 2. Inference production rules for building an expert system

Rule wording	Justification
If R1 is at the “Birth” stage, R2 is at the “Trough” stage, then RNI is high	When an organization is at the “Birth” stage, which is characterized by an unstable financial situation, the absence of its own niche in the market, and provided that the economy is in the “Trough” phase, when production declines, the unemployment rate is high and the loan interest rate falls, the need for innovation of agricultural organizations is maximum.
If R1 is at the “Birth” stage, R2 is at the “Recovery” phase, then RNI - medium	If the organization is at the “Birth” stage, which is characterized by an unstable financial situation, the absence of its own niche in the market, and the economy is in the “Recovery” phase, when investments in fixed assets increase, unemployment decreases, demand and purchasing power of the population increase, and loan interest rates increase then the favorable environmental impact reduces the need for innovation.
If R1 is at the “Birth”	If the organization is at the “Birth” stage, which is characterized by an unstable

https://doi.org/10.15405/epsbs.2021.07.4
Corresponding Author: Elena A. Ilina
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

stage, R2 is at the "Peak" phase, then RNI is medium	financial situation, the absence of its own niche in the market, and the economy is in the "Peak" phase, when all production capacities are involved, full employment is accompanied by a general increase in wages and prices, then the favorable influence of the external environment reduces the need for innovation.
If R1 is at the "Birth" stage, R2 is at the "Recession" stage, then RNI is high	If the organization is at the "Birth" stage, which is characterized by an unstable financial situation, the absence of its own niche in the market, and the economy is in the "Recession" phase, when there is an over-accumulation of production capacities, a decrease in fixed capital investments, an increase in unemployment and prices, then the need for innovation agricultural organizations is high.
If R1 is at the "Growth" stage, R2 is at the "Trough" phase, then RNI is high.	When an organization is at the "Growth" stage, which is characterized by low financial stability, significant growth in the size of the organization and rapid growth in financial results, and the economy is in the "Trough" phase, when there is a decline in production, the unemployment rate is high and the loan interest rate falls, the need for innovation of agricultural organizations is high.
If R1 is at the "Growth" stage, R2 is at the "Recovery" phase, then RNI is medium	When an organization is at the "Growth" stage, which is characterized by low financial stability, significant growth rates of the organization and rapid growth of financial results, and the economy in the "Recovery" phase, when investments in fixed assets increase, unemployment decreases, demand and purchasing power of the population increase and loan rates increase, the need for innovation of agricultural organizations is average.
If R1 is at the "Growth" stage, R2 is at the "Peak" phase, then RNI is medium	When an organization is at the "Growth" stage, which is characterized by low financial stability, significant growth in the size of the organization and rapid growth in financial results, and the economy in the "Peak" phase, when all production capacities are involved, full employment is accompanied by a general increase in wages and prices, that favorable environmental impact reduces the need for innovation to an average.
If R1 is at the "Growth" stage, R2 is at the "Recession" phase, then RNI is medium	When an organization is at the "Growth" stage, which is characterized by low financial stability, significant growth rates of the organization and rapid growth of financial results, and the economy is in the "Recession" phase, when there is an over-accumulation of production capacities, a decrease in fixed capital investments, an increase in unemployment and prices then the need for innovation of agricultural organizations is average.
If R1 is at the "Maturity" stage, R2 is at the "Trough" phase, then RNI is medium	When an organization is at the "Maturity" stage, which is characterized by a stable financial position, a significant niche in the market, product recognition, and provided that the economy is in the "Trough" phase, when production declines, the unemployment rate is high and the loan interest rate falls, the need for innovation of agricultural organizations is average.
If R1 is at the "Maturity" stage, R2 is at the "Recovery" phase, then RNI is low.	If an organization is at the Maturity stage, which is characterized by a stable financial position, a significant niche in the market, product recognition, and the economy in the Recovery phase, when investments in fixed assets increase, unemployment decreases, demand and purchasing power of the population increase, and rates increase loan capital, the favorable influence of the external environment and the stable position of the organization minimize the need for innovation.
If R1 is at the "Maturity" stage, R2 is at the "Peak" phase, then RNI is low	If the organization is at the Maturity stage, which is characterized by a stable financial position, a significant niche in the market, product recognition, and the economy is in the Peak phase, when all production capacities are involved, full employment is accompanied by a general increase in wages and prices, then the level of need in innovation is low.
If R1 is at the "Maturity" stage, R2 is at the "Recession" phase, then RNI is medium	If an organization is at the "Maturity" stage, which is characterized by a stable financial position, a significant niche in the market, product recognition, and the economy is in the "Recession" phase, when there is an over-accumulation of production capacities, a decrease in fixed capital investments, an increase in unemployment and prices, then the need in the innovation of agricultural organizations is the average.
If R1 is at the	When an organization is at the "Transformation" stage, which is characterized by

https://doi.org/10.15405/epsbs.2021.07.4
Corresponding Author: Elena A. Ilina
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

"Transformation" stage, R2 is at the "Trough" phase, then RNI is high.	decreasing financial stability, a reduction in the market niche, and provided that the economy is in the "Trough" phase, when production declines, the unemployment rate is high and the loan interest rate falls, the need for innovation of agricultural organizations is high.
If R1 is at the "Transformation" stage, R2 is at the "Recovery" phase, then RNI is medium	If the organization is at the "Transformation" stage, which is characterized by decreasing financial stability, a reduction in the market niche, and provided that the economy is in the "Recovery" phase, when investments in fixed assets increase, unemployment decreases, demand and purchasing power of the population increase, and loan capital rates, the average level of need for innovation.
If R1 is at the "Transformation" stage, R2 is at the "Peak" phase, then RNI is high	If an organization is at the "Transformation" stage, which is characterized by decreasing financial stability, a reduction in the market niche, and the economy in the "Peak" phase, when all production capacities are involved, full employment is accompanied by a general increase in wages and prices, then the level of need for innovation is high.
If R1 is at the "Transformation" stage, R2 is at the "Recession" phase, then RNI is high	If an organization is at the "Transformation" stage, which is characterized by decreasing financial stability, a reduction in the market niche, and the economy is in the "Recession" phase, when there is an over-accumulation of production capacities, a decrease in fixed capital investments, an increase in unemployment and prices, then the need for innovation agricultural organizations is high.

The presented rules made it possible to visualize the dependence of the level of need for innovation of agricultural enterprises on the factors taken into account (Figure 01).

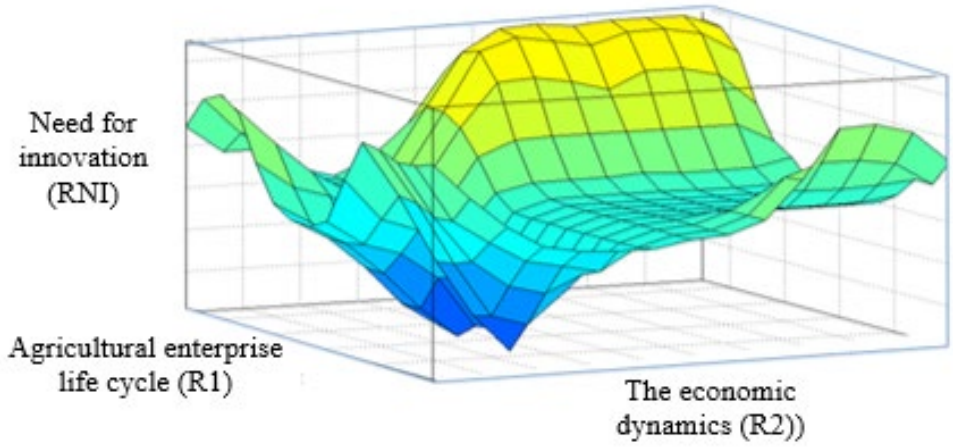

Figure 1. The dependence of the level of need for innovation (RNI) at the stage of development of the organization (R1) and the phase of the economic cycle (R2)

Then we determined the need of the enterprise for a specific type of innovation at a certain stage of development and economic cycle phase.

6. Findings

https://doi.org/10.15405/epsbs.2021.07.4
Corresponding Author: Elena A. Ilina
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

This method was tested using the materials of four operating agricultural enterprises of the Irkutsk region (Table 03).

Table 3. Assessment of the level of need for innovation (RNI) at the stage of development of agricultural organizations in the Irkutsk region (R1) and the phase of the economic cycle of Russia (R2)

Organization	Organization Development Stage		Economic dynamics		Need for innovation (RNI)
	Stage	R1	Phase	R2	
LLC “Academy”	Birth	31,2	Recession	0,198	High
ACC “Usolsky pig farm”	Growth	100,0	Recession	0,198	High
APJSC “Belorechenskoe”	Maturity	64,7	Recession	0,198	Medium
LLC “Paris”	Maturity	45,9	Recession	0,198	High
CJSC “Irkutsk seeds”	Transformation	28,2	Recession	0,198	High

Currently the country's economics is undergoing the Recession stage. Since the recession of all coinciding parameters of the cyclical nature of the economics will continue until 2017-2020, to determine the need for innovation, the R_2 parameter remains unchanged for all organizations. Since the agricultural enterprises of the region are at different stages of development, the R_1 parameter is individual for each organization. The analysis showed that most agricultural enterprises have a high need for innovation. It should be noted that the two organizations that are at the Maturity stage have different needs for innovations, which were influenced by the current financial and economic situation of the organization, therefore, the proposed model takes into account not only the stage of development and the phase of economic dynamics, but also the current financial economic position of the organization.

The differentiation of the complex of introduced innovations depends on the stage of agricultural enterprise development (Tyapkina et al., 2018). To determine the complex of innovations that are necessary at each stage of the enterprise’s development, an expert assessment was performed on the basis of which a discrete scale was developed consisting of qualitative assessments of the need for marketing, product, organizational and technological innovations.

Using the results of expert evaluation, we find the average needs assessment in the form of innovations that make up the complex of innovations of an agricultural enterprise in points for each type of innovation at a particular stage of organization development. The average rating of each type of innovation corresponds to their specific weight (share) in the total cost of the innovation project. So, for the Birth stage, the structure of the innovation project is as follows:

$$35\%M + 29\%P + 14\%O + 22\%T = RNI. \quad (1)$$

That is, taking into account the specifics of the Birth stage, agricultural enterprises when developing an innovative project, need to allocate project costs between types of innovations is as follows: 35% for marketing, 29% for product, 14% for organizational and 22% for technological innovations.

For the Growth stage, the structure of the innovation project is as follows:

$$32\%M + 22\%P + 22\%O + 24\%T = RNI. \quad (2)$$

For the Maturity stage, the structure of the innovation project is as follows:

https://doi.org/10.15405/epsbs.2021.07.4
Corresponding Author: Elena A. Ilina
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

$$24\%M + 32\%P + 19\%O + 25\%T = RNI. \quad (3)$$

For the Transformation stage, the structure of the innovation project is as follows:

$$28\%M + 25\%P + 21\%O + 26\%T = RNI. \quad (4)$$

But since in modern conditions it is extremely difficult for agricultural enterprises to attract financing, and there is not enough internal resources to support current activities, it is proposed to introduce a complex the general view of which is presented in Figure 02 in accordance with each stage of the organization's development.

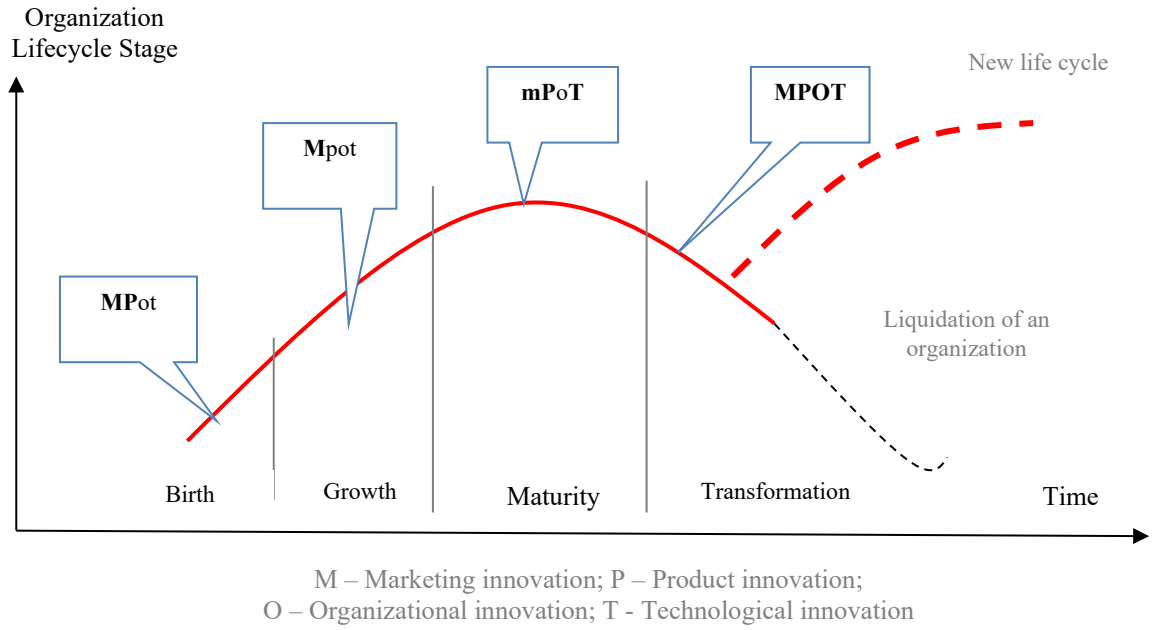

Figure 2. Stages of development and complex of introduced innovations

At the Birth stage, the primary strategic goal is to enter the market, therefore, at this stage of the organization, marketing and product innovations are primarily necessary. When an organization just starts and enters the market, the organizational structure may be chaotic at first glance, but it is acceptable for this stage. The organization adapts to the market, so it has a flexible structure and high staff turnover. That is, at this stage, the innovation development model is represented by the MPot complex, that is, at this stage marketing and product ones are recommended that are aimed at replacing existing products on the market that will differ in either qualitative or quantitative characteristics. Their degree of intensity should be explosive, since the further development of the organization depends on the strength of the initial impulse. By the nature of the satisfaction of needs, formative new needs are required. And in type and importance, marketing (since there is no market share) and product (a new product or a product manufactured using new technology) play a primary role. At the Growth stage, the primary strategic goal is to expand market share by establishing relationships with contractors, cutting off unnecessary and unpromising activities and optimizing the production process, therefore, marketing innovations should be intensively introduced at this stage. The innovation development model is represented by the Mpot

https://doi.org/10.15405/epsbs.2021.07.4
Corresponding Author: Elena A. Ilina
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

complex, that is, marketing innovations are recommended, and product, organizational and technological innovations can be implemented at the discretion of each organization, taking into account the specifics of internal and external factors. The organization at this stage already has a new product, an organizational structure has been formed, technological innovations have already been mastered at the initial stage, but not so much technology is used as the result of innovative technology - an innovative product. Organizations are gaining momentum, the growth rate at this stage is significant, therefore improving innovations are needed, that is, they continue to develop their initial idea. These innovations are aimed at expanding production and market. The degree of intensity should be uniform for dynamic and progressive development without disruption. By the nature of the satisfaction of needs, innovations should be guided by existing needs and those that were created at the previous stage.

At the Maturity stage, organizations occupy a niche in the market, their financial condition is stable. The most difficult thing is to maintain market position and financial and economic status, therefore it is extremely important for an organization to develop a new product, begin to master new technology, which will allow taking preventive measures to reduce the risk of transition or a long stay at the Transformation stage. The need to master innovation at this stage is also connected with the fact that the organization at this stage has the maximum capabilities: material, financial, human resources and access to relevant information, therefore the recommended innovations look like an mPoT complex. Improving innovations are needed aimed at streamlining the financial and economic activities of the organization, the desire to improve the efficiency of use of all resources in the organization. Their degree of intensity should be massive. By the nature of the satisfaction of needs, innovations should be guided by existing needs, but simultaneously forming new needs are required.

At the Transformation stage, organizations undergo a hidden decline in all parameters, that is, all parameters of financial and economic activity may be at the level of standard values or even higher, but the growth rate will have a bearish tendency. If the organization is at this stage, then two development scenarios unfold in front of it: either recession and bankruptcy, that is, many scientists call this outcome the Death stage, or the transition to a new cycle of development. To prevent the liquidation of the organization, it is necessary to introduce new technologies, use product innovations to find a new market or expand an existing one. In addition, it is necessary to emphasize the importance of organizational innovations, since there is a high probability of unjustified staff increase, on the one hand, and on the other, the existing form of organization of production has led to a recession, therefore, a cardinal rearrangement in the field of organization of economic activity is needed. At this stage, the recommended innovations are presented by the MPOT complex. The organization begins to lose ground in the market, therefore, both basic and improving innovations are needed, aimed at replacing existing goods that will differ in qualitative and quantitative characteristics, also aimed at expanding production and the market. By the nature of the satisfaction of needs, innovations should be guided by existing needs, but simultaneously forming new needs are required. And in type and importance - marketing, product, organizational and technological innovations are required, since at this stage of the organization it is necessary to stop the process of reducing all parameters of financial and economic activity, and significant investments are needed to return the organization to its previous stage of development. And

most importantly, for organizations to improve their position at this stage, organizational innovations are needed to help change the conduct of financial and economic activities.

7. Conclusion

Thus, for innovation implementation into agricultural enterprises, it is necessary, first of all, to take into account their functioning conditions (stage of economic development) and opportunities (stage of organization development), then, determine the need for innovation on the basis of the proposed methodological approach. According to the results of the assessment, the enterprise belongs to one of the four identified groups, for each of which a complex of innovations is proposed that has the greatest prospects for implementation.

The innovation complex consists of four basic types: marketing, product, organizational and technological. It must be emphasized that innovations in stages are considered from the perspective of the organization, that is, all innovations are primarily breakthrough and new to this organization.

At each stage of the organization's development, there is its own set of innovations, and for each stage the most significant are highlighted. The essence of a differentiated approach to innovation implementation is that it is important for organizations to introduce different innovations at each stage of development, but it is impossible in modern conditions to stop looking for lower costs for the production of products or technology with a more rational use of resources or improving the organization of business and all relationships with counterparties, customers and employees. Innovations implementation requires significant investments in terms of finances, highly qualified personnel, continuous monitoring of not only the occupied market, but also related markets, and the search for new, still unclaimed needs. It is difficult for organizations to develop and maintain in their structure all the competencies necessary for mastering innovations as marketing, organizational, product or technological ones. At the same time, the market is experiencing an increase in the rate of saturation of the product, thereby accelerating the product life cycle, which reduces the payback period on investments.

References

Juglar, C. (1862). *Des Crises Commerciales et Leur retour Periodique en France* [Commercial Crises and Their Periodic Return to France. Ideal social science library]. *Bibliothèque idéale des sciences sociales.* Guillaumin.

Kitchin, J. (1923). Cycles and Trends in Economic Factors. *Review of Economics and Statistics, 5,* 10-16.

Kondratev, N. D. (1922). *World Economy and Its Conjunctures During and After the War*. Regional Branch of the State Publishing House

Kuznets, S. (1930). *Secular Movements in Production and Prices. Their Nature and their Bearing upon Cyclical Fluctuations.* Houghton Mifffin Company.

Nechaev, A. S., Bovkun, A. S., & Zakharov, S. V. (2017). *Innovation Management Characteristics of Industrial Enterprises,* 556-559.

Tyapkina, M. F. (2018). Rating of agricultural enterprises of Irkutsk region based on multivariate analysis. In *European Proceedings of Social and Behavioural Sciences* (pp. 1285–1294). European Publisher. https://doi.org/10.15405/epsbs.2018.12.158

Tyapkina, M. F., Mongush, J. D., & Ilina, E. A. (2019). Cyclical fluctuations of the Russian economy. *IOP Conference Series: Materials Science and Engineering*, *667,* 012105.

Tyapkina, M. F., Vlasova, I. O., & Ilina, E. A. (2018). A methodical approach to assessment of innovation potential of agricultural enterprises. In *European Proceedings of Social and Behavioural Sciences* (vol. LVIII, pp. 1820-1826). European Publisher. https://doi.org/110.15405/epsbs.2019.03.02.211