

## RISK MANAGEMENT STANDARDISATION IN POLISH CONSTRUCTION ENTERPRISES UNDER UNCERTAINTY

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**Purpose:** The paper aims to outline the issues related to the standardisation of risk management in construction enterprises operating in the conditions of uncertainty. In particular, it discusses possible applications of international risk management standards in the operations of major Polish contractors as participants of investment and construction processes. This is particularly important now, when contractors have to operate in the conditions of volatile and uncertain surroundings.

**Design/methodology/approach:** The paper uses the method of synthesis, as well as deduction and the basics of induction. The authors draw on their own expertise and experience gained from long-term research into risks faced by organisations from the construction industry in their operations. The publication uses a case study analysis; for that an analysis of source materials available on the Internet was carried out. All the deliberations included in the paper are based on a review of scientific literature.

**Findings:** The discussions here focus on the applicability and the utilitarian dimension of the knowledge contained in the paper. They concern major organisations which render construction and assembly services in Poland. In the context of the research one of the biggest listed construction companies in Poland, included in the stock-exchange index of WIG-Construction, is analysed. For the needs of the paper the organisation is anonymised. Some conclusions apply to all the remaining 35 companies from the WIG-Construction index.

**Research limitations/implications:** The paper presents only the selected and most relevant issues related to the standardisation of risk management in the operations of construction enterprises. The conclusions drawn from the findings apply to the construction risk, which is seen in the science as a separate research category. They also refer to the problem of uncertainty. The empirical illustration is provided by one construction enterprise only; in the scientific research a case study analysis has both its advantages and its drawbacks.

**Practical implications:** The paper contains a proposal that standard risk management solutions should be implemented by construction contractors, which have to deal with uncertainty and risks in their operations. The implicational dimension of the paper is determined by the discussed issues.

**Originality/value:** The deliberations contained in the paper may be seen as casting light on the problems of risk management standardisation in the operations of construction companies. The paper constitutes an attempt to transfer the frameworks – offered by the subdiscipline that is referred to in the scientific literature as Enterprise Risk Management (ERM) – to construction

organisations i.e. contractors. The deliberations contained in the paper may encourage broader empirical studies in this field to be conducted in the future.

**Keywords:** Construction risk, risk management standards, strategic management, construction enterprises, uncertainty.

**Category of the paper:** Conceptual paper, case study.

## 1. Introduction

Today's organisations have a lot of challenges to meet when it comes to risk management. Fundamentally, this concerns all organisations, without any exceptions, and in this case these are construction enterprises as key participants of investment and construction processes. The problem is particularly important now when construction contractors have to operate in an uncertain environment. This uncertainty is largely connected with the events that are referred to in the scientific literature as black swans (Kotnis, 2014; Taleb, 2007). The black swans determine the conditions in which construction companies carry out their business. In this context, we may point out, without much hesitation, to the COVID-19 pandemic (Myrczek et al., 2021; Curran, 2022; Wolniak, 2022), which have had an unprecedented negative impact on a number of sectors of an economy, including the construction industry. The general uncertainty in the business environment is also caused by an armed conflict in Ukraine (United Nations, 2022) that is going on right now. These are currently two key issues falling under the category of uncertainty. We should also not ignore here the long-term consequences of the global financial crisis of 2008, which has hit the construction industries worldwide. In addition, we should keep in mind the factors which may cause the construction risk to occur – such as inflation – although these are usually analysed on a smaller scale and remain beyond a contractor's control.

Whichever specific factor triggers a global risk in the construction industry, however, today's construction managers – when making decisions – need to take into account uncertainty. Therefore, people who carry out management over construction companies look at their organisations now from a slightly different angle than they used to. This also stimulates scientists to continue and explore the knowledge which is referred to in the scientific literature as Construction Risk Management – CRM (Palmer et al., 1993; Flanagan, Norman, 1993; Edwards, 1995; Hatem, 1998; Boothroyd, Emmett, 1996; Godfrey, Halcrow, 1996; Bunni, 2003; Sawczuk, 2004; Weatherhead et al., 2005; Smith et al., 2006; Loosemore et al., 2006; Saporita, 2006; Burtonshaw-Gunn, 2009); at the same time, researchers may be encouraged to seek answers to the questions about new ways of dealing with the construction risk and the measures which may be undertaken to this end. Therefore, a proposal may be put forward here that international risk management standards should be implemented by such organisations.

To put it simply, these standards are formalised procedures and specific methodology in the area of risk management, which should be used in construction enterprises. These issues are the basic subject of the discussions in the paper, which aims, first of all, to find out whether standard solutions may be implemented in business practice of major Polish construction companies.

Therefore, the key objective of the paper is to present the issues related to the standardization of risk management in the largest construction enterprises which operate in the conditions of uncertainty. It should be emphasized that the paper exposes the utilitarian dimension and the applicability of such knowledge. It constitutes, in a way, an attempt to transfer the risk management frameworks offered by Enterprise Risk Management – ERM (Jędralska, 1992; Merna, Al-Thani, 2001; Lam, 2003; Krzakiewicz, 2005; Pickett, 2006; Dallas, 2006; Damodaran, 2009; Szczepankiewicz, 2010; Kasiewicz, 2011; Chapman, 2011; Gorzeń-Mitka, Korombel, 2011; Urbanowska-Sojkin, 2012; Buła, 2015; Raczkowski, Tworek, 2017; Bożek 2018; Sorin, Anca, 2020; Ricardianto et al., 2023) to the operations of construction companies. The paper contains a review of risk management concepts and discusses the key issues in this area.

This publication is a result of the research into risk in the construction industry, carried out by its authors (Tworek, Myrczek, 2015; 2016; 2021; Kosmalski, Myrczek, 2019; Myrczek et al., 2020; 2021; Myrczek, Tworek 2022). The paper provides a synthesis of a section of the knowledge in this field, combined with an in-depth review of scientific literature.

## **2. Uncertainty and (construction) risk – the theoretical approach**

The scientific literature offers a variety of approaches to the definition of both categories – uncertainty and risk. These two terms are often seen as synonymous, which is not so mistaken when looking at them in terms of organisational practice. However, in the world of science it should be noted that these are two separate research categories. In the scientific area, these notions were ultimately defined in 1921 by F.H. Knight, who saw risk as a measurable category and uncertainty as a non-measurable one (Knight, 1921). In a way, this was a turning point in the history of research into risk and the theory of uncertainty. What needs to be clearly stated here, however, is the fact that a significant number of scientists, such as mathematicians, had conducted their studies in this area even before that, as indicated in the scientific literature (Bernstein, 1997; Kaczmarek, 2008; Raczkowski, Tworek, 2017). It would be impossible to list here all the authors referred to in the scientific literature as the ones who undertook some research into risk and uncertainty in organisations. In particular, this statement applies to representatives of management and quality sciences. In other words, the more types of organisations were classified, the more groups of authors who dealt with the theory of risk and uncertainty in organisations may be found (Koźmiński, 2005; Jędralska, 2010; Jędralska,

Czech, 2011; Bochenek, 2012; Korombel et al. 2016; Raczkowski, Tworek, 2017). One should also not ignore the universal division into private and public organisations and, consequently, the division into commercial risks and public risks (Young, Fone, 2001; Fone, Young, 2007; Drennan, McConnell, 2007; Hood, Miller, 2009; Klimczak, 2009; Kumpiałowska, 2015; Fleming et al., 2016; Kosieradzka, Zawila-Niedźwiecki, 2016; Sienkiewicz-Małyjurek, 2018; Zawila-Niedźwiecki, 2018; Osborne et al., 2019); we should also keep in mind third-sector organisations (Herman et al., 2004; Chen, Bozeman, 2012; Domański, 2014; Tworek, Kozubek, 2022). Whatever types of organisations, classified in terms of ownership, from the scientific point of view it is important to remember about the key research trends, i.e. the ones which provide the definitions of risk, as compared to the notion of uncertainty. This is illustrated in Table 1.

**Table 1.**  
*Different trends in defining risk, as compared to uncertainty*

Type of trend/approach	Observations, conclusions and generalisations
Philosophical and classical basis for the definition of risk	<ol style="list-style-type: none"> <li>1. Risk is a difficult, frequently impossible to predict, potential changeability of outcome (effects) of an event.</li> <li>2. Risk is connected with: <ul style="list-style-type: none"> <li>– operating in unrecognised conditions,</li> <li>– doubts concerning the area of operation,</li> <li>– signals concerning the nature of so-called random events.</li> </ul> </li> <li>3. Risk is objective in its character and that is why it is necessary to differentiate „risk” from „risk realisation” and „management in the conditions of risk”.</li> <li>4. When defining risk it’s advisable to connect an objective element, i.e. risk itself, with a subjective element, such as a state of mind, i.e. uncertainty (risk is an objective correlate of subjective uncertainty).</li> </ol>
Neoclassical framework for an analysis of risk attributes	<ol style="list-style-type: none"> <li>5. Risk connected with business operations requires a point of reference, such as the category of profit, the value of which in the conditions of uncertainty is a variable.</li> <li>6. Risk propensity is determined by the value of an expected profit.</li> <li>7. Risk is not the same as uncertainty. Measurable uncertainty is risk.</li> </ol>
Characteristics of risk, according to the defensive trend in risk definition	<ol style="list-style-type: none"> <li>8. Risk is a negative phenomenon: a threat of a negative deviation from an aim, a potential incorrect decision to be made, a threat that an unfavourable result may be obtained.</li> <li>9. Uncertainty is a subjective category, while risk is objective.</li> <li>10. This approach is the basis for the theory of insurance, which deals with the notions of: a random event, an act of god, a fortuitous event, danger and hazard: physical, moral and spiritual.</li> <li>11. In the theory of insurance risk has many interpretations, sometimes totally different ones: <ul style="list-style-type: none"> <li>– risk as a possibility (chance, likelihood) of a loss,</li> <li>– risk as the probability of a result which differs from the expected one,</li> <li>– risk as the subject of insurance,</li> <li>– risk as uncertainty (a threat).</li> </ul> </li> </ol>

Cont. table 1.

<p>Approach to identification of risk characteristics, according to the offensive trend</p>	<p>12. Risk is inherently related to activities carried out [by an organisation] and it is a potential source of losses or profits. „Risk” has a negative meaning in the economic sense, and its positive equivalent is „opportunity”.</p> <p>13. Uncertainty is a static phenomenon, while risk is a dynamic one, closely linked to an activity.</p> <p>14. The phenomenon of uncertainty, once recognized, turns into a risk. When defining risk one may differentiate between objective and subjective elements. Objective elements include:</p> <ul style="list-style-type: none"> <li>– an undertaking or interests exposed to risk,</li> <li>– events which induce threats, the possibility of their occurrence and the time when they occur,</li> <li>– size of losses, which may be caused by these events.</li> </ul> <p>Subjective elements of risk include:</p> <ul style="list-style-type: none"> <li>– awareness [in an organisation] of threats connected with undertaken [project] or interests,</li> <li>– uncertainty – whether there is any risk in a given case, and if yes, what losses the risk may lead to,</li> <li>– a decision to take on responsibility for events which may occur.</li> </ul> <p>15. Risk is a function of uncertainty which always accompanies risk.</p> <p>16. Risk is a dynamic category, closely connected with act or omission.</p> <p>17. In the context of act [by an organisation] we may talk about the risk which:</p> <ul style="list-style-type: none"> <li>– has to be taken,</li> <li>– may be taken,</li> <li>– should not be taken.</li> </ul>
<p>Risk definition trend within the decision-making theory</p>	<p>18. Risk accompanies decision-making problems but only when there is no certainty as to the effects of a decision made (i.e. they are not determined). In these decisions risk may occur independently (in probabilistic situations) or in combination with uncertainty (in strategic situations).</p> <p>19. Decision-making in the conditions of uncertainty and risk is based on the game theory, in which – contrary to the theory of probability – there is a possibility to choose one of many action strategies available.</p> <p>20. An analysis of decision-making tasks must be conducted, together with an analysis of the environment in which these decisions are made: uncertainty, dynamics and complexity.</p>

Source: Karmańska, 2008, pp. 59-60.

When looking at Table 1 we can see that these two notions may be defined in various contexts. Undoubtedly, this is not an exhaustive list of definitions which we can come across in the scientific literature (Bernstein, 1997; Smith, 2003; Kaczmarek, 2008; Bochenek, 2012). In general, it may be assumed that risk is a much narrower phenomenon than uncertainty (Kaczmarek, 2008; Dydkowski et al. 2022). Contrary to uncertainty, risk, as a category, may be defined in the scientific field by means of probability distribution (Knight, 1921; Keynes, 1921; Arrow, 1971; Hull, 2005; Liu, Meyer, 2021), despite the fact that both the notions concern the future, which is inherently uncertain (Drucker, 1964; Collins, 1992; Jędralska, 1992; Courtney, 1994; Smith, 2003; Chapman, Ward, 2002; Krzakiewicz, 2005; Kaczmarek, 2008; Cleden, 2009; Jędralska, Czech, 2011; Kotnis, 2014; Głodziński, 2014; McGranaghan, Otto, 2022; Alós-Ferrer, Garagnani, 2022). It should be noted that the scholarly literature distinguishes one more state i.e. certainty (Wideman, 1992; Young, Tippins, 2001; Drennan, McConnell, 2007; Damodaran, 2009; Urbanowska-Sojkin, 2012; Power, 2016; Raczkowski, Tworek, 2017). No matter how the categories are defined, which research trend the theory of risk and uncertainty is set in or what divisions of organisations are taken into account in

practical terms, every organisation has its own (and sometimes) unique risk profile. This is also true about organisations operating in the field of construction, such as construction enterprises.

In general, as knowledge develops many authors in their publications have attempted to come up with new definitions of risk and uncertainty. This also concerns researchers from the subdiscipline of CRM (Flanagan, Norman, 1993; Palmer et al., 1993; Edwards, 1995; Hatem, 1998; Godfrey, Halcrow, 1996; Boothroyd, Emmett, 1996; Bunni, 2003; Sawczuk, 2004; Weatherhead et al., 2005; Loosemore et al., 2006; Smith et al., 2006; Saporita, 2006; Burtonshaw-Gunn, 2009; Tworek, Myrczek, 2016; 2021; Kosmalski, Myrczek, 2019). In particular, in the construction industry we deal with the construction risk as a separate scientific and research category; the understanding of risk in the construction industry results, first of all, from the specific nature of construction and assembly production. The scientific literature emphasises the specific features of such production, namely: first of all, immovability or permanent connection to the ground; secondly, an individual character of specific products and their high complexity; thirdly; a long production cycle; fourthly; capital intensity of the product and its longevity; fifthly; aesthetic values of products, which have a significant impact on the environment in which human beings live (Gawron, 1991). In addition, two key categories of risks in the construction industry include, first of all, risks related to nature, including weather conditions and geological conditions, and secondly, risks related to activities, such as the social risk, the political risk, the economic risk, the financial risk, the legal risk, the health risk, the technical risk, the cultural risk and the management risk (Edwards, Bowen, 1998). Here we may refer to the black swan theory, already mentioned in the introduction (Taleb, 2007) and, in particular, the COVID-19 pandemic (Myrczek et al., 2021; Chudziński et al., 2022; Myrczek, Tworek 2022), which occurred suddenly and unexpectedly in the present economic surroundings of organisations, changing the rules of a social and business life and, consequently, destroying the formerly followed standards and the image of the reality (Taleb, 2007). In the construction industry, the negative consequences of the pandemic overlapped in time with the consequences of the armed conflict in Ukraine (Curran, 2022; United Nations 2022); on one hand – this has had its impact on the operations of contractors and, on the other hand, a new category of risk, i.e. an armed conflict, emerged and has had its impact on the construction industry. Therefore, these new subcategories of a construction contractor's risk, which have hardly been researched so far, if at all, should be added to the ones addressed in the scientific literature. One should also consider the universal division into internal and external risks as well as exogenous and endogenous factors causing risks for construction contractors. Moreover, we should remember about the four main types of construction risks, i.e. the risks of time, price, quality and safety on a construction site (Flanagan, Norman, 1993). In general, the scientific literature indicates that construction risks may be divided into the ones which can – to some extent – be controlled by a contractor and the ones which are beyond their control; this division also refers to the factors which cause construction risks (Flanagan, Norman, 1993; Godfrey, Halcrow, 1996; Boothroyd, Emmett, 1996; Bunni, 2003; Loosemore et al., 2006;

Dallas, 2006; Smith et al., 2006; Burtonshaw-Gunn, 2009; Kosmalski, Myrczek, 2019). All this may lead to the statement that a big challenge for contractors now is posed by management carried out in the conditions of uncertainty i.e. in a situation when organisations are not able to fully identify and then estimate risks, in particular the ones coming from the external environment. As a consequence, there is a proposal here – in order to make risk management more effective in such organisations – that the existing international risk management standards, e.g. the ones offered by ERM (Merna, Al-Thani, 2001; Lam, 2003; Raz, Hillson, 2005; Pickett, 2006; Szczepankiewicz, 2010; Kasiewicz, 2011; Bożek, Tworek, 2011; Chapman, 2011; Gorzeń-Mitka, Korombel, 2011; Buła, 2015; Dubiel, 2016; Bożek 2018; Sorin, Anca, 2020; Haddad, Laghzaoui, 2020; Ricardianto et al., 2023) should be applied.

### **3. Towards standardisation of risk management in construction enterprises operating in the conditions of uncertainty – an attempt at a synthetic presentation of the issue**

The implementation of any risk management theory in practical operations of construction enterprises requires an in-depth knowledge of the specific character of risks that such organisations have to handle; an example may be the risk of force majeure, which is typical for the construction industry (Boothroyd, Emmett, 1996). No two contractors are identical, just like no two projects are exactly the same. It should be noted here that the construction industry is commonly regarded as a risky industry. This is due to the existence of factors which are characteristic for specific types of construction contracts; examples may include risk factors which occur in the specialised type of construction, such as the construction of gas pipelines (Kosmalski, Myrczek, 2019). Besides, risk-inducing factors occur with different intensity throughout different stages of an investment and construction process. In particular, at the project implementation stage, the risks coming from a contractor may be reflected by e.g. first of all, a lack of appropriate experience needed to perform the construction contract; secondly, too late start of construction work; thirdly, incorrect planning of the construction project; fourthly, major mistakes made at the performance stage; fifthly, engagement of inappropriate subcontractors and suppliers of prefabricated goods and construction equipment; sixthly, suspension of work due to an accident at a construction site; seventhly, violation of mandatory procedures and regulations required under the Building Law; eighthly, use of cheaper and worse quality construction materials (Tworek, 2010) etc. For comparison, the risks coming from an investor's side usually concern, first of all, a decision to discontinue a project during its implementation; secondly; mistakes in the project documentation (which is required from investors); thirdly, delays in payments for part of construction work done; fourthly, delays in commencement of construction work; fifthly, delays in commissioning of construction work;

sixthly, a lack of required expert surveys and approvals; seventhly, delays due to the introduction of changes to the project documentation (Tworek, 2010) etc. One should also not forget here about a wide range of risks coming from the other participants of the investment and construction process, such as a bank which finances the construction project.

Irrespective of the type of risks identified, the risk management process itself should be formalised in construction enterprises. In addition, a review of the literature on the subject may lead to an assumption that in today's organisations (not only the ones from the construction industry) risks should be managed in an integrated way (Merna, Al-Thani, 2001; Lam, 2003; Pickett, 2006; Dallas, 2006; Damodaran, 2009; Szczepankiewicz, 2010; Kasiewicz, 2011; Gorzeń-Mitka, Korombel, 2011; Buła, 2015; Bożek 2018; Haddad, Laghzaoui, 2020; Sorin, Anca, 2020; Ricardianto et al., 2023). Here it should clearly be stated that many international risk management standards are based on the concept of integrated risk management in organisations. Their review is presented in Table 2.

**Table 2.**

*Key international standards for risk management in organisations and their features*

Feature	FERMA	COSO II	AS/NZS
Definition of risk	Combination of probability of an event and its consequences. The standard draws attention to the existence of negative risks and positive risks but focuses, first of all, on the former ones.	A possibility that an event will occur and negatively affect the achievement of objectives. It talks about negative and positive aspects of risks (opportunities).	A possibility of an event which may occur and affect the operations of a company, leading to profits or losses, measured from the point of view of probability and consequences. Looks at negative and positive aspects of risk.
Definition of risk management	A process in which an organisation solves risk-related problems in a methodical way.	Performed by management, leadership or other personnel of an enterprise. This process is incorporated into strategies and activities across a company. It aims to identify potential events which may have a negative impact on the enterprise, to keep risks within specific limits and to provide reasonable assurance that the company's objectives are going to be met.	Culture, process and structures directly focused on obtaining benefits while controlling threats.
Application	A standard which may be used in all organisations, also in the public sector.	A universal standard addressed, first of all, to American listed companies.	A standard which may be used in all organisations.
How detailed	A very general description of the risk management process and its stages.	A very detailed description of stages within a risk management process.	A general description in the standard and a brief extension in the manual.
How formalised the process is	Indicating entities which participate in the process and a recommendation to create general internal regulations.	A risk management system, which is relatively strongly embedded in the structure of an organisation and the need to create extensive legislation.	Specification of entities involved in risk management and indicating formal documents supporting the risk management system.



Cont. table 2.

Setting objectives	No specific section on setting objectives. It emphasises the impact of risk management on the achievement of strategic objectives.	Setting of objectives is one stage within a risk management process. It emphasises the correlation between risk management and the achievement of strategic objectives. There are four types of objectives: strategic, operational, reporting and compliance.	Setting of objectives is incorporated into a risk management process.
Risk identification	Risk identification is seen as part of a risk analysis, in which types of risks and their estimations are described. Some hints are given in this respect. It is recommended that risk identification should be carried out in a methodical way to ensure that all actions are defined. An attachment to the standard includes a short list of risk identification techniques.	Within risk identification the standard refers to an analysis of the internal and external surroundings of a company, which may be a source of events that positively or negatively affect the implementation of a strategy (it provides a catalogue of exogenous and endogenous factors). COSO provides detailed information on risk identification techniques (supplemented with examples).	AS/NZS does not dedicate much space to risk identification. It emphasizes the need for regularity, whether a risk is controlled by an organisation or not. The standard provides guidelines on what information is needed to identify risks, the method for risk identification and the documentation which closes this stage of the process.
Risk measurement	Once risk is assessed, a reference must be made to pre-established criteria and a decision needs to be taken on how to proceed.	No separate section on measurement. Some references to risk measurement may be found in the section which deals with risk assessment and risk responses.	The guidelines section includes criteria for measurement and a concept of acceptable risk. No references to historical events in the determination of the criteria for assessment.
Reporting and communication	Reporting and (internal and external) communication precede the risk response section.	Under COSO, reporting and communication follow risk responses and audit activities.	Issues on reporting and communication are presented in part one of the standard.
Risk response	FERMA does not devote much attention to this issue. It points out that a risk response comprises risk control and risk mitigation, as well as risk avoidance, risk transfer and risk financing.	COSO distinguishes four possible risk responses: avoidance, reduction, sharing, acceptance. It provides a brief analysis of costs and benefits. A more detailed approach can be found in a section on application techniques.	AS/NZS describes separately actions connected with risks, which bring positive and negative consequences. The main part of the standard contains a brief analysis of costs and benefits of every risk response described, but more details on this topic (qualitative and quantitative analyses) are given in the section containing guidelines.

Cont. table 2.

Monitoring of the risk management process	Monitoring should provide information on risk identification and appropriate control activities.	COSO distinguishes two types of monitoring – ongoing monitoring and ad hoc monitoring. The standard provides a detailed description of the observation process, including subjective and objective scopes of reporting.	Ongoing monitoring combined with drawing of conclusions is very important in the risk management process. The section with guidelines includes a detailed description of monitoring and measuring of effectiveness of the risk management process.
Responsibility for risk management	The standard specifies the roles and responsibilities for: management, business units, a risk management unit and internal audit. In addition, it discusses a risk management policy and resources for the implementation of the process.	The standard specifies roles and scopes of responsibility for: management, directors, CRO, CFOs, internal auditors and external parties. The supplementary part contains detailed examples of job profiles for CRO, CEO, audit committee and a risk committee.	The AS/NZS standard makes a very general reference to this topic and discusses the following issues: evaluation of current practices, ensuring support from senior management, establishing responsibility, ensuring appropriate resources.
ERM limitations	Does not cover this topic.	Even the best risk management system is not bound to lead to the achievement of objectives. COSO indicates the following limitations: a management process, human error, repeated attempts to outsmart control processes, costs of risk responses.	Does not cover this topic.
Supplementary documents	References to ISO/EIC standards	Strongly connected with COSO (internal control) and the provisions of the Sarbanes-Oxley Act.	Suggested use of additional standards for specific types of risk.

Source: Kasiewicz, 2011, pp. 93-96.

Table 2 is basically a synthesis of the features demonstrated by the specific risk management standards, which are listed there. These are the key standards that have been developed through organisational practice. What matters here is the fact that many of the components of the standard solutions presented in Table 2 have their origin in the risk (and uncertainty) management theory as such. More specifically, this may apply to, on one hand, the very definition of risk and the way a risk management process runs in organisations, and on the other hand, the methodical approach to risk management; methodical aspects are a particularly important element of the modern knowledge of risk management in organisations (Merna, Al-Thani, 2001; Lam, 2003; Pickett, 2006; Dallas, 2006; Kasiewicz, 2011; Chapman, 2011; Kumpiałowska, 2015; Buła, 2015; Kozieradzka, Zawila-Niedźwiecki, 2016; Bożek 2018). Risk and uncertainty management is inextricably linked to the stages of strategic management, i.e. strategic thinking and strategic action (Jędralska, Czech, 2011).

Apart from the risk management standards listed in Table 2, special importance should be attached to ISO 31000:2009 standard (The International Organization for Standardization) Risk Management – Principles and guidelines, including supplementary documents, i.e. ISO Guide

73:2009 – Vocabulary and ISO/IEC 31010:2009 – Risk Assessment Techniques (ISO 31000; Dubiel, 2016; Haddad, Laghzaoui, 2020); in Poland an equivalent to this standard is a new version of a risk management norm of PN-ISO 31000:2018 (Bożek, 2018). In organisational practice it plays quite a significant role, when compared to the other standards listed in Table 2. The reason is, first of all, the fact that it is certified by ISO. However, one cannot exclude also other standard solutions which, similarly to ISO 31000, have their advantages and drawbacks. A clear advantage of the British standard of FERMA (The Federation of European Risk Management Associations), which was developed for public organisations (FERMA, 2004) by The Institute of Risk Management – IRM, The National Forum for Risk Management in the Public Sektor – ALARM and The Association of Insurance and Risk Managers – AIRMIC, is its simplicity. The standards of COSO II (The Committee of Sponsoring Organizations of the Treadway Commission) and AS/NZS (Standards Australia and Standards New Zealand) were developed for private organisations and are more complex (COSO, 2004; Raz, Hillson, 2005; Pickett, 2006; Haddad, Laghzaoui, 2020; Sorin, Anca, 2020). They require specific expertise. Nevertheless, a number of solutions offered by these standards are – to a varying extent – used by participants of investment and construction processes; this is, first of all, due to high universality of their applications. A separate scientific monography would be required in order to present them in more detail, since there are many more international risk management standards available worldwide.

### **3.1. One of the largest Polish construction enterprise – a case study analysis**

In Poland the largest construction enterprises are listed on the Warsaw Stock Exchange under the stock-exchange index of WIG-Construction. In compliance with the effective regulations all information is made public and is generally available on the Internet. A detailed analysis of the thirty six construction companies may lead to a conclusion that responsibility for risk management in organisations is carried by senior management. In such companies there is an obligation to have their risks identified and analysed, but different organisations have their risk management processes formalised to a different extent. For example, in their integrated report for 2020 one of the key companies managing a very big portfolio of construction investments (a group of construction companies) identified the following types of construction risks:

- „(...) broadly understood economic uncertainty caused by the COVID-19 pandemic,
- a rise in prices of construction materials, crude oil derivatives and energy,
- a rise in prices of services, a limited availability or bankruptcy of subcontractors,
- a rise in labour costs and a limited availability of skilled workers,
- delays in timely performance or insufficient work quality of subcontractors,
- delays in obtaining of required administrative decisions,
- changes to the scope of work or to technologies specified in contracts,
- unfavourable weather or land conditions” (2020 Report).

According to the report, despite having control mechanisms in place and general protection against (credit, currency and third party liability) risks in an organisation, some factors may still occur and lead to the project performance with a profit margin lower than the originally planned one (2020 Report). At the end of the day, every risk finds its reflection in a financial result generated by a construction enterprise. For the sake of comparison, in 2022 the key risk identified in the operations of the company were deteriorating conditions on the market of construction and assembly services in Poland (2022 Report). That risk was seen as a very serious one, possibly leading to some delays in transfers of funds or a reduction in funds available for the performance of infrastructure and railway construction projects, high inflation, a rise in prices of fuels and energy and an increase in costs of construction and assembly production (2022 Report).

In organisational practice the contractor under review, on one hand, issues a map of key risks for their organisation, to be presented at meetings of their management board and audit committee and, on the other hand, a map of other risks controlled and monitored by departmental directors of the group of construction companies, who also sit on supervisory boards in subsidiaries (2020 Report). When reviewing the information given on the contractor's website, we can see that in practical terms risk management is carried out slightly differently to the content of Table 2; practice often differs from theory. The experience gained by managers from the performance of construction contracts effectively limits the key non-financial risks, i.e. the ones coming mostly from engaged subcontractors (2020 Report). It should be noted that the surveyed contractor, just like all the remaining construction companies included in the stock-exchange index of WIG-Construction, operated in the conditions of uncertainty, at the time of a so-called black swan i.e. the COVID-19 pandemic. In addition, a compliance policy, which they put in place, also played its role, although in 2022 the risk in that area was identified as moderate (2022 Report).

#### **4. Conclusions**

All the deliberations included in this publication may be summarised in two ways, i.e. from the theoretical point of view and from the practical one. On the background of the theory of organisational management and risk management or, in general, organisational management in the conditions of uncertainty, we may agree with many authors in the scientific literature that uncertainty and risk are interlinked notions (Knight, 1921; Bernstein, 1997; Krzakiewicz, 2005; Kaczmarek, 2008; Karmańska, 2008; Jędralska, Czech, 2011). This refers to the content of Table 1. In particular, when applying the theory to construction enterprises operating in uncertain and risky situations, it should be stated, first of all, that there are different types of uncertainty (Jędralska, 1992) and there are different construction risks; and secondly,

the construction risk is a narrower concept than the category of uncertainty; thirdly; it is difficult to specify the state of certainty in the construction industry; fourthly, building contractors make some decisions without having complete knowledge of the future and some decisions when having such knowledge, i.e. in the state of certainty (Chapman, Ward, 2002; Hull, 2007; Alós-Ferrer, Garagnani, 2022; McGranaghan, Otto, 2022); fifthly, (in the construction industry) a lack of any knowledge of the future concerns the notion of uncertainty (Collins, 1992; Wideman, 1992; Bernstein, 1997; Koźmiński, 2005; Jędralska, 2010); sixthly, depending on the trend in the definition of risk (Table 1), risk management carried out by a contractor may be seen, on one hand, as an opportunity, and on the other hand, as a threat (Kaczmarek, 2008) – and this aspect is particularly important from the point of view of the theory of risk management in construction enterprises.

The other context of the deliberations is practical knowledge. Fundamentally, the international risk management standards outlined here have their origin in the organisational practice, which is often referred to as consulting (Table 2). Therefore, this knowledge should be considered in terms of function and functionality (Tworek, Myrczek, 2016). In particular, practical risk management in construction enterprises should be analysed in an integrated way, which means that, first of all, risk management in all areas of a construction company's operations; secondly, responsibility for risk and uncertainty in an organisation is defined and rests with internal audit and audit committees within supervisory boards (in listed construction enterprises included in the stock exchange index of WIG-Construction); thirdly, all the risk management methods are used in a complementary way; fourthly, risk management concerns an organization's surroundings, including its external environment – these are the conditions of the COVID-19 pandemic or the effects on the construction industry of the armed conflict in Ukraine; fifthly, risk management supports the general management over a construction enterprise; sixthly, risk management is ongoing and regular, and it is viewed as a process; seventhly, effective risk management reduces the global risk a construction contractor has to face" (Tworek, Myrczek, 2016). In general, this is a systemic approach to risk management in construction enterprises operating in the conditions of uncertainty, which may apply, in particular, to the thirty six largest Polish construction contractors.

Summing up, contractors operating in the conditions of uncertainty need to implement in their organisations the solutions offered by international risk management standards. In case of the Polish largest construction enterprises listed on the WSE, this refers to the standard of COSO II or a concept of implementing the standard of ISO 31000. This may help many contractors to avoid unnecessary additional consequences of risks, which complies with the construction risk mechanism described in the literature on the subject (Palmer et al., 1993; Flanagan, Norman, 1993; Edwards, 1995; Hatem, 1998; Boothroyd, Emmett, 1996; Godfrey, Halcrow, 1996; Bunni, 2003; Sawczuk, 2004; Weatherhead et. al., 2005; Smith et al., 2006; Loosemore et al., 2006; Saporita, 2006; Burtonshaw-Gunn, 2009; Tworek, Myrczek, 2016;

2021; Kosmalski, Myrczek, 2019). The implementation of the existing risk management standards in the operations of construction contractors seems to be the best solution.

However, when trying to define how widely the standard risk management solutions outlined in this publication are used by all the building contractors operating on the Polish market, a countrywide empirical study should be conducted. This, however, may be a task for the future. The present publication may inspire other researchers dealing with risk management and uncertainty in organisations to undertake such studies.

## References

1. Alós-Ferrer, C., Garagnani, M. (2022). Strength of preference and decisions under risk. *Journal of Risk and Uncertainty*, Vol. 64, Iss. 3, pp. 309-329.
2. Arrow, K.J. (1971). *Essays in the Theory of Risk Bearing*. Chicago: Markham.
3. Bernstein, P. (1997). *Against the Gods: The Remarkable Story of Risk*. Chichester: John Wiley & Sons.
4. Bochenek, M. (2012). Ryzyko i niepewność w naukach ekonomicznych – rozważania semantyczne. *Ekonomia. Prace Naukowe*, no. 4(21). Wrocław: Wydawnictwo Uniwersytetu Ekonomicznego.
5. Boothroyd, C., Emmett, J. (1996). *Risk Management: A practical guide for construction professionals*. London: Witherby.
6. Bożek, S. (2018). *Standaryzowane zarządzanie ryzykiem w podejściu procesowym: implikacje dla przedsiębiorstwa ubezpieczeniowego*. Katowice: Wydawnictwo Uniwersytetu Ekonomicznego.
7. Bożek, S., Tworek, P. (2011). Risk Management Standardization in Entrepreneurship. Selected Issues. In: D. Dluhošová (Ed.), *Financial Management of Firms and Financial Institutions* (pp. 436-445). Proceedings from 8<sup>th</sup> International Conference. Ostrava: VŠB – Technická Univerzita Ostrava.
8. Buła, P. (2015). *System zarządzania ryzykiem w przedsiębiorstwie jako element nadzoru korporacyjnego*. Kraków: Wydawnictwo Uniwersytetu Jagiellońskiego.
9. Bunni, G.N. (2003). *Risk and insurance in construction*. London/New York: Spon Press.
10. Burtonshaw-Gunn, S.A. (2009). *Risk and Financial Management in Construction*. Farnham: Gower Publishing.
11. Chapman, Ch., Ward, S. (2002), *Managing Project Risk and Uncertainty: A Constructively Simple Approach to Decision Making*. Chichester: John Wiley & Sons.
12. Chapman, J.R. (2011). *Simple tools and techniques for enterprise risk management*. Chichester: John Wiley & Sons, Ltd.

13. Chen, Ch., Bozeman, B. (2012). Organizational Risk Aversion: Comparing The Public and Non-Profit Sectors. *Public Management Review*, Vol. 14, Iss. 3, pp. 377-402.
14. Chudziński, P., Cyfert, S., Dyduch, W., Zastempowski, M. (2022). Risk management during the Covid-19 crisis: business responses in the Polish water utilities. *AQUA – Water Infrastructure, Ecosystems and Society*, Vol. 71, No. 3, pp. 388-398.
15. Cleden, D. (2009). *Managing Project Uncertainty*. Farnham: Gower Publishing.
16. Collins, D. (1992). The Strategic Management of Uncertainty. *European Management Journal*, Vol. 10, Iss. 2, pp. 125-135.
17. COSO (2004). Enterprise Risk Management – Integrated Framework. Executive Summary.
18. Courtney, H., Kirkland, J., Viguerie, P. (1994). Strategy under Uncertainty. *Harvard Business Review*, November/December, p. 107.
19. Curran, D. (2022). Covid-19, World Risk Society, and Transformation of the State. In: P.R. Brown, J.O. Zinn, (Eds.), *Covid-19 and the Sociology of Risk and Uncertainty* (pp. 247-265). London/New York: Palgrave Macmillan.
20. Dallas, M.F. (2006). *Value & Risk Management*. Oxford: Blackwell Publishing.
21. Damodaran, A. (2009). *Ryzyko strategiczne. Podstawy zarządzania ryzykiem*. Warszawa: Wydawnictwo Akademii Leona Koźmińskiego.
22. Domański, J. (2014). *Zarządzanie ryzykiem w organizacjach non profit*. Warszawa: Wolters Kluwer.
23. Drennan, L., McConnell, A. (2007). *Risk and Crisis Management in the Public Sector*. London: Routledge.
24. Drucker, P.F. (1964). *Managing for Results: Economic Tasks and Risk-taking Decisions*. London: Heinemann.
25. Dubiel, B. (2016). Standardy zarządzania ryzykiem w jednostkach samorządu terytorialnego. *Zeszyty Naukowe, s. Finanse, Rynki Finansowe, Ubezpieczenia, nr 74, t. 1*. Szczecin: Uniwersytet Szczeciński, pp. 481-491.
26. Dydkowski, G., Krawczyk, G., Urbanek, A. (2022). *Ryzyko w umowach i rozliczeniach w miejskim transporcie zbiorowym*. Katowice: Wydawnictwo Uniwersytetu Ekonomicznego.
27. Edwards, J.P, Bowen, A.P. (1998). Risk and risk management in construction: a review and future directions for research. *Engineering, Construction and Architectural Management*, Vol. 5, No. 4, p. 342.
28. Edwards, L. (1995). *Practical risk management in the construction industry*. London: Thomas Telford.
29. FERMA (2004). A Risk Management Standard. London: AIRMIC/ALARM/IRM.
30. Flanagan, R., Norman, G. (1993). *Risk management in construction*. Oxford: Blackwell Publishing.
31. Flemig, S., Osborne, S., Kinder, T. (2016). Risky Business – Reconceptualizing Risk and Innovation in Public Services. *Public Money & Management*, Vol. 36, Iss. 6, pp. 425-432.

32. Fone, M., Young, C.P. (2007). *Managing Risks in Public Organizations*. New York: Palgrave Macmillan.
33. Gawron, H. (1991). *Ekonomika przedsiębiorstwa budowlanego*. Poznań. Wydawnictwo Akademii Ekonomicznej.
34. Głodziński, E. (2014). Zarządzanie projektami w warunkach niepewności – zakres i metodyka. *Przegląd Organizacji*, No. 7, pp. 34-39.
35. Godfrey, S.P., Halcrow, W. (1996). *Control of Risk: A Guide to the Systematic Management of Risk from Construction*. London: Construction Industry Research and Information Association.
36. Gorzeń-Mitka, I., Korombel, A. (2011). *ERM zintegrowane zarządzanie ryzykiem. Wybrane problemy teorii i praktyki*. Częstochowa: Politechnika Częstochowska.
37. Haddad, H., Laghzaoui, F. (2020). Review of risk management standards: Convergences and divergences. *Moroccan Journal of Quantitative and Qualitative Research*, Vol. 2, No. 1, pp. 71-80.
38. Hatem, J.D. (1998). *Subsurface Conditions: Risk Management for Design and Construction Management Professionals*. New York: John Wiley & Sons.
39. Herman, L.M., Head, L.G., Jackson, M.P., Fogarty, E.T. (2004). *Managing Risk in Nonprofit Organizations. A Comprehensive Guide*. Hoboken: John Wiley & Sons, Inc.
40. Hood, C., Miller, P. (2009). *Risk and Public Services*. Oxford: ESRC Public Services Programme.
41. Hull, C.J. (2007). *Risk Management and Financial Institutions*. New York: Pearson Education, Inc.
42. ISO 31000 (2009). Risk management – Principles and guidelines on implementation. ISO: Geneva.
43. Jędralska, K. (1992). *Zachowania przedsiębiorstw w sytuacjach niepewnych i ryzykownych*. Katowice: Wydawnictwo Akademii Ekonomicznej.
44. Jędralska, K. (Ed.) (2010). *Zarządzanie niepewnością*. Katowice: Wydawnictwo Akademii Ekonomicznej.
45. Jędralska, K., Czech, A. (2011). O naturze niepewności i jej interpretacji. *Master of Business*, No. 3, pp. 9-18.
46. Kaczmarek, T.T. (2008). *Ryzyko i zarządzanie ryzykiem. Ujęcie interdyscyplinarne*. Warszawa: Difin.
47. Karmańska, A. (2008). *Ryzyko w rachunkowości*. Warszawa: Difin.
48. Kasiewicz, S. (2011). *Zarządzanie zintegrowanym ryzykiem w przedsiębiorstwie w Polsce*. Warszawa: Oficyna Wydawnicza Wolters Kluwer Business.
49. Keynes, M.J. (1921). *A treatise on probability*. London: Macmillan and Co.
50. Klimczak, K.M. (2009). Wdrożenie zarządzania ryzykiem w jednostkach sektora finansów publicznych. *Przegląd Organizacji*, No. 5, pp. 23-26.



51. Knight, F.H. (1921). *Risk, Uncertainty, and Profit*. Boston: Hart, Schaffner & Marx.
52. Korombel, A., Bitkowska, A., Moczyłowska, J.M. (2016). *Najnowsze trendy w zarządzaniu ryzykiem – apetyt na ryzyko, ryzyko personalne, ryzyko w procesach biznesowych*. Częstochowa: Wydawnictwo Politechniki Częstochowskiej.
53. Kosieradzka, A., Zawila-Niedźwiecki, J. (2016). *Zaawansowana metodyka oceny ryzyka w publicznym zarządzaniu kryzysowym*. Kraków: edu-Libri.
54. Kosmalski, S., Myrczek, J. (2019). *Zarządzanie ryzykiem w procesie budowy gazociągu przesyłowego*. Warszawa: Difin.
55. Kotnis, M. (2014). Modele zarządzania ryzykiem w warunkach niepewności. *Zeszyty Naukowe, s. Finanse, Rynki Finansowe, Ubezpieczenia, no. 65, t. 1*. Szczecin: Uniwersytet Szczeciński, pp. 481-491.
56. Koźmiński, K.A. (2005). *Zarządzanie w warunkach niepewności. Podręcznik dla zaawansowanych*. Warszawa: PWN.
57. Krzakiewicz, K. (2005). Niepewność i ryzyko w działalności menedżerskiej w procesie internacjonalizacji przedsiębiorstw. In: J. Bizon-Górecka (Ed.), *Strategie zarządzania ryzykiem w przedsiębiorstwie – wpływ otoczenia na funkcjonowanie przedsiębiorstwa*. Bydgoszcz: TNOiK, „Dom Organizatora”.
58. Kumpiałowska, A. (2015). *Praktyczne narzędzia zarządzania ryzykiem w jednostkach sektora publicznego*. Warszawa: C.H. Beck.
59. Lam, J. (2003). *Enterprise Risk Management: From Incentives to Controls*. Hoboken: John Wiley & Sons.
60. Liu, L., Meyer, J. (2021). Stochastic superiority. *Journal of Risk and Uncertainty, Vol. 62, Iss. 3*, pp. 225-246.
61. Loosemore, M., Raftery, J., Reilly, Ch., Higgon, D. (2006). *Risk Management in Projects*. London/New York: Taylor & Francis Group.
62. McGranaghan, Ch., Otto, G.S. (2022). Choice uncertainty and the endowment effect. *Journal of Risk and Uncertainty, Vol. 65, Iss. 1*, pp. 83-104.
63. Merna, T., Al-Thani, F.F. (2001). *Corporate Risk Management*. Chichester: John Wiley & Sons.
64. Myrczek, J., Tworek, P. (2022). Managing finance and risk in Polish property development enterprises in the period of SARS-CoV-2 pandemic. *Zeszyty Naukowe, s. Organizacja i Zarządzanie, z. 163*. Gliwice: Politechnika Śląska, pp. 365-380.
65. Myrczek, J., Juraszek, J., Tworek, P. (2020). Risk management analysis in construction enterprises in selected regions in Poland. *Technical Transactions, Vol. 117, Iss. 1*, pp. 1-13.
66. Myrczek, J., Tworek, P., Podstawka Z. (2021). Financial management and risk among Polish developers in the period of COVID-19 pandemic. *Zeszyty Naukowe, s. Organizacja i Zarządzanie, z. 154*. Gliwice: Politechnika Śląska, pp. 191-200.

67. Osborne, S., Brandsen, T., Mele, V., Nemec, J., Fleming, S. (2019). Risking innovation. Understanding risk and public service innovation – evidence from a four nation study. *Public Money & Management, Vol. 36, Iss. 6*, pp. 426-430.
68. Palmer, J.W., Maloney, M.J. Heffron, L.J. (1993). *Construction Insurance, Bonding and Risk Management*. New York: McGraw-Hill.
69. Pickett, S.H.K. (2006). *Enterprise Risk Management. A Manager's Journey*. Hoboken: John Wiley & Sons.
70. Power, M. (2016). *Riskwork: Essays on the Organizational Life of Risk Management*. Oxford: Oxford University Press.
71. Raczkowski, K., Tworek, P. (2017). What does risk management in an economy really mean? In: K. Raczkowski (Ed.), *Risk Management in Public Administration* (pp. 1-39). London/New York: Palgrave Macmillan.
72. *Raport zintegrowany 2020*. Available online: <https://raportroczny.budimex.pl/2020/pl/zarzadzanie/kultura-zarzadzania/system-zarzadzania-ryzykiem/>, 10.09.2023.
73. *Raport zintegrowany 2022*. Available online: <https://raportroczny.budimex.pl/2022/istotne-ryzyka>, 10.09.2023.
74. Raz, T., Hillson, D. (2005). A Comparative Review of Risk Management Standards. *Risk Management: An International Journal, Vol. 7, Iss. 4*, pp. 53-66.
75. Ricardianto, P., Lembang, T.A., Tatiana Y., Ruminda, M., Kholduna, I.A., Kusuma I.G.N.A.G.E.T., Sembiring, A.F.H., Sudewo, C.G., Suryani, D., Endri, E. (2023). Enterprise risk management and business strategy on firm performance: The role of mediating competitive advantage. *Uncertain Supply Chain Management, Iss. 11*, pp. 249-260.
76. Saporita, R. (2006). *Managing Risks In Design and Construction Project*. New York: ASME.
77. Sawczuk, B. (2004). *Risk Avoidance for the Building Team*. London: E&FN Spon.
78. Sienkiewicz-Małyjurek, K. (2018). Ryzyko relacyjne w sieciach zarządzania publicznego. *Przeгляд Organizacji, No. 11*, pp. 43-49.
79. Smith, J.M. (2003). *Appraisal, Risk and Uncertainty*. London: Thomas Telford.
80. Smith, N.J., Merna, T., Jobling, P. (2006). *Managing risk in construction projects*. Oxford: Blackwell Publishing.
81. Sorin, G.A., Anca, E.A.N. (2020). Enterprise Risk Management: A Literature Review and Agenda for Future Research. *Journal of Risk and Financial Management, Vol. 13, Iss. 281*, pp. 1-22.
82. Szczepankiewicz, E.I. (2010). Zintegrowane zarządzanie ryzykiem (ERM) w przedsiębiorstwie. *Ekonomika i Organizacja Przedsiębiorstwa, No. 11*, pp. 37-45.
83. Taleb, N.N. (2007). *The Black Swan: The Impact of the Highly Improbable*. London: Penguin Books Ltd.
84. Tworek, P. (2010). *Ryzyko wykonawców przedsięwzięć inwestycyjnych*. Wydawnictwo Akademii Ekonomicznej w Katowicach.

85. Tworek, P., Myrczek, J. (2015). Methodical problems of response to the risks in investment and construction processes: A case of Polish largest developers (survey research). In: M. Čulík (Ed.), *Financial Management of Firms and Financial Institutions. Part IV. Proceedings from 10<sup>th</sup> International Conference* (pp. 1348-1355). Ostrava: VŠB – Technická Univerzita Ostrava.
86. Tworek, P., Kozubek, M. (2022). On the nature of risk and risk management in non-profit organizations: From the experiences of a Polish foundation – Part 2. *Zeszyty Naukowe, s. Organizacja i Zarządzanie, z. 163*. Gliwice: Politechnika Śląska, pp. 628-632.
87. Tworek, P., Myrczek, J. (2016). Zintegrowane zarządzanie ryzykiem jako funkcja wspomagająca kierowanie przedsiębiorstwem deweloperskim. In: A. Zakrzewska-Bielawska (Ed.), *Stan i perspektywy rozwoju nauk o zarządzaniu: wybrane problemy* (pp. 561-573). Warszawa: TNOiK „Dom Organizatora”.
88. Tworek, P., Myrczek, J. (2021). Risk management in construction enterprises in Śląskie and Małopolskie voivodships in Poland. *Zeszyty Naukowe, s. Organizacja i Zarządzanie, z. 150*. Gliwice: Politechnika Śląska, pp. 299-308.
89. United Nations (2022). Global Impact of war in Ukraine on food, energy and financial systems. Available online: <https://news.un.org/pages/wp-content/uploads/2022/04/UN-GCRG-Brief-1.pdf>, 17.09.2023.
90. Urbanowska-Sojkin, E. (2012), Ryzyko w zarządzaniu strategicznym. In: E. Urbanowska-Sojkin (Ed.), *Ryzyko w zarządzaniu strategicznym przedsiębiorstwem. Teoria i praktyka*. (pp. 35-50). Poznań: Wydawnictwo Uniwersytetu Ekonomicznego.
91. Weatherhead, M., Owen, K., Hall, C. (2005). *Integrating Value and Risk in Construction*. London: Construction Industry Research and Information Association.
92. Wideman, R.M. (1992). *Project & Program Risk Management*. Newtown Square: Project Management Institute.
93. Wolniak, R. (2022). *Wpływ pandemii COVID-19 na zarządzanie*. *Zeszyty Naukowe, No. 1(18)*. Katowice: Wyższa Szkoła Zarządzania Ochroną Pracy w Katowicach, pp. 21-32.
94. Young, C.P., Fone, M. (2001). *Public Sector Risk Management*. Oxford: Butterworth – Heinemann.
95. Young, C.P., Tippins, C.S. (2001). *Managing Business Risk: An Organization – Wide Approach to Risk Management*. New York: American Management Association.
96. Zawila-Niedźwiecki, J. (2018). *Od zarządzania ryzykiem operacyjnym do publicznego zarządzania kryzysowego. Wyzwania badawcze*. Kraków: edu-Libri