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Risk Management Strategies in Water Projects in Bulgaria

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Summary

The successful completion of a project in the water sector depends upon the proper identification of the risk factors, as well as determining the extent of their impact on the project objectives and the development of procedures and methods for specific risk reduction strategies. The aim of the paper is to assess the risk in the implementation of projects in the water sector in Bulgaria and to present strategies for the risk management. The methodological framework includes literature review of different strategies for risk management and risk evaluation of projects in the water sector. Based on the risk assessment, risk management strategies are defined depending on the type of risk.

Key words: risk management, strategy, project management, water sector

JEL G 32, O22, Q25

1. Literature review of strategies for risk management in water projects

Project management includes different stages and activities for the successful realization of specific project goals. These are the processes of planning, maintaining and developing the project activities, the preparation of project risk profile and risk management (Petkova, 2015)

Project management requires that specific results should be achieved that are limited in time and derive from coordinated actions of a project team. This implies the emergence of multiple and varied risks, including changes in legislation, delay of payments on the project, non-compliance with implementation deadlines, inefficient communication, team leaving, environmental and climate risk, etc. Depending on the type of risk that has a certain probability of occurrence and level of impact on the final result, different strategic steps can be taken that will lead to the acceptance, minimization or avoidance of the risk and the risk-related consequences.

At the beginning of the year 2016, 142 water projects were successfully completed, funded by a grant to the amount of BGN 724 million, of which contracts under the technical assistance procedure for the preparation of investment projects, contracts for the improvement and the development of water supply and wastewater infrastructure project for development of river basin management plans. Over 2600 km sewage network was built and reconstructed. Financed under the Environment Operational Program for the 2007-2013 period were the construction and reconstruction of 50 wastewater treatment plants. Along with the positive results water projects show several drawbacks. According to the National Strategy for Management and Development of the Water Sector

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(2012), insufficient administrative capacity is a constraint for the implementation of water projects. There is a shortage or lack of staff, time, technical knowledge and expertise in most institutions and actors in the water sector (MOEW, 2012). Insufficient administrative capacity combines with policy problems due to the excessive fragmentation of water functions between different institutions.

There is no stimulus or penalty in the country that could possibly improve the horizontal coordination between different sectoral policies. At the same time, the barrier to project management in the sector is the large number of laws and regulations that often change and contradictory texts exist in separate legal documents. According to other surveys (MOEW, 2011), barriers to the implementation of water projects are the selection of the project auditor, the coordination of the team, the provision of experts for the relevant project activities, the lack of technical assistance for contract organization and management, default on the terms of the contract, among other issues. All this requires that qualitative risk assessment should be carried out in water project management and that strategies for risk reduction should be drawn up.

The risk in investment projects, including projects in the water sector, can be defined as an accidental and unexpected event that has a negative or positive impact on at least one of the project indicators – deadline, value, scope and time (Project Management Institute, 2004). Still, the common practice in project risk management is the focus on the risk events, rather than the accumulated effect of all risk events and sources of uncertainty that go along with the decision making in a project (Chapman and Ward, 2004).

The overall goal of project risk management should comprise all stages of identifying, analyzing and responding to different project risks, so that the probability of the negative impact is reduced and the positive impact is increased and the assessment of risks leads to a specific method of impact (Rolik, 2017). Therefore, the main task of risk management is to reduce the risks in the process of project implementation and to neutralize the negative effects of the risk factors (Marinova, 2012). In this way, the response to different type of project risks will lead to developing, selecting and implementing strategies for the reduction of risk exposure (Zhang and Fan, 2014).

Project risk management is based on the analysis and assessment that use scientific approaches and advanced technologies. The risk of failure arises mainly due to the presence of uncertainty at all stages in the project (Petkova, 2015). In this connection authors like Shtub, Bard, Globerson (2005) consider that it is necessary to properly manage the risk and uncertainty during the realization of a project as most of the activities are not repetitive and routine in their nature.

Therefore, the management process represents a full commitment throughout the whole project cycle. In this regard, there is a high risk of uncertainty during the implementation of the project and therefore it is necessary to identify and analyze the risk factors for the project, to determine the extent of their impact on the project objectives and to develop procedures and methods for implementing specific risk reduction strategies. These strategies must be carefully selected in order to correspond to the different risks in the project implementation after the risk has been analyzed (Zoe et al., 2007). In this way, the response to project risks has a proactive approach for the mitigation of the potential negative impact of different risks (Miller and Lessard, 2001).

According to Tsvetkov (2006), the development and analysis of different scenarios is important in the process of risk management during the implementation of projects. This leads to proper systemization of possible alternatives for the implementation of innovative projects, as well as assigning specific strategies for action. This helps to carry out systematic risk planning.

According to other pieces of research (Project Management Institute, 2004), the strategies for the risk management in projects depend upon the character of the event and the expected effect. Four types of strategies can be defined. Strategies in response to negative risks or treats could be strategies: avoid, transfer, mitigate and accept. The second type of strategy is to act in response to positive risk opportunities that have a positive effect on project outcomes, like exploit, share, enhance, and accept. The authors also define a contingent response strategies and it is applied if certain events occur. The common strategy is applicable to both negative and positive events. The fourth type of strategy is an action strategy in response to unforeseeable circumstances.

Other authors consider that different methods of risk management are also possible. On one hand, a risk avoidance strategy can be taken. In this case a total reorganization of the process or activity is undertaken in order to completely avoid the risk.

On the other hand, risk can be transferred and divided between individual activities, employees or processes. Also, a strategy for risk control or risk sharing may be used between partners, participants or between contracting parties in public-private partnership schemes.

Other types of strategies in project risk management are risk transfer or risk acceptance. Choosing the most appropriate method involves balancing the implementation costs for each option in proportion to the benefits accruing from it (OPRD, 2007).

Risk management task group (2012) considers that risk response strategies could be classified as strategies for threats and for opportunities. Strategies for threats are 1) avoid risk 2) exploit risk and 3) transfer risk. Strategies for opportunities are 1) share risk 2) mitigate risk and 3) enhance risk. There is another strategy for both - acceptance. This strategy is adopted when it is not possible or practical to respond to the risk with the other strategies, or a response is not warranted by the importance of the risk. According to other research (Washington State Department of Transportation, 2014) risk response could be to avoid threats, exploit opportunities, transfer threats, share opportunities, mitigate threats, enhance opportunities and accept. It is not possible to avoided all threats or take advantage of all opportunities, but if respond to risks is successful and project knowledge increases, the risk exposure will diminish.

Bekefi, Epstein, Yuthas (2008) consider that some of the techniques that could move the project within an acceptable risk range include traditional risk mitigation strategies such as sharing, transferring and reducing risk. Norris, Perry, Simon (2000) share a view that response to risk could be one or a combination of five things: remove, reduce, transfer, avoid and acceptance of risk. Other authors share the view that the methods for impact on risk can be implemented using three types of strategy - reduction, retention or transfer (Yelistratov et al., 2010). Yelistratov et al. (2013) are on the opinion that the reduction strategy is the most acceptable one and that the result should lead to complete elimination of the risk.

Based on the author's views on possible risk strategies in project management, it can be concluded that risk management strategies for water projects are diverse, but the choice of specific strategy should be

cost-effective. In many cases a combination of risk reduction approaches is used.

2. Methodological framework

The aim of the paper is to assess the project risks in the water sector in Bulgaria, and on this basis to define strategies for risk management.

To this effect, the following tasks have been set: 1) To make a literature review on risk management strategies for projects in the water sector; 2) To evaluate the risk in the management of water projects; 3) Based on the risk assessment, conclusions and strategies for risk management should be proposed.

Conclusions in the paper are based on the results of university research project "Project management of sustainable development in water sector" (Stoyanova et al., 2015).

The risk assessment in project management in the water sector is based on the information obtained from a survey conducted between July and September 2016. For the purpose of the survey, structured interviews were conducted with experts in environmental protection departments in the administration of 16 municipalities from different regions and officials from the four basin directorates in the country. 80% of the respondents are experts at the regional level and the rest are situated in the specialized administration of the Ministry of environment and water in Blagoevgrad, Pleven, Varna and Plovdiv. The structured interview is appropriate for the purposes of the study because this method allows comparability between different research objects and is an appropriate for studying the external and internal environment of the implementation of projects in the water sector, the benefits that are achieved with them and the opportunities for achieving sustainability in the water sector through project management. At the same time, responses can be summarized and compared across the different types of respondents (basin directorates and municipalities).

Risk assessment methodology

In terms of risk assessment, the probability of occurrence in relation to the implementation of the project and the level of expected impact as a result of the occurred event are evaluated. Both components are evaluated based on the following indicators of risk: Change of legislation in the water sector; Failure to execute part of the contract by the beneficiary; Incorrect selection of technologies for project realization; Incorrect budgeting; Resignation of the staff of the project team; Incorrect selection of project team; The deadline for implementation of the project is not met; Delay in key stages of the project; Ineffective communication; Insufficient information provision; Inefficient allocation of project resources; Delay in payments on the project by the managing authority; Environmental risk; Climate risk.

Each individual risk is evaluated on a scale from 1 to 3, as indicated in Table 1.

Table 1. *Scale for a risk evaluation*

Scale	Probability of Occurrence	Impact
1	Low probability (0 -35 %)	Insignificant impact
2	Middle (36 - 70%)	Critical impact
3	High probability (up to 71 %)	Catastrophic impact

On the basis of risk assessment, a risk matrix with combination of probability and impact is carried out, which allows further ranking of risks. (Figure 1)

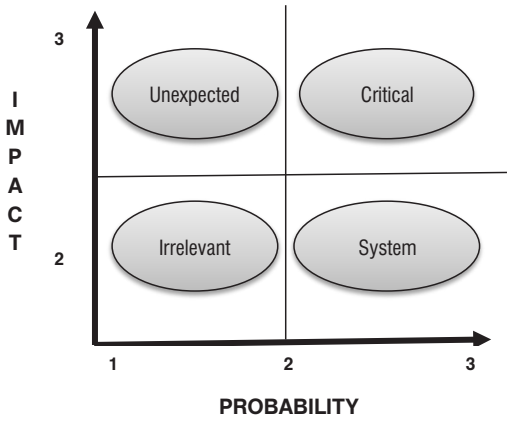

Fig. 1. *Risk matrix adapted by OPRD, 2007*

According to the applied methodology, risk is classified as: 1) Critical risks: possess both factors, valued at around 3; 2) Unexpected risks - their impact can be significant, although probability for their occurrence is less than the critical risks; 3) System risks - the probability of occurrence of these risks is high, but their impact is relatively low; 4) Irrelevant risks - both factors were assessed around 1.

Based on the risk matrix data, a risk profile is elaborated. It gives a clear idea of the level of risk in the project and its distribution over the identified risk indicators (Figure 2).

On the basis of the risk assessment, the risk rating for each indicator is calculated. The score is based on a three-step scale. The lowest value of the metric is 1 and the highest is 3. The probability and impact are evaluated independently on the scale. A rating is calculated using the following formula:

Rating = Probability * Impact.

Risk Classification:

- Low rating - from 1 to 3;
- Average rating - from 4 to 6;
- High rating - over 7 to 9

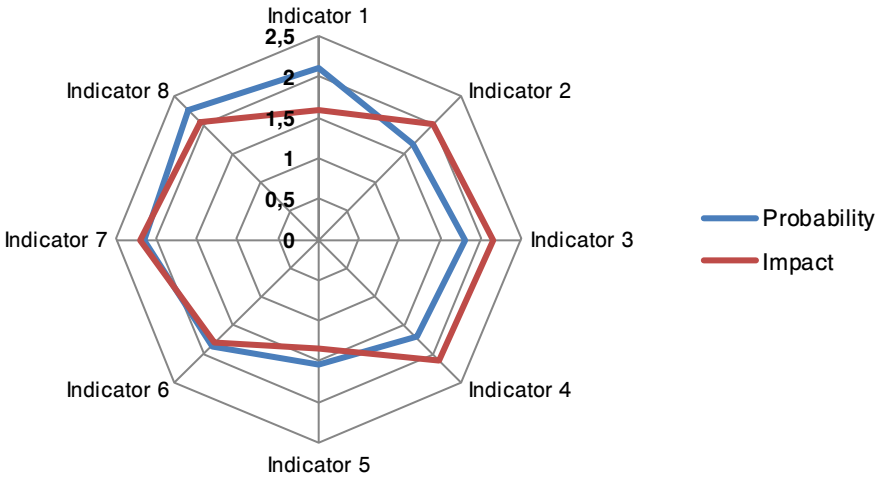

Fig. 2 *Risk profile*

Risk response strategies methodology

According to the applied risk assessment methodology and simple response matrix, risk management strategies for water projects can be defined, with a specific strategy being proposed for each type of risk (Figure 3).

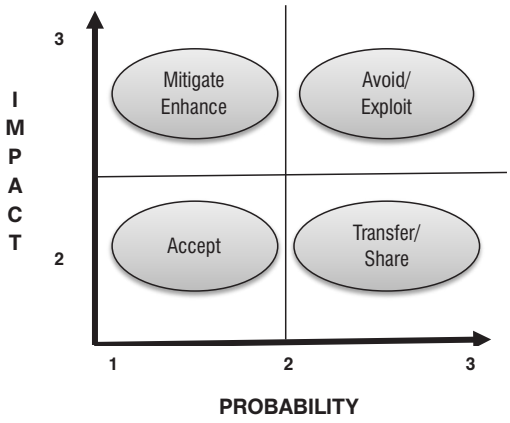

Fig. 3. *Simple response matrix Adapted by Washington State Department of Transportation, (2014)*

3. Risk assessment of project management in the water sector in Bulgaria

Risk assessment regarding the survey results

The risk assessment of project management in the water sector shows that around half of the respondents assess the likelihood of indicators such as *Failure to execute part of the contract by the beneficiary* (55%), *Incorrect budgeting* (45%), *Resignation of the staff in the project team* (50%), *Incorrect selection of project team* (45%), *Ineffective Communication* (55%), *Environmental Risk* (55%) and *Climate Risk* 50%) as low.

Estimates show that 60% of the experts believe that the chance for *Change of legislation in the water sector* is high. About half of the respondents are of the opinion that the indicators *Incorrect selection of technologies for project realization* (50%), *The deadline for implementation of the project is not met* (55%), *Delay in the key stages of the project* (55%), *Insufficient information provision* (45%), *Ineffective allocation of project resources* (50%) and *Delay in payments on the project by the managing authority* (50%) have an average degree to reveal. A small number of respondents (5 to 35%) consider that the assessed indicators are highly likely to occur. Most experts (40 to 90%) consider that these indicators assessed will have a critical impact.

The indicators *Failure to execute part of the contract by the beneficiary* and *Incorrect selection of technologies for project realization* are rated as critical by 90% of the respondents. They are followed by the indicators *Incorrect budgeting* (60%), *Incorrect selection of project team* (60%), *The deadline for implementation of the project is not met* (60%) and *Inefficient allocation of project resources* (70%).

The indicator *Delay in payments on the project by the managing authority* was estimated to have a catastrophic impact by 40% of respondents. One third of respondents believe that the indicator *The deadline for implementation of the project is not met* will have catastrophic impact. Half of the respondents consider indicators such *as Change of legislation in the water sector* (50%), *Environmental Risk* (50%) and *Climate Risk* (50%) will have insignificant impact on project management. More than half of the respondents define the indicator *Resignation of the staff in the project team* (65%) with a negligible impact.

The classification of risk types according to the assessed indicators shows that the *Delay in payments on the project by the managing authority*, *The deadline for implementation of the project is not met* and *Delay of key stages in the project* have been identified as a critical risk (Figure 4). These three indicators are assessed with a high degree of impact and a high probability of occurrence, which requires particular attention in risk management.

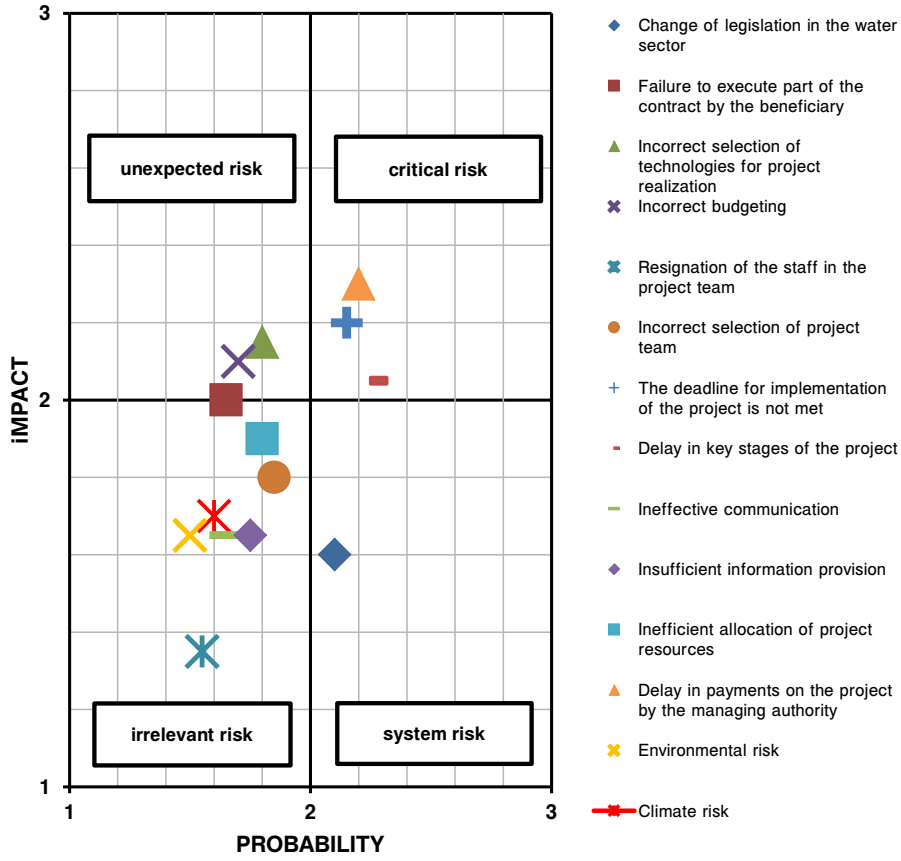

Fig. 4. *Risk matrix based on experts' opinion*

Incorrect selection of technologies for project realization and *Incorrect budgeting* falls into the quadrant of unexpected risk and have a high impact and relatively low probability of occurrence. *Failure to execute part of the contract by the beneficiary* is assessed by the experts as an indicator of medium impact and low probability of occurrence as it falls on the line between unexpected and irrelevant risks.

Experts believe that *Insufficient information provision*, Environmental *and Climate risk*, *Ineffective Communication*, and *Resignation of the staff in the project team* are irrelevant risks, all of which have low probability of occurrence and low impact. *Inefficient allocation of project resources* and *Incorrect selection of project team* also fall into the quadrant with irrelevant risks but they are determined with a medium probability of occurrence and average impact.

One of the indicators is defined as systemic risk and this is the *Change of legislation in the water sector*. The indicator is characterized with a medium probability of occurrence and a low degree of impact.

On the basis of the risk matrix data in Figure 5 a risk profile based on the opinion of the experts is presented.

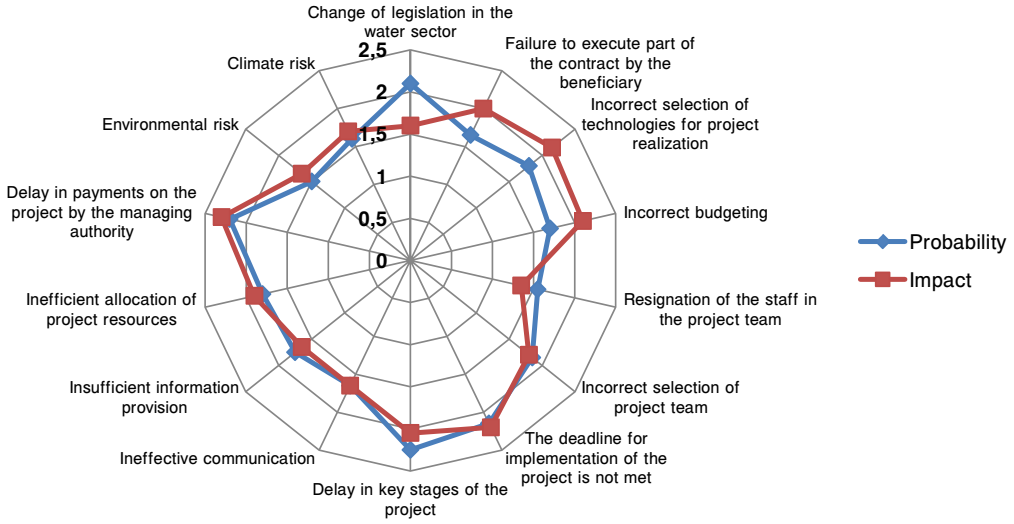

Fig. 5. *Risk profile based on expert opinion*

The risk rating calculations show that there are no identified risk indicators with high rating (Table 2) Indicators such as *Change of legislation in the water sector*, *Failure to execute part of the contract by the beneficiary*, *Resignation of the staff in the project team*, *Incorrect selection of project team*, *Ineffective communication*, *Insufficient information provision*, *Inefficient allocation of project resources*, *Environmental risk* and *Climate risk* are low-rated.

The rest of the indicators –*Incorrect selection of technologies for project realization*, *Incorrect budgeting*, *The deadline for implementation of the project is not met*, *Delay in the key stages of the project*, *Delay of project payments by the managing authority* have an average risk rating.

Table 2. *Risk rating based on expert opinion*

INDICATORS	RISK RATE
Change of legislation in the water sector	3
Failure to execute part of the contract by the beneficiary	3
Incorrect selection of technologies for project realization	4
Incorrect budgeting	4
Resignation of the staff in the project team	2
Incorrect selection of project team	3
The deadline for implementation of the project is not met	5
Delay in key stages of the project	5
Ineffective communication	3
Insufficient information provision	3
Inefficient allocation of project resources	3
Delay in payments on the project by the managing authority	5
Environmental risk	2
Climate risk	3

Indicators such as *Change of legislation in the water sector*, *Failure to execute part of the contract by the beneficiary*, *Resignation of the staff in the project team*, *Incorrect selection of project team*, *Ineffective communication*, *Insufficient information provision, Inefficient allocation of project resources*, *Environmental risk* and *Climate risk* are low-rated.

The rest of the indicators – *Incorrect selection of technologies for project realization*, *Incorrect budgeting*, *The deadline for implementation of the project is not met*, *Delay in the key stages of the project*, *Delay of project payments by the managing authority* have an average risk rating.

Risk response strategies relative to the risk assessment

According to the applied risk assessment methodology and simple response matrix, risk management strategies for water projects can be defined. A specific strategy could be proposed for each type of risk

The strategies that should be applied to indicators such as *Delay in payments on the project by the managing authority*, *The deadline for implementation of the project is not met* and *Delay in key stages of the project* are avoid and exploit, as they are defined as a critical risk. These indicators require immediate attention and monitoring of activities related to risk management. In terms of these indicators, risk could be avoided by removing the cause of the risk or executing the project in a different way. This type of risk could be managed thorough clarifying requirements, obtaining information, improving communication, or acquiring expertise. In this respect, the establishment of interdisciplinary planning teams is important for achieving project sustainability and opening new and effective methods for water management and conservation. With respect to the indicators listed above, the exploit strategy can be applied. Possible actions include: assigning more talented resources to a project to reduce time to completion and provide better quality than originally planned. (PMBOK, 2004)

The strategy that should be applied in connection with the indicators *Insufficient information provision*, *Environmental and Climate risk*, *Ineffective communication*, *Resignation of the staff in the project team*, *Inefficient allocation of project resources* and *Incorrect selection of project team* is the strategy of acceptance (Table 3). These indicators are defined as irrelevant risk and this type of risks could be managed through identifying the ones that will be from significance for the success of the project according to the available resources and requirements of stakeholders. This could be performed by the project manager and the team involved in risk assessment (Stoyanova, 2017). The project manager and the project team have to agree to a certain level of acceptance of risk when it occurs (Risk management task group, 2012). To overcome this type of risk with regard to the indicator "Insufficient information provision", specific programs may be required to assist beneficiaries in raising their qualifications on cost-benefit analyzes, regulatory framework in the Water sector, implementation of the Public Procurement Act and preparation of infrastructure projects for applying for grants. Addressing the climatic and environmental risks requires the reflection on the concept of sustainable development in project management by applying an innovative approach to creating new, advanced products and management techniques that achieve sustainability in water projects.

Incorrect selection of technologies for project realization and *Incorrect budgeting* are defined as unexpected risk and therefore the strategy *mitigate and enhance* should be used. Risk mitigation requires early action to reduce the probability and/or impact. This could require resources or time. The enhance strategy change the benefits realized for the project in a positive way.

Table 3. *Risk reduction strategies for the analyzed indicators*

	UNEXPECTED RISK		**CRITICAL RISK**
MITIGATE/ ENHANCE	• Incorrect selection of technologies for project realization • Incorrect budgeting	AVOID/ EXPLOIT	• Delay in payments on the project by the managing authority • The deadline for implementation of the project is not met • Delay in key stages of the project
	IRRELEVANT RISK		**SYSTEM RISK**
ACCEPT	• Insufficient information provision • Environmental risk • Climate risk • Resignation of the staff of the project team • Ineffective communication • Inefficient allocation of project resources • Incorrect selection of project team	TRANSFER/ SHARE	• Change of legislation in the water sector

The Change of legislation in the water sector has been identified as system risk and the strategy *transfer* and *share* should be used. Transferring risk involves finding another party who is willing to take responsibility for the risk management, and who will bear the liability of the risk should it occur. The aim is to ensure that the risk is owned and managed by the party best able to deal with it effectively. Another strategy possible for system risk is share. This strategy allocates risk ownership to another party who is best able to maximize its probability of occurrence and increase the potential benefits if it occurs.

Conclusion

The main purpose of risk management in the implementation of the water projects is to assess the probability of its occurrence and to select the appropriate strategy to avoid, minimize and curb the impact of risk on project success. All stages of identifying, analyzing and response to the different types of risk in a project should be covered, thus the probability of negative impacts will reduce and the potential for positive impacts will increase.

The applied methodology for the qualitative assessment of risk indicators in the management of water projects in Bulgaria could be used in other countries, although each project is perceived as unique and presumably the same set of processes and methods cannot possibly have a positive impact on project success and risk reduction. With regard to the application of the proposed methodology, it is important that the specificity of the water projects in different countries, the sector's development policies, the cultural differences across regions should be taken into account. It is on this basis that risk indicators in project management in the water sector should be identified and adequate strategies for their management should be drawn up.

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