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RISKS ASSOCIATED WITH THE SELECTION OF A DESIGNER IN A TENDER PROCESS

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Purpose: The main objective of this article is an attempt to define the risk factors associated with the selection of a designer in a tender procedure on the example of a biogas plant in Olsztyn. The study aims to understand what risks may arise in the process of selecting a designer and what actions can be taken to minimize them. The results are expected to provide practical guidance for decision-makers and tender participants to increase the efficiency and safety of the entire process.
Design/methodology/approach: The theoretical part of the study is based on a review of the literature and familiarization with the tender procedure of the discussed investment. The empirical part, on the other hand, consists of a seminar and a survey. In order to analyse the results obtained, risk assessments were carried out according to the classical approach as a product of the probability of their occurrence and the effects to which they may lead.
Findings: Choosing the right designer is crucial for the success of the entire investment. The decision made is not always optimal, despite the use of different selection methods, also taking into account computer tools supporting this process.
Research limitations/implications: The limitations of the research are related to conducting the analysis among a selected, small group of designers. Future studies should be extended to include a larger group of experts and for another biogas plant investment in order to compare the results. Also, the interpretation of expert data could have been carried out in many different ways.
Practical implications: So far, no similar survey has been carried out, which may be helpful for further tender procedures of this type to raise the investor's awareness when making decisions.
Originality/value: The article attempts to identify risk factors, thus showing how complex and ambiguous the decision-making process is, especially in tender proceedings, where many criteria are evaluated, and the choice made is not always optimal. Particular attention should be paid to the important aspects of risk in order to reduce them in the future. The article is mainly addressed to decision-makers of tender processes, but it is also universal in nature, because risk and decision-making accompany people at every step.
Keywords: risk management, tender procedure, biogas plant, multi-criteria decision making, risk factors.
Category of the paper: research paper, case study.

1. Introduction

1.1. Biogas plant investment

In construction activities, in the case of large investments financed from public funds, and also included in the group of those that may affect the environment, it is necessary to develop several variants and then choose the solution that meets the previously specified requirements to the highest extent (Szafranko, Jurczak, 2023). In the first step, the investor defines the goals of the project, specifies requirements such as efficiency, price, implementation time, compliance with regulations, adaptation of the project to local conditions, available raw materials. Then he sets the evaluation criteria, such as the designer's experience, references, innovation of activities. When the offers are received on the predetermined date, the selection is made. Due to the complexity of the process, this is not a clear and obvious topic. The selection is related to the bidder's analysis, taking into account the set criteria, so it is a multi-criteria problem (Leśniak, 2021; Leśniak, Radziejowska, 2017). The decision made is not always optimal, despite the use of different selection methods, also taking into account computer tools supporting this process. It often turns out that existing methods produce different results, so which one is the best? Does it exist or is it possible for it to be created?

A sustainable future is now becoming the watchword in many industries, including the construction sector. High exhaust emissions and environmental pollution are considered to be one of the main causes of climate change. In order to prevent these adverse phenomena, a policy focused on the use of renewable energy sources (RES) and the reuse of raw materials is being introduced. One such production plant that processes organic waste is a biogas plant. The product obtained in it is used as a renewable energy source, helps to reduce greenhouse gas emissions, thus creating a closed loop of raw materials (Chludziński, Duda, 2024).

The construction of a biogas plant is a complex undertaking that requires careful preparation, planning and implementation. In the first stage, which is crucial for further processes, a tender is announced to select the entity responsible for the implementation of the investment. The tender procedure is a process in which the contracting authority selects a contractor to perform a specific task, delivery or service. The main steps of this process are presented in Figure 1.

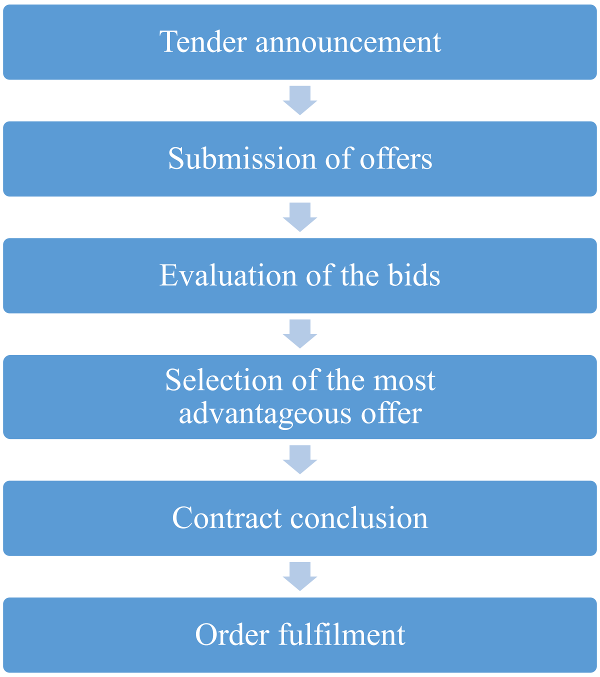

Figure 1. The main stages of the tender procedure.

Source: own study based on (USTAWA: Prawo Zamówień Publicznych, 2019).

One of the people involved in the implementation of the biogas plant investment is the designer. Choosing a project team is critical to your investment and its long-term success. The designer is responsible for preparing technical documentation, which is the foundation of the entire project. It is important that the investor can establish an effective relationship with him. In the tender procedure, the selection should be made on the basis of an objective assessment, guided by pre-established criteria, which should focus on design skills and experience.

1.2. Decision-making risks

Risk is an unavoidable element accompanying decision-making. At the time of making a choice, one does not have full information about potential external or internal factors, i.e. there is uncertainty in the decision and with it comes risk (Project Management Institute, 2003; Ward, Chapman, 2003). In order to minimize the probability of risk for a given investment, it is worth looking at it in the long term and referring it to similar projects that have already been completed. Hence, it is necessary to forecast the future effects of current decisions, identify possible threats and take preventive actions, which is the subject of many studies. There are many approaches to risk management in different areas of life. In Poland, the ISO 31000 standard, created in 2009 by the International Organization for Standardization (ISO), is often used (International Organization for Standardization). Its Polish equivalent is the PN-ISO 31000:2018 standard (PN-ISO 31000:2018 Zarządzanie Ryzykiem – Zasady i Wytyczne, 2018). According to it, risk management can be divided into stages, presented in Figure 2.

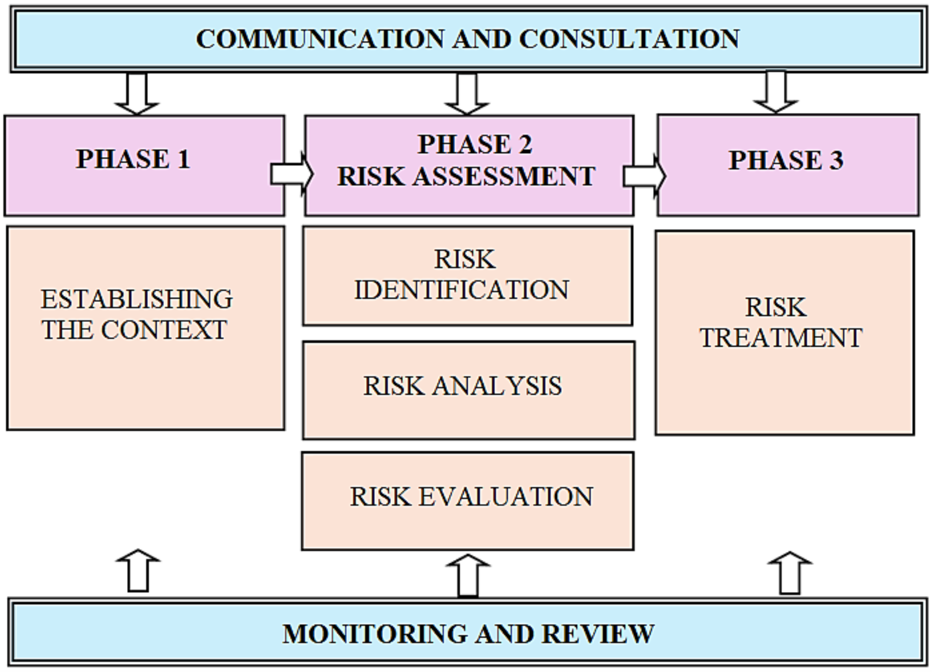

Figure 2. Stages of risk management according to ISO 31000.

Source: own study based on (PN-ISO 31000:2018 Zarządzanie Ryzykiem – Zasady i Wytyczne, 2018).

The essence of the first phase is to define the objectives, scope, investment features and general assumptions. The next phase moves on to the risk assessment stage, which is first to identify the risks, i.e. to identify the factors that may affect the implementation of the project. In this case, it is a good idea to classify them according to accepted principles. Risks are then measured, by determining the probability of their occurrence and the severity of their consequences. For this purpose, qualitative methods are used – descriptive and quantitative, making a hierarchy. The second one is based on mathematical and statistical methods, which makes it more complicated and requires appropriate data. Most often, risk is described as the quotient of the probability of its occurrence and impact on the success of the project (Project Management Institute, 2003) (Formula 1):

$$R = f(P, C) \tag{1}$$

where:

R – risk,

P – the probability of a certain risk occurring,

C – the consequences of the event on the final effect of the project being implemented.

After such an assessment, it can be determined to what extent a given risk is material, whether it can be accepted, and what should be done about it. All this leads to the final phase, i.e. dealing with risk. In the simplest terms, two levels of risk management can be distinguished: the first is associated with the acceptance of risk in which no specific actions are required, and the second – immediate actions are necessary to reduce risks that exceed the tolerance threshold. Pritchard provided the following categories of risk response methods (Pritchard, 2002):

- risk avoidance,
- risk transfer,
- risk mitigation,
- risk acceptance.

1.3. Risk analysis in biogas plant investment – literature review

The authors of various publications have already undertaken an analysis of the risks to the overall success of a biogas plant project. In Kwestarz (2021), the main factors influencing the implementation of an agricultural biogas plant at the planning and preparation stage of the investment process are identified and presented. The results of an economic analysis over a 15-year operating horizon for investments with two levels of electrical power are included: 0.5 MW and 1 MW. After conducting detailed analyses, it was concluded that the construction of a biogas plant is profitable, estimating a simple payback time of 2-4 years. Other authors have presented a case study of risk analysis in the context of qualitative research based on literature review and surveys (Ligus, Słoński, 2018). The result of the analyses was the conclusion that biogas plants are associated with high risk and require professional management and control throughout the life cycle of the investment. Also the aspects of the operational risk of biogas plants have been discussed in the literature. In (Szymańska, Wieteska, 2017), the operation of biogas plants was assessed for the purpose of covering them with insurance coverage. Attempts have been made to estimate the sum insured, as well as the types and frequency of damage that may occur during the use of this type of facilities.

After reviewing the literature, it was noted that so far the topic of the risk associated with the selection of the biogas plant designer has not been discussed by scientists. Most of the articles focus on general aspects of investment, regulatory and technical risks that may affect the implementation of a biogas plant project. Therefore, it was decided to deepen this topic.

2. Methods

The main objective of this article is an attempt to define the risk factors related to the selection of a designer in a tender procedure on an example. A biogas plant up to 1MW in Olsztyn was selected for evaluation. The author, as a co-designer of the construction documentation for the biogas plant in question and on the basis of his own experience in designing the structure of buildings, identified possible risk factors when selecting the design team. The study aims to understand what risks may arise in the process of selecting a designer and what actions can be taken to minimize them. The results are expected to provide practical guidance for decision-makers and tender participants to increase the efficiency and safety of the tendering process.

The assumed goals were achieved through a literature review related to the topic and familiarization with the tender procedure of this investment. Then a seminar was organized, to which 14 designers with experience in tenders were invited. Of these, 2 designers participated in the creation of documentation for another biogas plant in previous years and 4 involved in the current project. A discussion was held on the possible risks associated with the selection of a designer for this particular biogas plant project in Olsztyn. First, forms were distributed, on which everyone had the opportunity to give their own objective answer, without consulting a group of experts, to the general issue: "Identify possible risk factors related to the selection of a biogas plant designer in Olsztyn". The responses received were summarized and each of them was publicly discussed, specifying their consequences and proposing remedies to avoid their occurrence. In the next stage, a survey was conducted among the same subjects, in which each identified risk had to be assessed in terms of two parameters: the probability of its occurrence and the effect it may have.

3. Research results

The biogas plant will process organic waste from separate collection and produce biogas and use it in the process of producing renewable electricity and heat. The area of the investment in question is undeveloped areas. The project involves the construction of a complex of buildings for technological purposes of a biogas plant with a capacity of up to 1 MW, together with technical infrastructure and communication in the form of a road and squares. The construction of the following facilities and equipment is planned: a reception hall with a social building, a storage building, cogeneration units, a building for cooling biogas, a mixing tank, an acidification tank, fermentation tanks of the first and second stage, end tanks, pumping station buildings, an underground fire-fighting water tank, an underground rainwater tank, an underground tank for technological wastewater, a drive-on scale, a biogas desulphurization station, an emergency flare, a biofilter.

During the seminar, 14 designers individually identified potential risk factors that may arise when selecting a designer in the tender process for the design of a biogas plant in Olsztyn. The results of such an analysis are presented in Table 1.

In the next stage, the above-mentioned risks were analysed. A survey was carried out in which a group of 14 designers of building structures from the Warmian-Masurian Voivodeship was asked to assess each risk in terms of two parameters: probability of occurrence of the event (P), severity of effects (S). The scores were made on a scale of 1 to 10, with 1 being low probability and little noticeable effect, and 10 being correspondingly high levels of each factor. On this basis, risk in the classical approach was calculated as a product of probability and consequences. The results are presented in Table 2.

Table 1.
Identified risk factors related to the selection of a designer in the tender procedure for the construction of a biogas plant in Olsztyn

Risk No.	Risk factor	Possible consequences	Countermeasures
1	Insufficient experience in designing biogas plants	- errors in design, underestimation of costs, time, improper selection of technology; - due to insufficient experience, it will take a lot of time to search for solutions, learn the designer, which can lead to significant delays	Specification in the tender requirements of the required experience of the designer in similar investments (e.g. required completion of this type of investment within the last 5 years)
2	Incorrect assessment of legal requirements and regulations – biogas plants require environmental decisions, obtaining various permits (e.g. for waste management, sewage disposal), opinions (sanitary and epidemiological station, fire brigade)	- failure to obtain the required decision, agreement, which in the long run delays the work and may even lead to its complete suspension; - insufficient knowledge of the time needed to settle the case – illogical schedule of work on obtaining legal documents – delays, and therefore also financial losses; - improper handling of an official matter may result in the imposition of penalties	Choosing a designer who has experience in this type of investment, as well as knows local legal regulations and procedures related to environmental and energy issues
3	Incorrect selection of technologies and engineering solutions	- the possibility of a failure and, in a worse situation, a construction disaster; - insufficient capacity of biogas plants; - suboptimal use of resources, e.g. raw materials for biogas production, energy	Selection of a designer with experience in the selection of biogas technologies, consultations with industry experts
4	Untimely completion of the project	- delays in the schedule – this may affect the delay in the start of construction of the biogas plant, lead to additional costs, penalties	Selection of a designer with experience, a detailed ("good") implementation plan, with a stable financial situation
5	Lack of contacts, cooperation with appropriate contractors and industry specialists	- the designer may encounter problems related to the implementation, e.g. it is difficult for him to find co-workers – industry specialists, specialist construction teams, it is more difficult to obtain information about technical and material solutions	At the tender stage, checking whether the designer cooperates with contractors and whether he has positive references from previous partners
6	Failure to adapt the design to local conditions - the designer may not take into account local conditions such as land, climatic conditions, availability of raw materials, local standards and regulations	- failure to adapt the biogas plant to the actual needs	Selection of a designer who will conduct a detailed analysis of local conditions, such as geotechnical and hydrogeological surveys, and will also take into account the specificity of Olsztyn in the project

Cont. table 1.

7	Communication and coordination problems – insufficient communication between the designer, investor, contractors and other stakeholders	- it can lead to delays, errors, misunderstandings, difficulties in the implementation of the project	Selecting a designer who has experience in managing large projects, has the appropriate competences in coordination and communication with all parties to the project
8	Language barriers may arise when designers from different countries collaborate	- disruptions in the implementation of the project, unnecessary conflicts, lack of support in the implementation of tasks	Selection of a designer with experience in cooperation with a foreign partner, fluent in English
9	Disruptions in data exchange between designers – lack of hardware compatibility with the necessary software or lack of ability to use technological solutions	- designers work with outdated files; - the need to make constant adjustments due to a lack of coordination	Selecting a designer who has experience in managing large projects, has the appropriate competences in coordination and communication with all parties to the project
10	Failure to take into account social and local aspects, failure to take into account the possible impact of the future investment on the environment	- social protests, delays in obtaining permits, arrangements, decisions	Consultation with the local community and authorities before the start of project work, taking into account the aspects discussed and ongoing contacts
11	Risk of miscalculations, e.g. biogas plant efficiency	- suboptimal biogas and energy production, affecting the profitability of the project	Checking the designer's skills in the field of accurate energy calculations, optimization of biogas production technology – checking the designer's experience
12	The lack of a financial reserve by the designer may lead to staff shortages	- budget overrun – related to market conditions, such as salary increases for specific positions (the designer hires a team, and such an increase in costs may lead to a situation where he will not be able to hire enough employees or with appropriate competences)	Choosing a designer who has experience managing large projects
13	The designer will not know the new technologies used to build a biogas plant (a biogas plant is associated with a large technological diversity and the need to use current solutions)	- designing technology that will not be optimal or will not meet the expectations; - if the designer wants to use new technologies, he will first have to familiarize himself with them, which causes delays	Selection of a designer who has experience in similar investments, who is up to date with new technologies used in the construction of biogas plants, who has partners in the technology industry – design assistance
14	Low returns on investment when the designer does not optimize materials, cross-sections, processes, and technologies	- lower profits from biogas production for the investor	Choosing a designer who has experience in similar investments, who knows and uses modern technologies

Source: own research.

Table 2.
Results of the assessment of identified risks – classic risk approach

Risk No.	**Probability P** (1-10)	**Effects S** (1-10)	**P·S**
1	4	10	40
2	6	7	42
3	7	8	56
4	8	8	64
5	7	5	35
6	4	8	32
7	6	6	36
8	6	8	48
9	5	6	30
10	6	8	48
11	3	10	30
12	2	7	14
13	5	7	35
14	3	9	27

Source: own research.

4. Discussions

The conducted analyses allowed to determine the risk associated with the selection of the designer of the biogas plant in Olsztyn. High P·S values indicate a high level of risk. In the case of the product $P \cdot S$, the maximum value that could be reached was 100. For this analysis, based on the results presented in Table 2, the following classification was established:

- $P \cdot S \geq 50$ – very high risk – immediate corrective action should be taken,
- $30 \leq P \cdot S < 50$ – high risk – corrective action should be taken, but it may not be necessary to apply them,
- $P \cdot S < 30$ – acceptable risk – corrective action can be taken, but the risk does not have a key impact.

According to the above classification, the risks are grouped in Table 3 and ranked from most significant to least for better clarity.

This summary shows that the highest risk in the discussed example is the untimely completion of the project (4) and the improper selection of technologies and engineering solutions (3). Equally high risk was identified for factors resulting from language barriers (8) and social aspects (10), and interestingly, they were assessed in exactly the same way. It is worth noting that in the case of insufficient experience in designing biogas plants (1) and with the risk of incorrect calculations (11), the effects were assessed as 10, i.e. the most severe, so it is important that such situations do not occur, because they can bring significant losses. Such an analysis of individual risks allows you to focus more on them, think about how you can prevent them or how to prepare for their possible occurrence.

Table 3.
Summary of identified risks by product value P · S

Risk No.	Probability P (1-10)	Effects S (1-10)	P·S
4	8	8	64
3	7	8	56
8	6	8	48
10	6	8	48
2	6	7	42
1	4	10	40
7	6	6	36
5	7	5	35
13	5	7	35
6	4	8	32
9	5	6	30
11	3	10	30
14	3	9	27
12	2	7	14

Source: own research.

In the available literature, no direct publications focusing exclusively on the bidding risks associated with the selection of a biogas plant designer were found. However, identified factors such as insufficient experience of the designer, underestimation of investment costs or non-compliance of the design documentation with local regulations have been included in Kwestarz (2021). According to the U.S. Environmental Protection Agency (U.S. Environmental Protection Agency, 2020), an effective selection of a designer should take into account not only the criterion of price, but precisely the experience in similar projects, the ability to manage risks or knowledge of legislation.

5. Conclusions

The conducted research allowed to identify risk factors related to the selection of a designer in the tender procedure for the construction of a biogas plant in Olsztyn. So far, no similar study has been carried out, which may be helpful for further tender procedures of this type. Particular attention should be paid to the important aspects of risk in order to reduce them in the future. During the tender process, it is crucial to conduct a detailed analysis of the designer's financial capacity. Improper assessment can lead to liquidity problems, which can result in delays or non-completion of the project. The designer must have appropriate qualifications and experience in the implementation of similar projects. Lack of appropriate competence can lead to design errors that can affect the quality and safety of implementation. Also, improper time management by the designer can lead to delays in the implementation of the project. It is important that the designer has experience managing projects of similar scope and scale. The designer must be aware of the applicable laws and regulations related to the implementation of the project. Improper compliance can lead to legal and financial consequences.

On the basis of the research and analysis carried out, measures are proposed for decision-makers and tendering institutions to increase the efficiency and safety of the designer selection process. It is recommended to implement a pre-qualification stage, which will allow the competence of potential designers to be verified at the very beginning of the process. It is definitely worth paying more attention to qualitative criteria in the evaluation of bids than to price alone. It is also important to encourage designers to use compatible software and digital collaboration platforms to improve data exchange and coordination between participants in the construction process. At the contract signing stage, it is recommended to include penalties for delays, mandatory third-party liability insurance and a discussion with the designer about contingency plans in case of errors, changes or non-compliance with regulations. For procurement staff, it is recommended to organise regular training on tender evaluation, technical analysis and the risks involved in the selection itself. Implementing these recommendations can significantly reduce investment failures and increase the efficiency of the tendering process.

Choosing the right designer in a tender procedure requires a thorough financial, technical, schedule, legal and quality analysis. Only a comprehensive approach to risk assessment can ensure the success of a project.

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