The development of risk-oriented methodology to identify the intellectual capital cost management in the information technology era

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ABSTRACT: *To develop the methodological recommendations based on the concept of intellectual capital for the subjective evaluation of the importance of its components for a particular business and their vulnerability to risks leading to a decrease in the value of intellectual capital with the information technology is proposed.*

Using the morphological analysis technique, the authors highlight the key components of intellectual capital that are valued in terms of utility and rarity. Using questionnaire, a survey carried out in the form of interviews with 72 representatives of small, medium-sized and large business; the importance of structural components of intellectual capital has been identified for different size businesses and influence of information technology, as well as the distribution of risks of utilityand rarity loss has been obtained depending on types of intellectual capital.

The differences in the structure of the intellectual capital of small, medium-sized and large organizations of the Rostov region, associated with the increase of the importance of organizational capital with the consolidation of the organization, are identified. It is established that the greatest concerns among respondents is associated with the risk of utility loss of existing intangible assets, while risks, leading to the loss of rarity, are not perceived as serious danger.

The results of the study allow defining strategic pathways to invest funds in maintaining and increasing the value of intellectual capital using the risk-based approach. Intangible assets,which are identified as most important, as well as loss of their value to the specific organization, vulnerable to the risks, should become priorities in the intellectual capital cost management.

Categories and Subject Descriptors:
[H.5.3 Group and Organization Interfaces]: Organizational design; **[K.4.3 Organizational Impacts]**

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1. Introduction

Intellectual capital, as the value of the intangible assets of the organization, which can be used by the organization for obtaining future benefits, is an important source of development and incontestable competitive advantage in

in the contemporary economy. The majority of scholars (Brooking, 1996; Edvinsson and Malone, 1997; Stewart, 1997; Sveiby, 1998; Sullivan, 2000; Lev, 2002; Gaponenko, 2014) agree that intellectual capital consists of three components: human capital (associated with cognitive abilities of employees), organizational capital (internal structures of the organization, ensuring the preservation and transmission of information that can become knowledge), and customer capital (relationships with the outside world that would produce income generation).

The interest in knowledge as the source of wealth of the organization gave rise to the need to assess their value, because intellectual resources can be purchased, sold, exchanged, reduced in the course of their use or, conversely, self expand. Two directions are defined in appraisal activities – cost appraisal directly for the purpose or sale (the"appraisal" is used by the British professional terminology) and the probable cost valuation to highlight the growth prospects of the object'svalue and its most effective use. This article deals with the research of intellectual capital for management and advisory services using information technology.

Cost management of intellectual capital is impossible without a clear understanding of the criteria, which should be used when determining the priority areas for investment of funds in the intellectual capital development. The majority of the researchers proposes to rely on the assessment of the profitability of the intangible assets to highlight promising areas of intellectual capital cost management as well as the whole business management in general (Brooking, 1996;Kobersy, I. S. & Barmuta &others, 2015). However, the allocation of revenues generated by a particular intangible asset is difficult and sometimes unsolvable problem. In this article, we propose to look at the situation from a different perspective and define strategic pathways of intellectual capital management based on assessments of the amenability of intangible assets, included in the intellectual capital, to the risk of utility and rarity loss, rather than income-based assessment, because the loss of these properties of the asset leads to the loss of its value. In this stage, it is important to know the contribution of a particular component in the formation of the total value of the intellectual capital.

Use of risk-oriented concept of intellectual capital management is related to the increase of interrelated hazards and risks in the external environment, which if implemented, leads to stronger global crises. Such conditions hamper the adherence to the fundamental principles and assumptions of previously developed theories of intellectual capital as well as assess its value *and properties*, such as equilibrium, sustainability and stability. It is therefore necessary to seek new approaches to intellectual capital management in a volatile external environment. The present study is aimed at the development of the intellectual capital concept and its cost assessment theory towards the implementation of the basic framework in a context of uncertainty and risk.

Theoretical studies in the field of intellectual capital will be in demand if they find their application in practice. However, when studying the literature, it was revealed that despite the relatively developed framework, intellectual capital assessment and management practice has not yet become widespread. However, the importance of connections, relationships, experience and knowledge of employees and other intangible assets is recognized by many business participants. One of the reasons for the limited practical implementation of the developed theoretical concepts in the field of intellectual capital is the lack of methodological recommendations that would allow highlighting and describing the intellectual capital components of a specific organization, assessing their importance and value. Furthermore, most researchers of the intellectual capital are testing their designs at large organizations, for which there is enough public information about the financial performance and assets, as well as the results of research activities. Currently, the intellectual capital of small and medium-sized organizations remain virtually unexplored, and thus they are unable to effectively manage available intangible resources.

This article is aimed at solving the mentioned problems with the deployment of information technology, because its aim is developing methodogical recommendations for the subjective assessment of the importance of intellectual capital components of a particular business and their vulnerability to risks leading to a decrease in the value of intellectual capital. In addition, special attention is paid to the distinction of the intellectual capital of small, medium-sized and large businesses. Accordingly, the following hypothesis is suggested: the structure of the intellectual capital and the subjective estimate by entrepreneurs of the risks that impact individual intellectual capital components are interrelated and depend also on the size of the business and the impact of information technology.

This work is based on existing research on the concept and structure of intellectual capital and influencing risks, therefore, its content is considered in the following sequence:

- Development of recommendations to study the importance and vulnerability to risks of human, organizational and consumer capital cost, respectively;
- An empirical study in the form of questioning of entrepreneurs of small, medium-sized and large businesses;
- A comparative analysis of the perceived importance of the intellectual capital components for organizations involved in different size businesses, as well as building a relevant risk profile of the intellectual capital cost, differentiated depending on the size of the business and the influence of information technology;
- The conclusions resulting from the study.

2. Materials and methods

The value of the intellectual capital is never constant, since there is:

• The self-expansion of the cost in proportion to the generation of new knowledge in the light of technology infusion;

• Impairment of knowledge, which cease to be rare and becomes available according to the proliferation of new technologies;

• Reducing the ability of intangible assets to generate income. For example, the cost of human capital first increases,according to the training and gaining experience of employees, while then the value of such workers declines due to their aging and reduction of their physical and creative activity (Gaponenko, 2014).

We recommend exploring the factors leading to the impairment of the intellectual capital of the organization as the risks affecting the value of intellectual capital. Cause of risk is the uncertainty of information about future events sinceits sources lie in the political, legal, economic, environmental, social, technological, and information environment.

Analyzing known intellectual capital valuation methods, we can note that the possibility of accounting for risks exists only in those methods,which are based on the future cost performance of the property being appraised. The conducted research involves consideration of intellectual capital as the aggregate of its components – human, organizational and consumer capitals. Therefore, the value of intellectual capital should be based on a component-wise approach employing "asset by asset" valuation method. Such methods, based completely or partially on information about future events, include:

1) Monetary valuation methods of intellectual capital:

• Technology Broker (Brooking, 1996), Accounting for the Future (Nash, 1998), Total Value Creation (Anderson & McLean, 2000),and the Value Explorer (Andriessen D. & R.,Tissen, 2000);

2) Non-monetary valuation methods of intellectual capital:

• **Intangible Asset Monitor (Sveiby, 1998),**Value Chain Scoreboard(Lev, 2001), Skandia Navigator (Peña, 2005), and Balanced Score Card, (Kaplan & Norton, 1992)

Both these groups can be used for the purposes of risk-based management of intellectual capital and its cost.

For the purposes of this study, we used the Recommendations of the European Commission on the definition of micro, small and medium-sized organizations #2003/361/EC <URL: http>, as the main normative document of business segmentation according to business size. In accordance with these recommendations, small businesses were classified as organizations with up to 50 people and an annual turnover up to 10 million Euro, medium-sized organizations –from 51 to 250 employees and annual turnover up to 50 million Euros, while the rest of the organization was related to large business.

The study was conducted using questionnaires. In total 100 questionnaires were composed. They were sent by email to the representatives of top management of small, medium-sized and large businesses. Exactly 72 completed surveys were received back including,

• 31 questionnaire from individual entrepreneurs, small business owners;

• 34 questionnaires from representatives of the medium-sized business (individual entrepreneurs, directors, and deputy directors); and

• 7 questionnaires from the representatives of large business (top management).

The survey was carried out between May and July 2016. The average waiting period for the return of the questionnaire was one month. Sending the questionnaire was preceded by a verbal agreement of consent to answer the questions. Along with the questionnaire we have sent also materials explaining the basic concepts.

In accordance with the research purpose consisting in the evaluation of the relative importance of intellectual capital components, as well as obtaining estimates of risks that threaten the cost of the intellectual capital components, the questionnaire was divided into two parts.

In the first part, we asked to rate the importance to the business of particular intellectual capital components. The second part of the questionnaire was designed to assess the extent of risk that threatens the existing intellectual capital components.

When assessing risk, it is important also to consider the period during which risks are assessed. The period is defined by the objectives and the availability or lack of the previously developed intellectual capital management strategy. In this survey, we asked to assess the risks that might threaten the intellectual capital of a specific organization within the current year.

The questionnaire was prepared in semi-closed form – respondents were offered a list of intellectual capital components, which could be supplemented.

The questionnaire was comprised of three sections in accordance with the kind of intellectual capital.

The human capital (first section) included 9 categories of employees:

• responsible for the development of the organization;

• responsible for production operation (logistics, accounting, quality control);

• manufacturing products / providing services in the information technology;
• communicating with customers (sales managers);
• responsible for relations with regulatory authorities;
• creating new products and technologies;
• responsible for relations with suppliers;
• responsible for the promotion of the organization;
• sharing information within the organization using the information transfer technology.

A fragment of the first section of the questionnaire is presented in Fig. 1.

To complete the questionnaire, it was necessary to do the following:

1. To assess the importance for the organization of each component of human capital that is specified in column 2. To do this one had to color the corresponding figure in column 3 (hereafter all points are highlighted by coloring, since the questionnaireswere sent by email). The importance is determined by the extent to which one employee could be replaced quickly and inexpensively with another. The importance of employees having more experience, special knowledge, abilities and skills is valued at 5 points. The less is the employees' knowledge, valuable experience and other necessary skills, the lower the score. If employees, having a standard level of knowledge and skills, can easily be replaced by others, it is proposed to set their score at 0. If the importance of the employee is zero, all further risks will also be worth 0 points.

2. To assess the risk of human capital rarity loss. If the employee has a non-zero value of importance, then the interviewee has to assess various risks:

• the risk of employee's dismissal from the organization(for the forecast period, i.e. one year in current questionarrie).

• the risk of the emergence of more experienced and trained employees at competitors organization.

Figure 1 corresponds to low risk, 2 – medium risk, and 3 • high risk.

3. To assess the risk of human capital utility loss(ability to generate income). If it is expected that during the forecast period (one year in given questionary) the employee will retain his ability to bring income to an organization, it is necessary to select 0. If the employee would lose his potential to bring the income to the organization (due to illness, personal crisis, etc.). Then it is needed to score the risk depending on the expected degree of potential loss: 1 – low risk of loss, 2 – average risk of loss, 3 – high risk of loss.

4. If in column 2 there was no component important for the organization under study, then the interviewee could add such component himself and accordingly fill in columns 3-6.

Assessment of the Importance And The Riskiness of Human Capital Components (Reflecting employees skills and experience)

No	Component / human capitalcarrier	Importance of the component for your business	Assessmentof the risk of loss:		
				rarities	Utility in
			due to employee's dismissal	due to emergence of more experienced employee's incompetitive organization	terms of ability to generate income
1	2	3	4	5	6
1	Employees,responsible for the developmentof the organization	0 1 2 3 4 5	0 1 2 3	0 1 2 3	0 1 2 3
2	Employees, producing goods or providing services	0 1 2 3 4 5	0 1 2 3	0 1 2 3	0 1 2 3
	etc.				
	The proposed component	0 1 2 3 4 5	0 1 2 3	0 1 2 3	0 1 2 3

Figure 1. Fragment of first section of the questionnaire for risk assessment of intellectual capital

The second and third sections of the questionnaire were composed in a similar manner.

The second section was devoted to organizational capital. As indicated in work of Gaponenko, 2014, organiza-

tional capital consists of the following parts:

a) Knowledge that exists in the form of the results of intellectual activities, recorded on paper and electronic media and having legal protection. The questionnaire suggests to rate the importance and the riskiness of the loss of three relevant components: invention patents, utility model, and selection achievements; the certificate on useful model, trademark, service mark, right to use the appellation of origin; computer software protected by patent law, and databases;

b) Knowledge that exist in the form of results of the intellectual activities, recorded on paper and electronic media and not having legal protection. Four components were offered for rating: the results of R&D not protected by patent law; hardware and software; market research data, sales reports and other types of reports;and databases having no legal protection;

c) The systems of knowledge transfer through the information (communication) channels using technology inseparable from the organization. The questionnaire included 4 such components: interrelations with higher authorities; organizational structure of management, rules and procedures; job compensation and quality control management system; and organizational culture.

The second section of the questionnaire suggests to rate the importance of the component, in the form of a question: "How do you assess the contribution of this component in the generation of the organization's revenue?"It is proposed to rate the question similar to the first section of the questionnaire – the higher contribution, the higher the score.

It is proposed to assess the riskiness of loss of the organizational capital componentsas the following risks of loss:

• risk of rarity loss (inaccessibility for use by competitors) at legal or illegal usage of the results of intellectual activities or the reproduction of organizational structures by competitors. The more inaccessible is the object for competitors (the higher the confidence in the reliability of the legal protection and information security in the organization) the lower the risk of losing rarity;

• risk of utility loss due to the emergence of new more advanced results of intellectual activities, forms and structures of doing business, as well as incomplete extraction of potential income. The higher the risk, the higher the score.

A fragment of the second section of the questionnaire on the intellectual capital risk assessment is presented in Fig.2.

Assessment of the Importance And The Riskiness of Organizational Capital Components

No	Component / organizational capitalcarrier	How do you assess the contribution(importance) of this component inthe generation of organization's income?	Assessment of the risk of loss:		
			Rarities (inaccessibility foruse by competitors) atlegal or illegalusageby competitors of the results of intellectual activities or the reproductionof organizational structures	Utilityresultedfrom	
				the emergence of new, more advanced results of intellectual activities, business forms and structures	in complete ex - traction of potential income
1	2	3	4	5	6
a) the results of intellectual activities having legal protection					
1	Patents for invention, utility model or selection inventions	0 1 2 3 4 5	0 1 2 3	0 1 2 3	0 1 2 3
2	…				
	The proposed component	0 1 2 3 4 5	0 1 2 3	0 1 2 3	0 1 2 3

Figure 2. Fragment of second section of the questionnaire for risk assessment of intellectual capital

The third section of the questionnaire is focused on the assessment of consumer capital, which is represented by 4 components: communications and relationships with customers, ensuring repeat purchases or the influx of new customers; communications and relationships with suppliers, providing competitive advantages in price, quality, delivery terms and other benefits; communications and relationships with external bodies, contributing to the normal work of the organization or receiving new orders and lowering costs; public relations, ensuring the inflow of new customers or retaining existing ones.

In addition to assessing the importance of these components to the business, we proposed to assess risks of the following losses:

• the risk of rarity lossof these relations as the risk of copying organization's relations with suppliers, customers and external bodies by other organizations;

• the risk of the utility loss. The value of connections and relationships may be lost either due to the fact that the organization itself has ceased to inspire confidence, or by change in contact not depending on organization (exit of the provider from the market, the dismissal of the staff of the controlling entity, with whom a contact has been made, etc.). Accordingly, the loss of utility was evaluated in two aspects: loss of confidence and break of the contact independently of the organization.

The risk assessment score was established in the same way as in the previous cases: the higher the risk, the higher the score.

A fragment of the third section of the questionnaire is presented in Fig. 3.

Assessment of the Importance And The Riskiness of Consumer Capital Components

No	Component / consumercapitalcarrier	The importance of the component for your business	Assessment of the risk of loss:		
			Rarities when copying the system of relations by other organizations	Utility resulted from loss of trust to the organization for various reasons	Utility resulted from the termination of the contact that does notdepend on the organization
1	2	3	4	5	6
1	Communication and relationshipswith customers, ensuringrepeat purchasesorthe influx of new customers	0 1 2 3 4 5	0 1 2 3	0 1 2 3	0 1 2 3
…					
	The proposed component	0 1 2 3 4 5	0 1 2 3	0 1 2 3	0 1 2 3

The number of staff _____ Nature of business _____

The place of doing business _____

The age of your organization _____ Your position_____

Figure 3. A fragment of the third section of the questionnaire on intellectual capital risk assessment

The assessment methodology of the results obtained is as follows:

1. Priority rating of each type of intellectual capital (S_k) is conducted by the formula:

$$S_k = \frac{\sum_{i=1}^{n} g_{ki}}{G_{k(max)}}$$

where g_{ki} – is the total sum of the scores of importance of the k-th type of intellectual capital;

$G_{k(max)}$ – is the maximum possible amount of importance on the k-th type of intellectual capital;

n – is the number of components forming the k-th type of intellectual capital.

k – is the type of intellectual capital (human, organizational, structural).

2. Further the contribution of the each component in the overall value of intellectual capital is determined by formula:

$$q_k = \frac{S_k}{\sum S_k}$$

3. The risks of utility and rarity loss are assessed similarly. Consequently, we obtain the distribution of risks of rarity and utility loss depending on the types of intellectual capital. If rarity or utility were determined by two parameters, then the assessments of two parameters are summed.

4. Thus, processing the questionnaire individually for small, medium-sized and large businesses, and revealing the average value of the contribution of each type of capital, we obtain the distribution of the importance and vulnerability of the risks of value loss depending on the type of intellectual capital for different size businesses.

Results

After processing the received questionnaires, we obtained the following distribution (in %) of intellectual capital components in terms of their importance depending on the types of businesses represented in the Rostov Region (Fig. 4).

Figure 4. Average distribution of estimates of the importance of intellectual capital components of the organizations in Rostov Region depending on business size

Small business	Medium-sized business	Large business
Human capital	Human capital	Human capital
Organizational capital	Organizational capital	Organizational capital
Consumer capital	Consumer capital	Consumer capital

We represent the risk profile of the intellectual capital of the enterprises of the Rostov Region that shows the distribution of the subjective estimate by entrepreneurs their concerns about the loss of a particular component of intellectual capital (Fig. 5).

Small business	Medium-sized business	Large business
Loss of human capital rarity	Loss of human capital rarity	Loss of human capital rarity
Loss of human capital utility	Loss of human capital utility	Loss of human capital utility
Loss of organizational capital rarity	Loss of organizational capital rarity	Loss of organizational capital rarity
Loss of organizational capital utility	Loss of organizational capital utility	Loss of organizational capital utility
Loss of consumer capital rarity	Loss of consumer capital rarity	Loss of consumer capital rarity
Loss of consumer capital utility	Loss of consumer capital utility	Loss of consumer capital utility

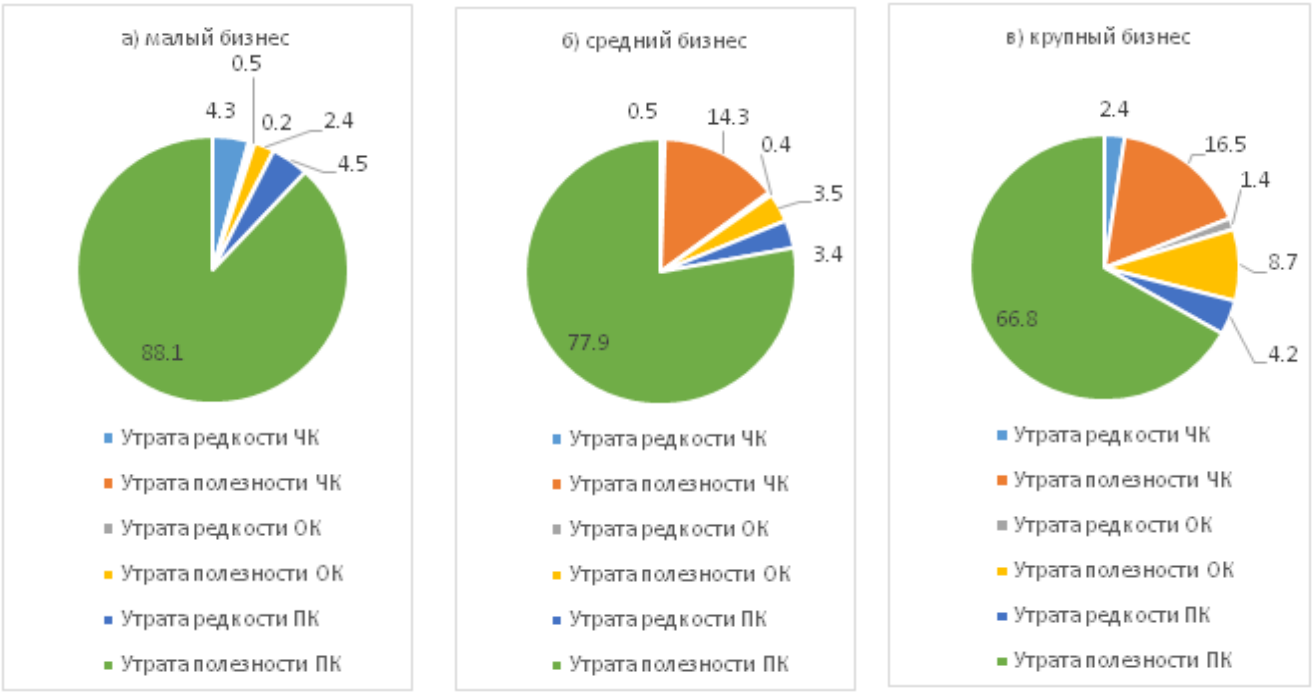

Figure 5. Average distribution of concerns of entrepreneurs involved in different size businesses about the risk of the utility and rarity loss of the intellectual capital components

3. Discussion

Analysis of the intellectual capital structure of organizations in Rostov Region,based on answers of interviewed entrepreneurs, has shown that regardless of the business size and information technology influence, the most important is the consumer capital due to the high dependence of business on relationships with customers, suppliers and governmental authorities. Human capital was named second most important component. Its importance is higher in medium-sized businesses. Small business entrepreneurs give a low estimate of the human capital importance, because they consider themselves the only valuable component of human capital, since they personally define the business development strategy and concentrate all the valuable contacts in their own hands. Representatives of medium-sized businesses delegate some important powers to the employees because of larger business activities.Therefore, for them the value of human capital is higher. Large business also recognizes the importance of human capital, though to a lesser extent than the medium-sized business, since other intangible assets associated with the organizational capital are also important to large business.

In general, entrepreneurs do not attach special importance to the organizational capital, however, a trend of increasing the role of organizational capital becomes more pronounced in proportion to the size of the business. It was also revealed that the importance of the intellectual activity results in the organizational capital was not mentioned in 67 questionnaires out of 72 question lists. This speaks to the low innovation activity of the Russian economy that is also confirmed by the work of Mazur V.V., Barmuta K.A., Demin S.S., Tikhomiro E.A., and BykovskiyM. (2015).

Analysis of concerns about the risks of loss of intellectual capital assets among the representatives of different businesses has shown an interesting trend – the Russian entrepreneurs are almost not afraid that their intangible assets will lose their rarity, that is, will become available to competitors. Mainly they are concerned about the possible loss of assets' potential to generate income. Most of all entrepreneurs are apprehensive about losing relationships that allow them to enter into new profitable contracts and purchase raw materials on favorable conditions.

Comparing the importance of the distribution of the intellectual capital types and fears of entrepreneurs concerning the impairment of the cost of these capitals, we can make a conclusion about the validity of the hypothesis that there is a relationship between the structure of the intellectual capital and the distribution of the subjective estimate of the risks influencing its components. The relationship between the structure of intellectual capital, assessment of subjective risks, leading to impairment of intellectual capital, and size of the business enterprise is not pronounced clearly, however, there are definite relationships between the structure of the intellectual capital and the size of the business.

Conclusion/Application

Developed methodical recommendations for the subjective

estimate of the importance of the intellectual capital components of a particular business and information technology and their vulnerability to risks, leading to a reduction of the value of intellectual capital, and can be employed in managerial and consulting activity of the organization in case if the organization independently assesses its intellectual capital and develops its management strategy and unwishing to advertise its assets. These recommendations can be applied to the business subjects different in size, because the proposed methodology provides the possibility of expanding or narrowing the list of components that make up intellectual capital.

The results of the structural distribution of the intellectual capital of the organizations in Rostov Region, obtained during the validation of the proposed technique, revealed a dominance of consumer capital as a key form of intellectual capital. The information and communication process also has influence substantially. The high entrepreneurs' concerns about the loss of mentioned valuable intellectual asset and can serve a guide when developing the organization's strategy.

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