



IMPROVEMENT OF FINANCIAL SUPPORT OF RAISING PRODUCT QUALITY WITH THE HELP OF SMART MANAGEMENT INFORMATION SYSTEMS

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ABSTRACT

We analysed the directions for improving financing for the growth of quality in the conditions of smart production and revealed the advantages and features of their realisation in developing and developed countries. These directions were systematised in the context of factual and prospective use. We also determined their possible modifications given the transformations of economic and technological development. We distinguished the effects of the improvement of financial support in this sphere, which include network, environmental, and social. We demonstrated the necessity of substantiating the possibility of achieving the effects of these categories for the interested parties; this measure is a precondition for their efforts in the creation of favourable financial conditions for the innovative business.

The goal of this paper was to identify the directions for improving financial support for raising product quality with the use of smart management information systems.

In the course of the research, we used the method of system approach, statistical analysis, the trend method, and comparative analysis.

The novel aspect of this paper lies in identifying the factual and prospective directions of improvement of financing smart productions, which ensures an increase in product quality and the creation of new product samples.



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1. INTRODUCTION

Management of product quality at different stages of the production life cycle requires the use of innovative technologies and modern tools, including the ones

integrated into smart management information systems which control precision and other parameters. This concerns high-precision productions, but some sectors and companies continue functioning at a low level of automatization and with the absence of digital support

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of production processes. However, high-tech productions support stable economic, social, and environmental development of countries with a high level of economic development. Such productions and countries of their location are less dependent on the fluctuations of prices for resources, materials, and energy. This is because the main share of value-added of manufactured high-tech products is connected with the use of intangible assets, namely AI technologies that are used in modern smart management information systems. These technologies raise the competitiveness of manufacturers of products, ensuring high consumer qualities of the latter through the achievement of precision and reduction of expenditures for defects, as well as the possibility of ensuring unique features.

The creation of high-tech productions, which are oriented towards an increase of product quality in the conditions of smart management information systems, requires financing. Traditional forms of financial support might be insufficiently effective for smart productions in countries that face difficulties in access to finance. This is true for developing countries and small and medium companies in developed countries. Revealing new financial opportunities to raise product quality in the conditions of using smart management information systems becomes an important direction of scientific search. Digital space provides perspectives for the development or adaptation of the mechanisms of improving financial support in this sphere. It is relevant to justify the guarantee of protection and profitability of financing in this sphere, which involves the attraction of the government and other parties who are interested in an increase in product quality in different sectors of the economy.

The goal of this paper was to identify the direction of improving the financial support of raising product quality with the use of smart management information systems. This goal set several tasks, which include the identification of factual directions of financing in this sphere and the substantiation of promising directions of financial support of management solutions in smart productions, which are oriented towards an increase in the parameters of product quality.

2. EXPERIMENTAL SECTION

The methodological basis of this research involved the application of a range of methods and scientific & practical, statistical, and analytical materials, according to the objective and tasks of the paper.

The method of system approach was used to reveal the directions of financial support in the context of assessment of the activities of subjects and functioning of the objects of corporate management in production sectors.

Statistical analysis allowed identifying the data on the implementing the revealed directions of financial support of the selected subjects in this sphere over the considered periods. The trends method was used to determine the factual and future directions of financing smart productions that are aimed at the growth of quality. The comparative method was utilised to compare the results of implementing the considered directions of financial support for the improvement of product quality with the use of smart management information systems.

We analysed scientific and practical materials in the sphere of improvement of financing of the growth of product quality with the use of smart management information systems.

Stojkovski et al. (2021) presented characteristics of the Equipment-as-a-Service (EaaS) model which is used at the level of consumers of production spheres. This model is a transition of companies that own high-tech equipment and smart management information systems and companies which have demand for these assets to a new form of organisation of economic activities and management of the technological sphere.

Kim et al. (2023) analysed factors that substantiate managerial decision-making on the financial support of high-tech projects, including the ones that involve the support of the subjects of small and micro businesses with high innovative potential. The authors distinguished the network effect of efforts on the implementation of innovative measures to raise product quality. According to scholars, the network environment consists of the sphere of employment, infrastructures that need products of higher quality, consumers who are oriented towards certain parameters of quality, and adjoining sectors that produce goods (services) that are necessary for innovative measures.

Azadi et al. (2021) dwelt on comparative characteristics of internal (through stimulation of factual customers and potential consumers) and external financing (bank establishments) of smart productions in the conditions of Industry 4.0. The authors developed a model that allows modelling financial support for financial sustainability in the conditions of factual economic, environmental, and social parameters.

Phuyal et al. (2020) considered the evolution of smart productions and production systems and assessed their features and capabilities, which have grown over the last years due to the application of new AI technologies. The authors presented a comparison of modern smart production systems and the ones that will be used in various sectors shortly. The issues of adaptation of the capabilities of AI are the top-priority issues of the development of certain sectors of industry.

Liang et al. (2023) elaborated on theoretical and evolutionary aspects of the formation of the systems of management information and their integration and application in different spheres. The researchers presented a historiography of the emergence of these systems and considered their features. Attention should be paid to forecast analysis of the future application of these systems in such spheres as managerial decision-making and support of the optimal distribution of resources in smart productions.

Ismanov et al. (2024) presented an assessment of the connection between the effectiveness of measures on the improvement of financial support of innovative measures in the improvement of the level of management information systems. By the example of two leading innovative companies, the authors substantiated the existence of direct dependence between the given components. This dependence is explained by the fact that an increase in the company's demands in the sphere of corporate information management at the current stage of the formation of AI could be satisfied due to innovations, which require the corresponding financial support.

Kusakina et al. (2018) proved the hypothesis that small companies in countries with emerging economies cannot enter the market without the government's support. This support concerns the attractive entrepreneurial environment, which includes access to financial support. Financing the sector of small and medium companies, which are aimed at innovations, is rather risky.

At the current stage, there is a sufficient number of studies on the given issues. Still, it is necessary to perform a complex evaluation of the factual and prospective range of directions of financing of this category.

3. RESULTS

Reforms of production sectors are connected with the large-scale implementation of high-tech equipment, which is integrated into smart management systems. Such transformations are impossible and will not be visible if the country or region does not have support from the government and interested parties, including high-tech companies. Further on, we shall analyse the aspect of financial support for the improvement of quality based on smart management information systems.

First, there is a direction connected with the rental of equipment, tools, and technologies within short-term, mid-term, or long-term relationships. This solution is interesting for production companies that cannot receive loans for the purchase of equipment and technologies by acceptable terms. Terms of rental can conform to the goals and capabilities of the companies. This direction

could be realised within the Equipment-as-a-Service (EaaS) model. It is implemented by the manufacturers of equipment and/or technologies, which are aimed at their promotion to certain segments of consumers (Stojkovski et al., 2021). Companies in the production and agricultural sectors which are interested in the growth of competitive positions use the services of companies that offer the rental of high-tech tools, equipment, and technologies.

The systematisation of the scientific & practical and analytical data (Rösler and Friedli, 2021; Kulezak, 2024; Wachs, 2024; Wang et al., 2024) showed that the use of this model is connected with the following specific features:

1) Manufacturers of equipment and technologies:

- Growth of sales volumes due to the development and implementation of flexible schemes for small and medium companies. These schemes may include short-term servicing of one production programme or mid-term and long-term servicing with coverage of different segments of customers;
- Advantages for forecasting the precise time of maintenance and diagnostics of equipment, and assessment of its integration with management information systems.;
- Advantages in design possibilities. Due to direct receipt of initial data on malfunctions and failures of equipment and systems, manufacturers receive information that is used to improve their products;

2) Final consumers (production companies):

- Savings on capital expenditures for new equipment and technologies;
- Savings on operational expenditures for exploitation and maintenance of equipment and administration of technologies as per the contract;
- Access to innovative technologies and equipment which allow achieving goals on an increase of product quality in the conditions of smart management systems.

Let us consider the examples of the effectiveness of the Equipment-as-a-Service model.

The first example is the effectiveness of final consumers (production companies) from the rental of robots that perform smart welding works (Path Robotics from the USA) compared to the use of welding equipment and technologies of rival companies. B. This manufacturer is popular in the U.S. and EU markets and other countries. It has been using the Equipment-as-a-Service model to promote products and technologies (Kulezak, 2024). Analysis of the indicators of efficiency of using these robots of Path Robotics showed the following:

- The cost of a yearly rent of one robotic installation (welding equipment connected to a smart management information system, which ensures the work with the

use of a digital twin) with 100 hours of functioning each month (12 months of exploitation) equals \$26,400. This is supposed to be a normal working regime, without failures or malfunctions over the whole guarantee period;

- To complete the same volume of work, a welder in the U.S. has to work 160 hours per month. If the equipment is similar to the equipment from Path Robotics (by power and efficiency), the monthly excess of operational loads of a welding machine equals 60 hours. This poses a threat of failures and malfunctions, which might lead to the need to purchase new equipment or perform repairs. The average wage of a welder with such productivity is \$22 per hour, which is \$46,300 per year;

- Costs savings from the use of robotized equipment, which has high precision and quality of work, due to the technology of digital twins, equals \$19,900 yearly, compared to the work of a welder.

It is possible to see the effectiveness of using the Equipment-as-a-Service model by the example of the products of Path Robotics. Effectiveness is ensured for final consumers (production companies which rent robotized equipment that is integrated with a smart management information system) and for the manufacturers of equipment and technologies. The latter may thus create a continuous flow of revenues from services, which would be a better solution compared to the absence of revenues from purchases that are not easily affordable for final users due to the absence of financing.

The second example is the effectiveness of final consumers (companies in the industrial sector) who use industrial robots that are integrated into the smart management information systems of Rapid Robotics (USA). Robots of Rapid Robotics are used in the following sectors: production and packaging of construction materials; production and control of the quality of packaging for pharmaceutical products; packaging and control of chemicals; production and control of the quality of medical products, etc. The specific features of using the Equipment-as-a-Service model by the robot manufacturer are as follows (Rapidrobotics, 2024; Kulezak, 2024):

- Preliminary training of robots, which are connected to management systems, for the given processes. This training involves the use of AI technologies, among which the key role belongs to computer vision and deep learning. The company that provides robots for rent independently deals with their settings, due to which the final consumer saves on robotization. This is very convenient for consumers, who, because of insufficient financial support and knowledge, cannot afford machine learning of robots, including rented robots. Before sending robots to the customer, Rapid Robotics collects data on future production. This allows commissioning robots in one minute, without the involvement of specialists in the sphere of robotization;

- Possibility of using a flexible system of payment for robot rental and smart management systems. This allows small and medium production companies to use technological advantages and raise the quality of products.

Second, we should note financial support, which involves the attraction of funds from regional and municipal programmes, grants, and the government in the sectors that need reforms (MPA, 2019). The reasons for such reforms include the need for the replacement of obsolete equipment and technologies to reduce the climate footprint from production (influence on the environmental indicators of quality); the need to stimulate innovative and high-tech production (focus on an increase of value-added of products, including exported ones and the growth of GDP).

To raise the level of international competitiveness of high-tech products and technologies, the UK uses programmes of support, the organisation of which is dealt with by ten regional innovative centres (Innovate UK) (Law, 2023; MPA, 2019). Over the last five years, the UK allocated budget financing to such centres, which provided support for the leading innovative production projects in promising sectors. Finances were provided mainly to the sector of small and medium companies involved in the implementation of high-tech production. Each company and group of companies (clusters) file applications to Innovate UK, which include a business plan and technological justification of the relevance of startups and projects for the country or city.

For 2023, the UK government allocated 75 million pounds for these programmes. The key projects realised in 2023 within this financial support in the UK include the following:

- Growth of production and improvement of modifications of satellites manufactured at the innovative factory in Glasgow. As of year-end 2023, more than 200 units of this smart equipment were produced and tested (Spire, 2024);

- Increase in the volumes of production of blue hydrogen (renewable energy source), which ensures decarbonisation of the gas supply of the UK. This project is realised in Teesside. Here an increase in the environmental indicators of energy quality is ensured. This project involves the activities of small and medium companies and is aimed at an increase in the environmental parameters of energy and socioeconomic support of these subjects in the sphere of technological upgrade of equipment and technologies.

In the context of the focus on financial support from the government, we should mention the experience of Germany, which, similar to the UK, is the world leader in the sphere of high-tech equipment and innovative technologies. We identified the directions of improving the government's financing in the sphere of the growth

of quality or the creation of new types of products in various sectors (Hillemann and Ehls, 2022):

1) Municipal financial support – example of “Hamburg-Kredit-Innovation”. Its terms are as follows (Greenlogisticscapital, 2024):

- Financial support is provided for digitalisation of production processes that facilitate an increase in product quality and production management with the use of smart management information systems; implementation of additive productions (including 3D print); development and implementation of innovative products or products with higher indicators of quality;
- Applications for financing can be filed by small, medium, and large companies; the form of financing – is bank loans; the interest rate is lower compared to the German banking system;
- Sum of financing: from EUR 25,000 to EUR 2,000,000;
- Loan term: 1-10 years;
- Production capacities and HQ of production companies that seek this financing must be located in Hamburg.

One of the successful examples of using this form of financial support is the start-up Mellow Boards (Hamburg), which produces electromotive systems for skateboards. Financing within the Hamburg-Kredit-Innovation projects equalled 2 million euros in 2015. Successful implementation of the project allowed the company to ensure mass production of innovative products in the sphere of sports and entertainment, which led to the growth of the company's capitalization and integration in external markets (Mellowboards, 2024). Innovative technological solutions, which lie in the basis of electromotive systems to skateboards from Mellow Boards, were able to successfully compete with such global brands in this sphere as Jil Sander and Daimler. The high quality of products of Mellow Boards was a precondition for early payment of the credit. Targeted promotion, supported by reliable expert evaluations, became an additional direction for attracting financial support for high-tech productions.

2) Grant programme InnoRampUp, which is financed at the municipal level through IFB Hamburg, is aimed at supporting innovative companies and start-ups. Innovative production companies and start-ups in the sphere of high-tech production may also apply for financing. The conditions and features of this grant programme include the following:

- Companies must function in the market for at least two years and be registered and located in Hamburg;
- The sum of the grant within one project is no more than EUR 150,000;
- This programme includes one-time no-refundable financial support to innovative start-ups and companies aimed at receipt of socioeconomic and environmental results for the territory (improvement of consumer indicators of

product quality; growth of production and sales, which leads to an increase in GDP and employment of local population, etc.);

- In case of receipt of a grant, the company may receive a location for production and office from the municipality. These locations have good infrastructure;
- A serious obstacle to the receipt of the grant is the difficulty with the completion of the application and the unpredictable time required for the final result (consideration may take one year or even more).

This programme has the following indicators of efficiency (Innovationsstarter, 2024b):

- Financing has been conducted since 2013, the total funds allocated for this initiative equals 25.5 euros, as of 2024;
- The Centre for provision of Grants in Hamburg supports 182 teams, which were financed within this project (consultations, recommendations, legal support);
- Over one year, this centre can finance around 14 projects;
- The revealed problems and mistakes in interrelations between the centre and applicants are systematised and taken into account in future practice. Control of effectiveness is a guarantee of continuation of this programme. Its components include the return of the grant (profitability of sales of high-tech products; achievement of target priorities).

3) Grant programme InnoFounder, which is supported by the municipality with the help of IFB Hamburg. This programme is aimed at supporting micro companies (with no more than five employees) and start-ups, which plan on promoting and selling products whose technological indicators of quality are higher compared to rivals. This aspect is the key argument of the issue of the grant; its assessment requires attracting experts in the corresponding spheres.

This programme involves the following:

- Financing of EUR 2,500 per month per employee for the period of 18 months;
- Over eighteen months, the start-up or company has to achieve competitive advantages in the indicators of product quality and volumes of sales which are envisaged by application's justification;
- Justification of the project, for which financing is allocated, must take into account all risks which concern the uniqueness and innovativeness of the products;
- High-tech production must be located in Hamburg.

The conclusions on the efficiency of this programme are as follows (Innovationsstarter, 2024a):

- 24 projects are financed during one year;

- The program has been functioning since 2018. Over 2018-2024, the total financing equalled EUR 8.7 million;
- The innovative centre of this programme management continues supporting (organisational help, legal issues, registration of trademarks, etc.) 122 teams. This centre functions to achieve the goals of innovative development and technologization of the infrastructure and sectors of the economy of Hamburg.

4. DISCUSSION

The considered directions of the improvement of financing of an increase in product quality based on smart management information systems have various levels of dissemination and scientific justification.

The direction that is realised within the Equipment-as-a-Service model (renting products and technologies) is used by individual subjects but is not that widespread in sectors that require reformation. At the current stage, there is no sufficient scientific and practical framework in this sphere that would ensure conceptual, legal, and organisational aspects of the application of this model. However, based on the distinguished advantages, it has further prospects for implementation. It is possible to assume that this model can be modified given the realities of emerging economies in the context of an increase in technological support. This improvement is possible through the attraction of the world's leading manufacturers of high-tech equipment and innovative technologies as lessors. This cooperation might be possible by the initiative of the governments of developing countries which are interested in economic growth through an increase in product quality in the main sectors of the economy. In this case, the government could guarantee conditions that are necessary for a partnership within the Equipment-as-a-Service model: Internet speed and coverage, safety, and normative and regulatory basis which regulates the protection of rights and interests of foreign companies in the country.

Financial support connected with the government's help at different levels of management is especially relevant in countries with decentralised management. The above examples of grants from the municipal authorities of Hamburg demonstrated their effectiveness and importance for promoting technologies and technological growth of the territory. The system of municipal support through grants is used to raise the innovative development of industry and the growth of

the quality of high-tech products. It is peculiar to developed countries with high financial capabilities. Support of high-tech productions through regional crediting programmes could be better adapted in developing countries. This is due to the possibility of the return of finances spent by the municipal entity for the innovative growth of companies.

Financial support through the demonstration of guaranteed advantages of future innovative results and growth of product quality might become very promising. To adapt it, it is necessary to use a large range of knowledge in the application of AI technologies, including the visualisation of efficiency with the help of neural networks. It is also necessary to seek help from experts in the sphere because their support might become decisive in the justification of the project.

5. CONCLUSION

Based on the above research, it is possible to make the following conclusions:

1. The key focus of innovative start-ups and companies in the sphere of improvement of financial support of raising product quality, which are issued with the help of smart management information systems, is connected with optimal conditions for the achievement of technological growth and business goals. The selection of these conditions depends on the potential of high-tech companies and start-ups and their management's ability to inform interested parties about the perspective of innovative activities. In this case, substantiation of future social, environmental, and network effects must be realistic and stimulate support.
2. Sectorial development of the country depends on the activities of innovative companies and talented specialists who can create unique solutions that ensure an increase in value-added products through the growth of their quality and the creation of new consumer qualities. Such results are possible in conditions that conform to science and technology. Therefore, technological strategies of territories, municipalities, regions, and countries must be focused on the possibility of finding funds for new inventions and their implementation. Governments of different levels might become examples of constructive management in the sphere of science and technology at a higher level, seeking the efficiency of the management of corporations and small and medium high-tech companies, which achieved high socioeconomic and environmental results. In this case, it is necessary to comprehensively evaluate the promising subjects of industry that can participate in the innovative development of the country.

References:

- Azadi, M., Moghaddas, Z., Farzipoor Saen, R., & Hussain, F. K. (2024). Financing manufacturers for investing in Industry 4.0 technologies: internal financing vs. External financing. *International Journal of Production Research*, 62(22), 8056-8072
- Greenlogisticscapital (2024). Hamburg-Kredit Innovation. Retrieved from <https://www.greenlogisticscapital.hamburg/foerdermittel/regional/hamburg-kredit-innovation> (Accessed: 04.09.2024)
- Hillemann, D., & Ehls, T. (2022). 7 German funding opportunities are now of interest to startups. Retrieved from <https://www.fieldfisher.com/en/insights/7-german-funding-opportunities> (Accessed: 04.09.2024)
- Innovationsstarter (2024a). InnoFounder. Zuschüsse für junge innovative Hamburger Startups. Retrieved from <https://innovationsstarter.com/innofounder/> (Accessed: 04.09.2024)
- Innovationsstarter (2024b). InnoRampUp. Zuschüsse für technologisch hoch innovative Hamburger Startups. Retrieved from <https://innovationsstarter.com/innorampup/> (Accessed: 04.09.2024)
- Ismanov, I. N., Muminova, E. A., Rasulova, S. X., & Shabaltina, L. V. (2024). Influence of financing innovations on information systems management in the digital economy. *Proceedings on Engineering Sciences*, 06(3), 1145-1152. doi: 10.24874/PES06.03A.007
- Kim, J., Jeong, H.-r, & Park, H. (2023). Key Drivers and Performances of Smart Manufacturing Adoption: A Meta-Analysis. *Sustainability*, 15(8), 6496. <https://doi.org/10.3390/su15086496>
- Kusakina, O.N., Bannikova, N.V., Morkovina, S.S., Litvinova, T.N. (2018). State stimulation of development of small entrepreneurship in developing countries. *European Research Studies Journal*, 19(2 Special Issue), 276-284.
- Kulezak, M. (2024). OEM servitization strategies: Why Equipment as a Service hasn't taken off yet. Retrieved from <https://iot-analytics.com/oem-servitization-strategies-equipment-as-a-service/> (Accessed: 04.09.2024)
- Law, R. H. (2023). UK government grants £75m to regional innovation hubs. Retrieved from https://nationaltechnology.co.uk/UK_government_grants_75m_to_regional_innovation_hubs.php (Accessed: 04.09.2024)
- Liang, C., Wang, X., Gu, D., Li, P., Chen, H., & Xu, Z. (2023). Smart Management Information Systems (Smis): Concept, Evolution, Research Hotspots and Applications. *Data Intelligence*, 5(4), 1-29. doi:10.1162/dint_a_00231
- Mellowboards (2024). In 3 years from dREAM TO dream product. URL: <https://www.mellowboards.com/en/story/> (Accessed: 04.09.2024)
- MPA (2024). Financing smart manufacturing. Retrieved from <https://www.mpa.co.uk/news-insights/mpa-research/financing-smart-manufacturing/> (Accessed: 04.09.2024)
- Phuyal, S., Bista, D., & Bista, R. (2020). Challenges, Opportunities and Future Directions of Smart Manufacturing: A State of Art Review. *Sustainable Futures*, 2, 100023. <https://doi.org/10.1016/j.sfr.2020.100023>.
- Rapidrobotics (2024). Robots in action. Retrieved from <https://www.rapidrobotics.com/capabilities/robots-in-action> (Accessed: 04.09.2024)
- Rösler, J. & Friedli, T. (2021). "A Capability Model for Equipment-as-a-Service Adoption in Manufacturing Companies". Progress in IS, in: Shaun West & Jürg Meierhofer & Christopher Ganz (ed.). Smart Services Summit, 59-71. Springer. DOI: 10.1007/978-3-030-72090-2_6
- Spire (2024). Precision satellite manufacturing made easy. Retrieved from: <https://spire.com/space-services/satellite-manufacturing/> (Accessed: 04.09.2024)
- Stojkovski, I., Achleitner, Ann-K. and Lange, T. (2021). Equipment as a Service: The Transition Towards Usage-Based Business Models. <http://dx.doi.org/10.2139/ssrn.3763004>
- Wachs, D. (2024). "Power by the hour" - Key success factors for the disruptive world of Equipment as a Service (EaaS). Bearingpoint. Retrieved from <https://www.bearingpoint.com/en/insights-events/insights/easy-does-it-for-oems/> (Accessed: 04.09.2024)
- Wang, Y. L., Song, M. L., Yang, L., Chen, J. H., & Li, P. (2024). Financing green innovation: A simulation approach for manufacturing enterprises. *International Journal of Simulation Modelling*, 23(3), 495-496

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