DOI: https://doi.org/10.32782/2524-0072/2024-68-55

UDC 332.146

INNOVATIVE POTENTIAL OF ENTERPRISE: CONCEPTUAL AND CATEGORICAL APPARATUS AND ECONOMIC AND MATHEMATICAL MODEL OF VALUATION

ІННОВАЦІЙНИЙ ПОТЕНЦІАЛ ПІДПРИЄМСТВА: ПОНЯТІЙНО-КАТЕГОРІАЛЬНИЙ АПАРАТ ТА ЕКОНОМІКО-МАТЕМАТИЧНА МОДЕЛЬ ОЦІНКИ

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The article is devoted to the study of the innovative potential of the enterprise, in particular, the conceptual and categorical apparatus and the development of the economic-mathematical evaluation model. The work analyzes the essence and components of innovative potential, which include financial, organizational, personnel, technical and technological, and intellectual resources. It was established that the innovative potential of the enterprise is a resource that not only determines its possibilities for creating innovations, but also requires a complex approach to management to ensure long-term development. Particular attention is paid to the definition of innovation potential through the prism of its influence on the development and implementation of innovations that allow enterprises to achieve competitive advantages and ensure sustainable development in the conditions of a changing market environment. It was determined that the innovative potential of the enterprise is a set of tangible and intangible resources that ensure the ability of the organization to develop and implement new products, processes and services. It has been established that innovative potential is an important element for achieving the strategic goals of the enterprise, developing and maintaining competitive advantages in the market. It was found that the main factors affecting the innovative potential of the enterprise are the presence of highly qualified personnel, the development of intellectual capital, the ability to implement the latest technologies and established partnership relations with external business entities. The article examines the methods of evaluating innovation potential using economic and mathematical models that allow determining the effectiveness of using available resources and identifying potential opportunities for their development. It has been established that an important aspect of the management of innovation potential is the availability of sufficient funding for the implementation of innovations, as well as the creation of an innovative climate in the organization. As part of the study, a model for determining the level of innovation potential was proposed by analyzing the financial resources of the business entity for their availability to cover current costs and the formation of reserves to ensure innovative activity.

Keywords: innovative potential, enterprise, economic-mathematical model, resources, assessment, innovative activity, competitive advantages.

Стаття присвячена дослідженню інноваційного потенціалу підприємства, зокрема понятійно-категоріального апарату та розробці економіко-математичної моделі оцінки. У роботі аналізується сутність та складові інноваційного потенціалу, які включають фінансові, організаційні, кадрові, техніко-технологічні та інтелектуальні ресурси. Встановлено, що інноваційний потенціал підприємства є ресурсом, який не лише визначає його можливості для створення інновацій, але й вимагає комплексного підходу до управління для забезпечення довгострокового розвитку. Окрему увагу приділено визначенню інноваційного потенціалу через призму його впливу на розвиток і впровадження інновацій, що дозволяють підприємствам досягати конкурентних переваг і забезпечувати стійкий розвиток в умовах змінного ринкового середовища. Визначено, що інноваційний потенціал підприємства є сукупністю матеріальних і нематеріальних ресурсів, які забезпечують здатність організа-

ції розробляти і впроваджувати нові продукти, процеси та послуги. Встановлено, що інноваційний потенціал є важливим елементом для досягнення стратегічних цілей підприємства, розвитку та збереження конкурентних переваг на ринку. Виявлено, що основними факторами, які впливають на інноваційний потенціал підприємства є наявність висококваліфікованих кадрів, розвиток інтелектуального капіталу, здатність до впровадження новітніх технологій і налагоджені партнерські відносини з зовнішніми суб'єктами господарювання. У статті розглядаються методи оцінки інноваційного потенціалу з використанням економіко-математичних моделей, що дозволяють визначити ефективність використання наявних ресурсів і виявити потенційні можливості для їх розвитку. Встановлено, що важливим аспектом щодо управління інноваційним потенціалом є наявність достатнього фінансування для реалізації інновацій, а також створення інноваційного клімату в організації. В рамках дослідження запропоновано модель визначення рівня інноваційного потенціалу шляхом аналізу фінансових ресурсів суб'єкта господарювання на предмет їх наявності для покриття поточних витрат та формування запасів для забезпечення інноваційної діяльності.

Ключові слова: інноваційний потенціал, підприємство, економіко-математична модель, ресурси, оцінка, інноваційна діяльність, конкурентні переваги.

Statement of the problem. The innovative potential of the enterprise is an important factor of its competitiveness and sustainable development in the context of rapid changes in the market situation and technological progress. However, the lack of certainty in the interpretation of the very concept of «innovation potential», the variety of approaches to its assessment and the lack of generally accepted methodological foundations complicate the process of its management and development at the enterprise level. This, in turn, leads to incomplete use of available opportunities enterprises in the implementation of innovative strategies. Therefore, there is a need to clarify the conceptual apparatus of innovation potential, as well as to develop effective economic and mathematical models for its assessment, which would increase the accuracy of assessment and improve management decisions on the development of innovation potential.

Analysis of the latest research and publications. In modern scientific literature, the issues of innovative potential of enterprises are actively studied. In particular, the most significant developments in the direction of interpretation and assessment of the innovative potential of enterprises include the works of such scientists as: Marchenko V. M. [5], Martiusheva L. S., Kalyshenko V. O. [6], Chaban V. H. [9], Fedulova L. I. [12] and others. However, to date, most of the available studies do not provide a single methodological approach to the interpretation and assessment of innovation potential, which complicates the comparison of results and the development of a general economic and mathematical model for assessing assessment.

Highlighting previously unresolved parts of the general problem. Despite a significant number of works devoted to innovation potential, a number of unresolved problems remain. In particular, there is a lack of a generalized conceptual approach that would cover various aspects of innovation potential and allow to adequately assess its role in the development of enterprise. The lack of a comprehensive economic and mathematical valuation model that could take into account both quantitative and qualitative characteristics of innovation potential also remains a problem. This complicates the adoption process management decisions on the effective use of enterprise resources to achieve innovative goals.

Formulation of the goals of the article. The aim of the scientific work is to develop a conceptual approach to determining the innovative potential of enterprise and substantiating the economic and mathematical model for its evaluation. The research consists in solving a number of tasks, in particular: to clarify the conceptual and categorical apparatus of innovation potential, defining its main components and connection with the general resources of enterprise; analyze the existing methods for assessing innovation potential and identify their shortcomings; develop economic and mathematical model, which will allow a comprehensive assessment of the innovative potential of the enterprise, taking into account its resource base and ability to implement innovations; to offer practical recommendations on the application of the developed model to improve the efficiency of management of the innovative potential of enterprise.

Presentation of the main material of the research. The potential of an enterprise is a multifaceted concept that reflects a set of resources, opportunities and values available to achieve strategic goals and ensure the stable development of the enterprise [1]. This concept includes not only material resources, such as equipment and finance, but also intangible ones – intellectual, innovative, human and other types of potentials that contribute to the development and strengthening of the competitiveness of the enterprise.

The potential of an enterprise can be considered as a set of different resources and capabilities, which are divided into several key categories [2; 3]:

1) natural conditions and resources are material and energy resources available to the enterprise, such as raw materials, water resources, energy capacity. They are a fundamental component, since without basic resources the production process is impossible;

2) opportunities – the ability of the enterprise to innovate, expand markets, improve product quality and meet customer needs. Opportunities are created at the expense of intellectual and human resources, including knowledge, experience and competencies of employees;

3) inventories are both material and financial resources used to ensure the continuity of the enterprise. These can be reserve stocks of raw materials, finished products or financial reserves that provide stability in the face of market fluctuations;

4) values – encompass corporate culture of enterprises, ethics, reputation and social responsibility. They create a positive image of the company, attracting employees and customers, and contribute to strengthening ties with partners and investors.

In this context, it is worth noting that one of the important characteristics of potential is the synergistic effect that occurs when different types of potentials interact. Synergy is an effect in which the interaction of individual components gives a greater result than the sum of their individual efficiencies [4; 5]. This means that the combined use of different types of potentials leads to an increase in the overall efficiency of the enterprise.

The implementation of a synergetic approach to potential management allows, firstly, to increase the overall efficiency of business processes – due to the well-established interaction of different types of potentials, the enterprise is able to achieve higher results; secondly, to ensure the flexibility and adaptability of business processes – the interaction of potentials allows you to quickly respond to changes in market conditions, develop new areas of activity and quickly change strategy; thirdly, to reduce the risks of the functioning of enterprises – synergistic interaction increases the stability of enterprises, since each type of potential can compensate for the weaknesses of the other; fourthly, to ensure the generation of competitive advantages – the use of synergy provides a unique combination of resources and opportunities, which makes the company's products or services more attractive to consumers, which allows you to maintain or increase its competitive position in the market.

For a deeper understanding of the synergy effect, we present a table of examples of interaction of different types of potentials (Table 1).

Thus, the potential of an enterprise is a dynamic set of resources, opportunities and values that can ensure its development and competitiveness. Due to the synergistic effect, the ability to combine different potentials allows you to achieve higher efficiency than when using them separately. Potential management based on a synergistic approach allows the enterprise to better use its resources, increase productivity and adapt to the challenges of today's market.

Based on the above, the term «potential» is a universal concept that can be applied to a variety of resources and areas of activity. In its broadest sense, capacity describes the capabilities or

Table 1

Synergistic effect from the combination of enterprise potentials

Combination of potentials	Synergistic effect
Innovative and intellectual potential	Working together on new products or services using the knowledge and experience of employees helps to expand market opportunities and improve product quality
Innovation and human resources	development of new products and (or) optimization of business processes taking into account the experience and knowledge of personnel
human and economic potential	Investing in staff training and development improves employee skills and reduces costs associated with employee turnover and underperformance
scientific, technical and production potential	The development of new technologies and their introduction into production ensure an increase in the quality, productivity and competitiveness of products

Source: author's development

abilities of a particular system, organization, or individual to achieve specific results, develop, and improve. This concept has become especially relevant in today's environment, when the development and sustainability of many organizations depend on the ability to use their resources efficiently.

In the scientific literature, there is a classification of different types of potentials, which differ in their functions and resource base [3; 6; 7]:

1) innovation capability – reflects the system's ability to create and implement new technologies, products, or processes. It is the basis for continuous improvement, adaptability, and competitiveness in the face of rapid changes in the market;

2) intellectual potential – encompasses knowledge, skills and creativity that contribute to the generation of new ideas and increase the effectiveness of activities. This is a set of competencies of employees that allows the organization to develop and achieve strategic goals;

3) scientific and technical potential is defined as the ability to conduct scientific research and develop the latest technologies. It plays a key role in the development of scientific advances, innovation, and technological advancements;

4) human resources – characterizes the organization's capabilities for personnel management and development, in particular, the attraction of qualified specialists, their training and professional growth. The stability and productivity of the organization depends on human resources;

5) economic potential – includes financial, material and other resources that ensure the stability and efficiency of activities. This is the ability of the system to stable economic development, income growth and cost reduction;

6) production potential is characterized by the capabilities of the production system, in particular its equipment, technologies and the level of organization of processes. It determines the ability of an organization to ensure that products are produced in accordance with market requirements.

It should be noted that the bulk of publications is devoted to the analysis of economic and intellectual potential, by which many authors generally understand the ability of an economic entity to function effectively with the optimal use of available resources. Such allocation of structural elements of innovation potential is based on a methodological approach to the study of innovation potential as an economic category. For example, some authors consider it expedient structure it as a multicomponent system with a deterministic combination of characteristics of each of them. Proponents of the resource approach regarding the term of innovation potential consider it expedient to integrate the totality of accumulated resources (human, technological, financial and scientific) as the ability and readiness of the enterprise to implement innovations [7–9].

This approach to the study of the innovative potential of enterprise is based on resources of a predominantly material nature, which determine the innovative capabilities of the enterprise. Such a view somewhat contradicts the position of scientists in the period of the origin of the term «innovation» itself. Thus, the well-known scientist Shumpeter J. noted that any changes are the result of serious intellectual work, which, in turn, is the basis for the formation of innovations [10; 11]. Thus, despite the fact that the resource approach is quite classical in the understanding of intellectual potential, it has a number of disadvantages. The identification of the terms «innovation potential» and «resources» is not entirely correct, since the value of resources is not always equivalent to the value of innovation potential and does not have a correlation with it. Moreover, according to this approach, as resources grow, so should the innovation potential. However, in practice, this is not always the case: There are enterprises with huge amounts of resources for growth and development, but for some reason they have a rather low level of innovation potential, and vice versa, there are organizations that generate innovative products and technologies due to a small volume.

The existing effective approach to the structure of the innovation potential of enterprise is focused on the cumulative result of innovation activity (Fig. 1).

Considering the issue of interpretation of innovation potential from the standpoint of resource capabilities, scientists note that it contains a set of tangible and intangible assets of the enterprise, which are able to intensify the activities of the enterprise to achieve innovative goals. For example, Chaban V. H. [9] notes that innovation potential is a set of existing and hidden opportunities to attract and use resources aimed at perceiving, implementing innovations that can be used to achieve the goals of economic entities. This point of view is relevant for enterprises of domestic production, when the potential for the

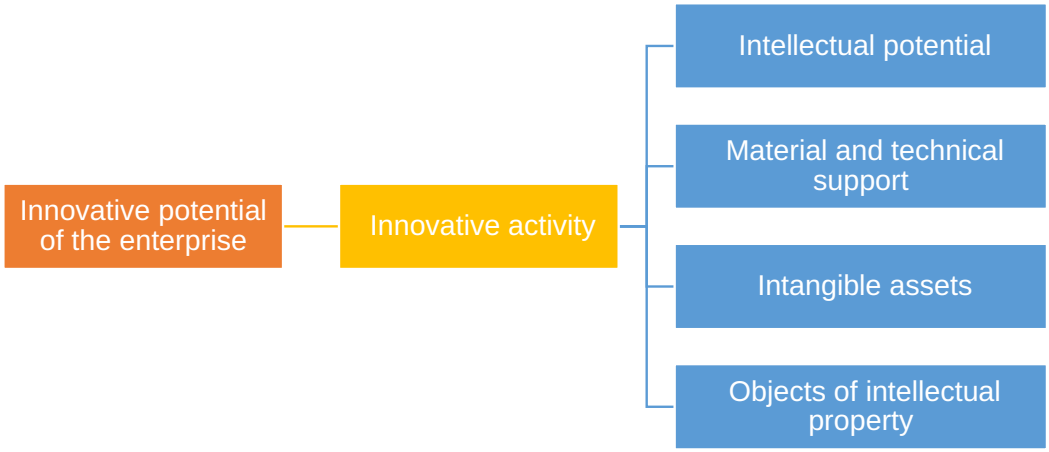

Fig. 1. Resource approach to the structure of innovation potential of enterprise

Source: formed by the author

implementation of innovative goods, processes and services is quite large, but is unused due to the lack of strategic orientation of the enterprise to the innovation, lack of stable financial support, as well as due to the lack of necessary knowledge and skills among employees. Without proper attention to the development of innovative potential, enterprises risk losing competitive advantages and opportunities for growth in the market. In confirmation of the above, Fedulova L. I. [12] notes that the key aspects of innovation potential are not only the available resources, but also the ability of the enterprise to adapt to changes taking place in the external environment.

The importance of this approach lies in the realization by enterprises that innovative potential is not only investment in the latest equipment or technologies, but also stimulation of creative activity of personnel, creation of conditions for the development of ideas and their effective implementation. Therefore, the development of innovative potential should be part of the long-term strategy of the enterprise, taking into account the needs of the market and the readiness of the organization for change.

On the basis of the study, we highlight three key features of the innovative potential of enterprise:

1) the innovative potential of the enterprise is equivalent to its real innovation capabilities;

2) innovative capabilities of the enterprise are dynamic and capable of growth in the implementation of competent and effective management of them;

3) the innovative potential of the enterprise is a tool for creating, developing and reproducing innovations.

One of the key tasks of the development of the innovative potential of the enterprise is the need to transform the knowledge, experience, competencies of intellectual human capital, which is a value for the effective functioning of production, management, technological and other processes of the enterprise [13]. This transformation is the process of transferring knowledge into material form, while its separation from the carrier and transition into an autonomous form of existence that can be used for a long period of time.

It should be noted that the innovative potential of the enterprise is the integration of certain resources of intellectual, financial, technical nature, which together provide the enterprise with the opportunity to form and reproduce innovative goods.

Summarizing the above material, it should be noted that the innovative potential of an enterprise is the resource that is able to influence the innovation activity and performance of an enterprise in the field of growth and development of innovations. The value of innovation potential is not so much its identification and evaluation in absolute or relative terms, but in the opportunities received for the enterprise to use it.

The typology of innovation potential, which determines the innovative activity of enterprise, proposed by the authors, consists in a combination of four main resources: intellectual, organizational, market and material-technical. It is in these four resources that there are opportunities for enterprises to reproduce and increase innovative products [14–16].

The typological structure is divided into separate blocks for the possibility of detailing their characteristics:

1) intellectual potential is a value that lies in knowledge. It is manifested in technological, production, managerial abilities, in production, embodied in personnel, etc. Innovative knowledge presented within the intellectual potential block is more than just knowledge, it is new «strong» knowledge, abilities, creativity, etc. It is this block that determines the quality of generation of unique ideas and projects. Intellectual potential, with proper management, is transformed into intellectual capital, that is, capital that generates profit for the owner;

2) organizational potential is a resource provided by intellectual property, technological, managerial, production, marketing processes; information communications system. Organizational potential is the value of the enterprise contained in the objects of intellectual property;

3) material and technical resource is a value expressed in the material capabilities of the enterprise, such as fixed assets, production equipment of the enterprise, financial resources. This block provides a material opportunity for the formation of an innovative product and is irreplaceable and important;

4) market potential is, first of all, a resource contained in professional partnerships and long-term work with them. We are talking about external partners, investors, venture funds, etc. Market potential is the value inherent in a relationship. This resource determines the capabilities and abilities of the enterprise to establish communications with the external environment.

Formation of the innovative potential of enterprise is carried out by evaluating its activity, taking into account the formed system of statistical indicators. As the simplest components (elements) of potential, we can consider the resources of reproduction, such as labor, land, capital, information and initiative. The main components of innovation potential, in turn, can be considered the innovation climate and financial, organizational, scientific, technical and technological, personnel, information and communication potential [17; 18].

Assessment of the components of innovation potential is possible only on the basis of the formed information base. Considering the information support of statistical research of the innovative potential of the organization, it is necessary, on the one hand, to start from its structure: financial, organizational, scientific, technical and technological, personnel, information and communication components and innovation climate, and on the other hand, from the principles of formation of statistical indicators of the innovative potential of the organization.

As a rule, normative values, indicators of competitors, indicators of a successful stage of management, values predicted in retrospect on the basis of expert assessments can act as reference values. In continuation of the above, the known values of the level of innovation potential in dynamics make it possible to assess the intensity of innovative development.

To do this, let's use the average growth rate formula. Basic growth rates reflect the intensity of growth over all time, and chain growth rates show its intensity by years, growth rates show an increase compared to the base year and each previous year.

Having drawn an analogy with the intensity of economic development, it is possible to propose a formula for the intensity of innovative development. As an example, the generalized characteristic of the intensity of economic development for n years is calculated as the geometric average of the annual rates according to the formula (1):

$$K = \sqrt[n]{K_1 * K_2 * \ldots * K_n}$$

or (2)

$$K = \sqrt[n]{\frac{Y_n}{Y_0}},$$

where K – annual growth rate expressed in coefficients; n – number of years (excluding basic); Y – absolute levels of series of dynamics.

Then the generalized characteristic of the intensity of innovative development of the organization can be determined by the formula (3):

$$IID = \sqrt[n]{GR(IP)_1 * GR(IP)_2 * \ldots * GR(IP)_n}$$

or (4)

$$IID = \sqrt[n]{\frac{IP_n}{IP_0}}.$$

In the evaluation process, special attention is paid to aspects such as the level of technological development, the qualifications of personnel, the ability to research and development, as well as the availability of resources for the implementation of new ideas. In addition, the assessment of innovation potential allows you to identify gaps that may hinder development, such as lack of funding, insufficient motivation of employees to innovate, or limited access to the latest knowledge and technologies.

Assessment of the innovative potential of an enterprise becomes necessary when the prerequisites for its implementation and further

development are created [16]. Such conditions are, firstly, the desire of the management apparatus to organize innovation activity, to organize innovation activity, to involve intrapreneurs in it, or to assess their abilities for intrapreneurship; secondly, the desire of members of the workforce to engage in innovative activities. In turn, the allocation of that part of the team that will make up the human capital of the organization.

It is obvious that if there is no desire on the part of the manager and members of the workforce to engage in innovative activity, then innovation activity is impossible. It is necessary to change the workforce, attract new energetic employees seeking self-development. When changing the composition of the workforce, it is necessary to check the conditions for the implementation of innovative potential again. If at least one of the conditions is not met, innovation is impossible.

If innovation activity is possible, it is necessary to determine the financial capabilities of the organization, which allow part of the income or borrowed funds to be invested in the development of innovations. As research shows, the majority of scientists are inclined to the resource approach, according to which the diagnostics of the level of innovative potential of enterprise is carried out for the availability of free financial and economic resources for the implementation of innovation activities [16]. Thus, Chaban V. H. [9], Levkovych O. V., Kalashnikova Yu. M. [19], Kolmakova O. M., Smachylo V. V. [20] propose to determine the level of innovation potential by analyzing the financial resources of an economic entity for their availability to cover current costs and formation of stocks in the context of ensuring innovation activity. This approach allows to determine how efficiently the enterprise will be able to implement long-term investments in the context of ensuring innovation activity. This approach allows to determine how efficiently the enterprise will be able to implement long-term investments in simultaneous provision of financial needs of current production and economic activities.

Based on the definition of the values of the function $IP^* = IP_i(X_i)$, four main types of innovation potential of enterprise can be distinguished (5) [16]:

$$IP^* = \left\{\left[IP_1(\pm X_1)\right],\left[IP_2(\pm X_2)\right],\left[IP_3(\pm X_3)\right]\right\},$$

where, IP^* – level of innovation potential; $\pm X_1$ – surplus (+) or shortage (-) of own sources of funding; $\pm X_2$ – excess (+) or shortage (-) of own and long-term borrowed funds; $\pm X_3$ – surplus (+) or shortage (-) of total financial resources; $X_{1,2,3}$ – partial model components.

Partial components of the economic and mathematical model, in turn, are determined according to the system of conditions (6) (Table 2):

$$IP_i(X_i) = \begin{cases} 1, K_i \geq 0 \\ 0, K_i < 0 \end{cases}.$$

The company's ability to create innovative products and provide unique services is currently not so much a tool for the formation of a stable financial flow, as it reflects the need

Table 2

Sources of financing and levels of innovative potential of enterprises

Sources of cost coverage and innovation potential indicator	Analytic interpretation	Brief description of the level of innovative potential of enterprises
Own funds	$IP = \{1,1,1\}$	High level of self-sufficiency. Innovative development strategies can be implemented by an enterprise without external borrowing
Equity plus long-term loans	$IP = \{0,1,1\}$	Normal financial provision of production with the necessary resources. To effectively attract new technologies to economic turnover, a certain amount of borrowed funds should be used
Equity plus long-term and short-term credits and borrowings	$IP = \{0,0,1\}$	Satisfactory financial support for current inventories and costs. To implement innovative development strategies, it is necessary to attract significant financial resources from external sources
Critical level of financial stability	$IP = \{0,0,0\}$	Deficit or absence of sources of cost formation

Source: formed by the author

of the enterprise to keep up with the times. The current speed of development of technologies, nanotechnology, microbiology, etc., is a benchmark for the innovation movement for enterprises, which allows you to optimize internal production processes. Obviously, it depends on how correctly and efficiently it will be built management of intellectual resource, which determines the possibilities of innovative development within the framework of the economic system, depends on the result of innovation activity [21; 22].

Conclusions. On the basis of the carried out research, it is expedient to note that the main features of the essence of the innovative potential of enterprise are: the innovative potential of enterprise is the resource of the enterprise, which allows to create, develop, reproduce and implement innovations consisting of deterministic elements; the potential for creating innovations is a conditional value, the return on which is determined by the effectiveness of its management; The innovative potential of an individual enterprise is differentiated, i.e. equivalent to the resource capabilities of the enterprise.

Assessment of the innovative potential of enterprise with the help of the proposed economic and mathematical model allows to objectively measure and analyze its level. The use of such models is necessary to optimize the processes of resource use and achieve high results in the field of innovation. They contribute not only to a detailed analysis of existing opportunities, but also to the identification of potential weaknesses in the innovation potential management strategy.

Thus, the innovative potential of the enterprise is a key factor of its competitiveness in the market, and its effective management allows not only to achieve innovative goals, but also ensures the sustainable development of the organization in a fast-paced market environment.

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