

PIOTR TWOREK

FUNDAMENTALS OF CONSTRUCTION RISK MANAGEMENT (CRM). SELECTED THEORETICAL AND PRACTICAL PROBLEMS

Introduction

The construction industry is one of the most risky branches of an economy. This is largely due to the specific nature of the construction and assembly business and the conditions, in which construction investments are carried out. In particular, force majeure risk constitutes a standard risk for the construction industry; the typical construction and assembly risks mainly concerns contractors as they carry out investment projects. The fact that there is a risk means that construction and assembly companies need to manage this risk. In this way they can limit any possible losses that a company may incur as a consequence of the risks and prevent such risks as industrial incidents or construction disasters, more effectively. The effectiveness of such measures, however, is affected by the quality of a risk management system, which is implemented in a company, and the quality of work performed by the people, who are responsible for risk. In order to manage risk effectively, a construction companies' staff needs to have an appropriate methodological background in this area and be familiar with general risk management principles. These issues are addressed in this paper. It aims, in particular, to discuss risk management problems in the construction industry from a contractor's point of view. The paper deals with this problem in a synthetic way; the author discusses only selected issues from a vast area of knowledge related to Construction Risk Management (CRM). The article is mainly theoretical, although some of the presented ideas are applicable. When formulating his conclusions, the author draws on his own experience, which he gained when conducting risk studies covering 100 leading construction and assembly companies in Poland.

Risk and risk management in construction

Risk in the construction business has to be analysed in a multidimensional way. It's a category, which should always be considered in the areas of economics, law, technology, ergonomics, ecology, etc. Therefore, risk may be defined in a number of ways.¹ For instance,

¹ See for example: C. Boothroyd, J. Emmett: *Risk Management. A Practical Guide for Construction Professionals*, Witherby & Co., London 1996, pp. 2–3.

the occurrence of risk in the construction industry is defined by J.J. Revere as a discrete occurrence that may affect the project for better or worse”.² Risk in the construction industry tends to be seen as a threat. As emphasised by N.G. Bunni “hazards in construction exist not only after the structure or the project is completed, but they also exist and, in fact, in larger numbers and probability of occurrence, during the construction period”.³ Such understanding of risk results from the defensive approach to risk definition; this is the way in which risk is defined by e.g. insurers. Risk in the construction industry should be defined in subjective and objective terms. In practice, risk is perceived differently by different participants of the investment and construction process. In general, an investor should answer two basic questions: can they risk a potential loss for a possible profit, i.e. is this gain worth taking on risk? can they afford such a risk, i.e. will a lack of protection against this risk not jeopardize an entire investment?”⁴ The contractor, in turn, tends to perceive risk through a possible loss or damage, which may occur during construction work.⁵ A typical contractor’s risk is the one defined (by insurers) as the builder’s risk. This is the origin of insurance titles in the construction industry – such as CAR (Contractor’s All Risks) and EAR (Erection All Risks) policies, which are regarded as ‘all risks’ types of insurance.⁶ „Under such insurance, the insured is given the insurance coverage against all unpredictable random events (all risks), which aren’t clearly excluded”⁷ „The risks which are excluded from insurance coverage are:

- a loss or damage due to a faulty design, material defects, faulty casting or faulty workmanship, material wear, corrosion, oxidation, a loss of value due to a break in use, and normal weather effects,
- mechanical or electric failures of the plant construction and its equipment,
- war actions, domestic riots and unrest, industrial action, revolts, revolutions, uprisings, civil unrest,
- deliberate negligence on the part of the insured or their representatives,
- fatal or non-fatal incidents of the insured and their employees,
- nuclear energy effects (nuclear reaction, nuclear radiation or radioactive contamination),
- any consequential losses, including penalties, losses due to delays, non-performance, loss of a contract,

² J.J. Revere: *Construction risk. A Guide to the Identification and Mitigation of Construction Risks*, 1st Books Library, Bloomington 2003, p. 92.

³ G.N. Bunni: *Risk and Insurance in Construction*, Spon Press Taylor & Francis Group, London–New York 2003, p. 40.

⁴ A. Minasowicz: *Efektywność i zarządzanie finansami w budownictwie*, Poltext, Warszawa 2009, p. 27.

⁵ See more: R.E. Hayes, J.G. Perry, P.A. Thompson, G. Willmer: *Risk Management in Engineering Construction*, Thomas Telford, Ltd., London 1986, p. 12.

⁶ P. Tworek: *The ‘all risks’ insurance in Polish construction industry*, Ekonomická Univerzita v Bratislave, Bratislava 2009, p. 1.

⁷ E. Butryn, W. Piskozub: *Ubezpieczenia inżyniersko-techniczne*, Poltext, Warszawa 2003, p. 16.

- in addition, the insurer isn't liable up to a deductible specified in the insurance contract and a loss of or damage to files, drawings, assignments, money, stamps, documents, debt securities, securities or cheques".⁸

Therefore, insurance plays a significant role in Construction Risk Management (CRM). Insurance is believed to be an important risk reduction instrument in the investment and construction process. This is illustrated in Table 1.

Table 1

Insurance/Risk Management Checklist

Areas of risk in construction	
Workers Compensation	1) Increase employers liability limit to \$1,000,000; 2) Reviewed alternative rating plans, captive, self-insurance, deductibles, etc.; 3) Coverage applicable in all but monopolistic fund states; 4) Defence Base Act; 5) Voluntary compensation coverage; 6) Status of executive officers or partners; 7) Status of United States-based employees sent outside the country; 8) Foreign employees; 9) Aircraft endorsement; 10) Repatriation expense; 11) United States Longshoremen's and Harbour workers' Compensation Act, Maritime, and Jones Act exposures; 12) Federal employers liability coverage; 13) Stop-gap employers liability coverage; 14) Workers compensation deductibles, where permitted; 15) Policy dates consistent with umbrella excess liability coverage; 16) Joint venture policies; 17) Checked classifications and audits; 18) Checked overtime charges; 19) Over-controlled, contractor controlled or other wrap-up programs; 20) Experience Rating Modifier; 21) Broad form named insured; 22) Coverage for newly-formed entities; 23) Advance notice of cancellation by earner, 60 day notice of cancellation and/or non-renewal; 24) Blanket waiver of subrogation if required by contract
Commercial General Liability (CGL)	1) Occurrence (CGL) policy form -\$1 million/ \$2 million/ \$2 million; 2) Deletion of selected contractual liability exclusions; 3) Completed operations and products liability coverage; 4) Broad form property damage coverage broadened; 5) Checked pollution coverage for jobsites; 6) Notice of occurrence amended; 7) No exclusion of explosion, collapse, or underground damage; 8) Personal injury liability coverage, remove exclusion (4); 9) Limits of liability; 10) General aggregate limit considerations; 11) Per project aggregate and per locations Broad form named insured endorsement; 12) Blanket additional insured if required by contract; 13) Blanket waiver of subrogation if required by contract; 14) Verified broad form liability extensions included; 15) Additional insured/protective liability requirements; 16) Adequate fire legal liability coverage and/or waiver of subrogation for damage to leased premises; 17) Verified host liquor liability coverage included; 18) Employee benefit liability coverage, limit of \$1 million; 19) Coverage for foreign operations; 20) Policy dates consistent with umbrella excess liability coverage; 21) Owned or non-owned watercraft liability coverage; 22) Owned or non-owned aircraft liability coverage; 23) Limits of liability consistent with excess umbrella requirements for underlying; 23) Joint venture past and present; 25) Residual wrap-up coverage; 26) Coverage for newly-formed entities; 27) Advance notice of cancellation by earner, 60-day notice of cancellation/non-renewal

⁸ *Ibidem*, pp. 16–17.

Table 1 Continued

Business Auto Policy	<p>1) Liability coverage applicable to any auto, symbol „1”; 2) Minimum limits –\$1 million; 3) Check mobile equipment against auto definitions; 4) Complete and accurate schedule of autos, garage locations, coverage, and deductibles; 5) Automatic coverage for additionally acquired autos without notice to earner; 6) Automatic coverage for auto physical damage; 7) Auto medical payments coverage; 8) Personal injury protection, if desired; 9) No-fault benefits, where applicable; 10) Underinsured motorists liability coverage; 11) Drive other car coverage options; 12) Assigned drivers who have no personal auto insurance; 13) Partnerships: Status of non-owned automobile coverage; 14) Additional insured’s: Lessors; 15) Individual named insured endorsement; 16) Auto physical damage coverage; 17) Distinct coverages and deductibles by classifications of autos; 18) Deductibles applicable to comprehensive coverage; 19) Deductibles applicable to collision coverage; 20) Consideration of alternative deductible levels, premiums; 21) Hired autos; 22) Foreign auto exposures; 23) Policy dates consistent with umbrella excess liability coverage; 24) Limits of liability consistent with commercial general liability; 25) Joint venture policies; 26) Partnerships; 27) Coverage for newly-formed entities; 28) Contractual liability coverage for autos; 29) Advance notice of cancellation by earner</p>
Umbrella /Excess Liability	<p>1) Complete and accurate schedule of underlying primary liability policies; 2) Complete and accurate answers to all umbrella policy application questions; 3) Pay on behalf of or indemnity contract; 4) Minimum underlying primary liability limit requirements; 5) Defense costs in addition to the limit of liability; 6) Status of following-form excess limitations, if any: a) Contractual liability, b) Completed operations liability, c) Care, custody or control property damage, d) Explosion, collapse, or underground damage, e) Blasting, if any, f) Fire legal liability, g) Broad form property damage; 7) Status of wrap-up exclusions or limitations, 8) Joint ventures past and present; 9) Check punitive damages exclusion; 10) Discrimination; 11) Asbestos exclusion or following form; 12) Notice of occurrence amended; 13) Primary defense when not covered by underlying policies; 14) Amount of self-insured retention; 15) Comparison of personal injury liability definitions with commercial general; 16) Liability policy; 17) Owned or non-owned aircraft liability coverage; 18) Owned or non-owned watercraft liability coverage; 19) Employee benefit liability coverage; 20) Foreign operations; 21) Policy dates consistent with underlying policies; 22) Coverage for newly formed entities; 23) Consideration of higher limits of liability in view of new primary aggregate limits; 24) Advance notice of cancellation by carrier; 25) Broad form named insured; 26) Residual wrap-up; 27) Checked contractor’s limitation endorsement for property damage limitations and professional exclusion</p>
Contractor’s Equipment Floater	<p>1) Broad all-risk perils in lieu of specific coverages; 2) Complete and accurate inventory of equipment; 3) Blanket limit of liability; 4) Valuation on replacement cost or actual cash value; 5) No coinsurance; 6) Provision for newly acquired equipment; 7) Automatic coverage for rented equipment; 8) Protection of lessor’s interest, including loss of use; 9) Automatic coverage for newly acquired equipment; 10) On-premises coverage; 11) Equipment in transit; 12) Equipment at job sites; 13) Deductibles applicable; 14) Consideration of alternative deductible levels, premiums; 15) Report of value requirements, if any; 16) Territorial coverage limitations; 17) Foreign operations; 18) Coverage for newly acquired entities; 19) Joint ventures; 20) Advance notice of cancellation by earner, 60-days notice of cancellation or non-renewal; 21) Boom coverage; 22) Rental cost reimbursement; 23) Mobile equipment; 24) Overturn of equipment</p>

Table 1 Continued

Builders Risk /Installation Floaters	1) Broad all-risk perils in lieu of specific coverages; 2) Coverage applicable to all work, including Differences in Conditions (DIG) exposures; 3) Coverage for materials and equipment in transit; 4) Coverage for flood damage; 5) Earthquake coverage; 6) Deductibles applicable; 7) Coinsurance requirements, if any; 8) Report of completed values or gross receipts requirements; 9) Territorial coverage limitations; 10) Waiver of subrogation requirements; 11) Complete and accurate name of insured; 12) Joint venture; 13) Termination of coverage on completion and acceptance by owner, not when work becomes part of the; 14) Building or project; 15) Adequacy of limits in relation to values; 16) Advance notice of cancellation by earner, 60-days notice of cancellation and/or non-renewal; 17) Checked off-site storage and in-transit coverage; 18) Scaffolding and false-work covered; 19) Temporary structures, foundations, and excavation sites; 20) Materials and supplies, including fences; 21) Testing coverage; 22) Water damage – back-up and seepage; 23) Freezing; 24) Debris removal; 25) Delayed opening coverage; 26) Design error or faulty workmanship; 27) Performance guarantee, efficacy; 28) Force majeure; 29) Sinkhole
Other Property Coverages	1) Broad all-risk perils coverage on buildings; 2) Broad all-risk perils coverage on contents, personal property; 3) Flood coverage; 4) Earthquake coverage; 5) Theft coverage; 6) Valuable paper coverage; 7) Difference in Conditions (DIG) coverage; 8) Deductibles applicable; 9) Consideration of alternative deductible levels, premiums; 10) Complete and accurate named insured; 11) Joint ventures; 12) Advance notice of cancellation by carrier
Crime Coverage	1) Blanket crime coverage; 2) Consideration of limits, deductibles; 3) Complete and accurate named insured; 4) Advance notice of cancellation by earner
Professional Liability	1) Blanket program or single project; 2) Claims made; 3) Notice requirement; 4) Policy territory; 5) Negligence requirement; 6) Scope of covered services; 7) Extended reporting provision (1 to 3 years); 8) Defense included or in addition to limits; 9) Faulty workmanship modified; 10) Pollution; 11) Subrogation issues; 12) Punitive damages; 13) Disputes over professional negligence; 14) Warranties; 15) Discrimination; 16) Insured versus insured
Other Miscellaneous Coverage	1) Employment practices liability; 2) Professional liability; 3) Contractor's pollution liability; 4) Electronic data processing; 5) Director's and officer's liability; 6) Life insurance on key officers

Source: based on: B. Carter: Construction Risk Management. University of Oklahoma, Webpage: <http://cns.ou.edu/Bill/files/research/Risk%20Management.doc> pp. 21–28.

Table 1 shows that there are numerous risk aspects in the construction industry (a case of U.S. construction). Therefore, insurers have to accurately define these risks, on a case-by-case basis, using various methods and tools, e.g. ready-to-use check lists. It should be stressed, however, that a number of entities participate in an investment and construction process, i.e. not just an investor, a contractor, a designer, an insurer or a subcontractor but also many others. Moreover, a bank which finances investment projects should be treated as a separate participant of a construction process. Mortgage banks play a particularly important role in this area as they specialise in financing of investments on the real estate market. As a consequence, risk will be perceived and managed differently by different entities. One of the most effective ways of reducing global risk in the construction industry will always

be mutual cooperation between the participants of the investment and construction process. In practice, however, every contractual party wishes to pass the greatest part of risk onto another participant. In Polish practice, most of risk tends to be borne by contractors.⁹ Therefore the important thing in the entire construction process is to ensure that:

- a contractor should clearly specify their scope of activities, i.e. who should do what, when and where, in what way and at what price. This will enable them to assign risk to particular events and people;
- if possible, the contractor should perform quantity work on risk;
- at the planning stage, the contractor should choose a system to perform work which will ensure reliable synchronization of actions and cooperation with all the participants of the investment process;
- when planning the execution of the project, the contractor should remember the golden rule which says that *if you fail to prepare, you prepare to fail*;
- at the construction work stage, the contractor should not forget about the need to monitor risk continuously;
- workers' safety on a construction site should be a priority for every contractor;
- the contractor should remember that some risks may be transferred onto the subsequent stages of the construction process;
- the contractor should pay special attention to the land conditions at the construction site and the force majeure;
- the contractor should control the progress of work in such a way as to prevent disruptions due to trifle reasons, and in particular, pay close attention to the use of working time as every work hour costs money;
- the contractor should always take into account the possibility of many risks occurring as late as at the facility operation stage;
- the contractor should monitor the cooperation between the project participants through an effective risk management system¹⁰.

All these measures, on the contractor's part, form an integral part of risk management, which is regarded by a company as a separate process. The creation and implementation of integrated risk management systems in construction companies will obviously contribute to improved efficiency of their operations and, first of all, will reduce losses which companies incur due to risk, hence increasing their goodwill. The construction risk management structure (CRMS) is presented in Table 2.

⁹ See more: P. Tworek: *Podział ryzyka w procesie realizacji przedsięwzięć inwestycyjnych w świetle badań ankietowych*, [in:] *Współczesne kierunki inwestowania – formy i efekty*, ed. H. Henzel, Akademia Ekonomiczna im. K. Adamieckiego, Katowice 2005, pp. 385–390.

¹⁰ P. Tworek: *Ryzyko wykonawców przedsięwzięć inwestycyjnych*, Akademia Ekonomiczna im. K. Adamieckiego, Katowice 2010, pp. 111–112.

Table 2

The Risk Management Structure (CRMS)

Phase	Key Issues
Risk Identification	<ul style="list-style-type: none"> – Identify the potential risk exposure – Classify the identified risk – Construct the risk curve using the risk mapping concept
Risk Analysis & Evaluation	<ul style="list-style-type: none"> – Quantify uncertainty using probability theory – Evaluate the potential impact of risk using Influence Diagrams and Monte Carlo simulation
Response Management	<ul style="list-style-type: none"> – Alternative responses for risk treatment – Recommendations and Assignment of Responses
System Administration	<ul style="list-style-type: none"> – Define a corporate risk management policy – System monitoring and review

Source: *Construction Risk Management*, Webpage: <http://www.pitb.gov.pk/downloads/Construction%20Risk%20Management.doc>, p. 5.

Table 2 presents the basic stages of the risk management process and describes the actions, which are taken within the four consecutive stages. This is the most general approach to the risk management process. In practical terms, this process may run in various ways, depending, for example, on a construction company's profile; some contractors specialise in investment projects in the areas of water engineering, industrial construction, tunnel construction etc. The essential thing here is to create the best possible risk management system for a given entity, and to implement this system in business practice. This may serve as a basis for formulating the definition of risk management, which would be appropriate for the specific company. Risk management in the construction industry is perceived in a number of ways¹¹. Taking into account the solutions presented in Table 2, Construction Risk Management (CRM), in the simplest terms, is a process of identifying, analysing, reducing and administering risk. According to The Construction Industry Institute CII in Austin, risk management means the practice of analyzing exposures to risk of loss (loss by fortuitous or accidental means) and taking steps to minimize those potential or real losses to levels acceptable to the organization¹². L. Edwards, however, stresses the fact that risk management involves risk analysis, control, transfer and financing¹³. However, no matter how risk management in a construction company is defined:

¹¹ See for example: *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*, Fourth Edition, Management Training & Development Centre, Warszawa 2009, p. 288.

¹² *Allocation of Insurance-Related Risks and Costs on Construction Projects*, Construction Industry Institute CII, Insurance Task Force. Publication 19-1, November, Austin 1993, p. 36.

¹³ L. Edwards: *Practical risk management in the construction industry*, Thomas Telford Ltd., London 1995, p. 15.

- corporate risk management should be a continuous process and a regular activity, not just an occasional one;
- corporate risk management should include activities related to the establishment and implementation of a company's strategy;
- corporate risk management is always designed to ensure that the basic goals of the company's operation are met;
- corporate risk management should be seen, first of all, as taking advantage of opportunities offered by risk, not just avoiding threats connected with it;
- corporate risk management should be an important element of the entire corporate management process;
- corporate risk management should be integrated and cover all types of risks related to the company's business operation".¹⁴

A particularly important issue here is the need to integrate the risk management system. Risk should be managed in all the areas where a company operates using appropriate methods, techniques and tools. Integrated risk management may be defined as a comprehensive and coherent system for managing credit risk, market risk, operational risk, economic capital and risk transfer in order to maximize a company's goodwill".¹⁵ Therefore, risk in a company should be managed in a systematic, comprehensive and regular way, in the areas of operating, investment and financial activities.

You will find a more detailed description of risk management systems for Polish construction companies in Fig 1.

The solutions presented in Fig 1 take into account the specificity of the biggest construction and assembly companies and the conditions, in which they operate. In particular, Fig. 1 shows the three basic stages of risk management, i.e. risk identification, risk analysis and risk response. Within every stage, there are a number of measures and actions to be carried out by the companies' employees who are responsible for risk. This process usually runs differently in different companies. This is due to a contractor's approach to risk and, more specifically, different risk responses. As can be seen in Fig. 1, the options here include risk avoidance, risk prevention, risk transfer and risk absorption (Step 3). As emphasized by A. Minansowicz "the occurrence of dynamic risk is connected with the utilitarian theory".¹⁶ "The theory indicates three basic approaches to the risk problem: avoiding risk – certain profits are required from a project but their lower level is also acceptable; searching for risk – high satisfaction is only possible with a high level of profit, even if uncertain; neutral approach – a medium position, analyzing threats and deciding in favour of projects with a medium risk level".¹⁷ However, before the contractor accepts the appropriate approach to risk,

¹⁴ *Rachunkowość w zarządzaniu ryzykiem w przedsiębiorstwie*, ed. E. Nowak, PWE, Warszawa 2010, p. 23.

¹⁵ *Ibidem*, p. 22.

¹⁶ A. Minansowicz: *op.cit.*, p. 28.

¹⁷ *Ibidem*, pp. 28–29.

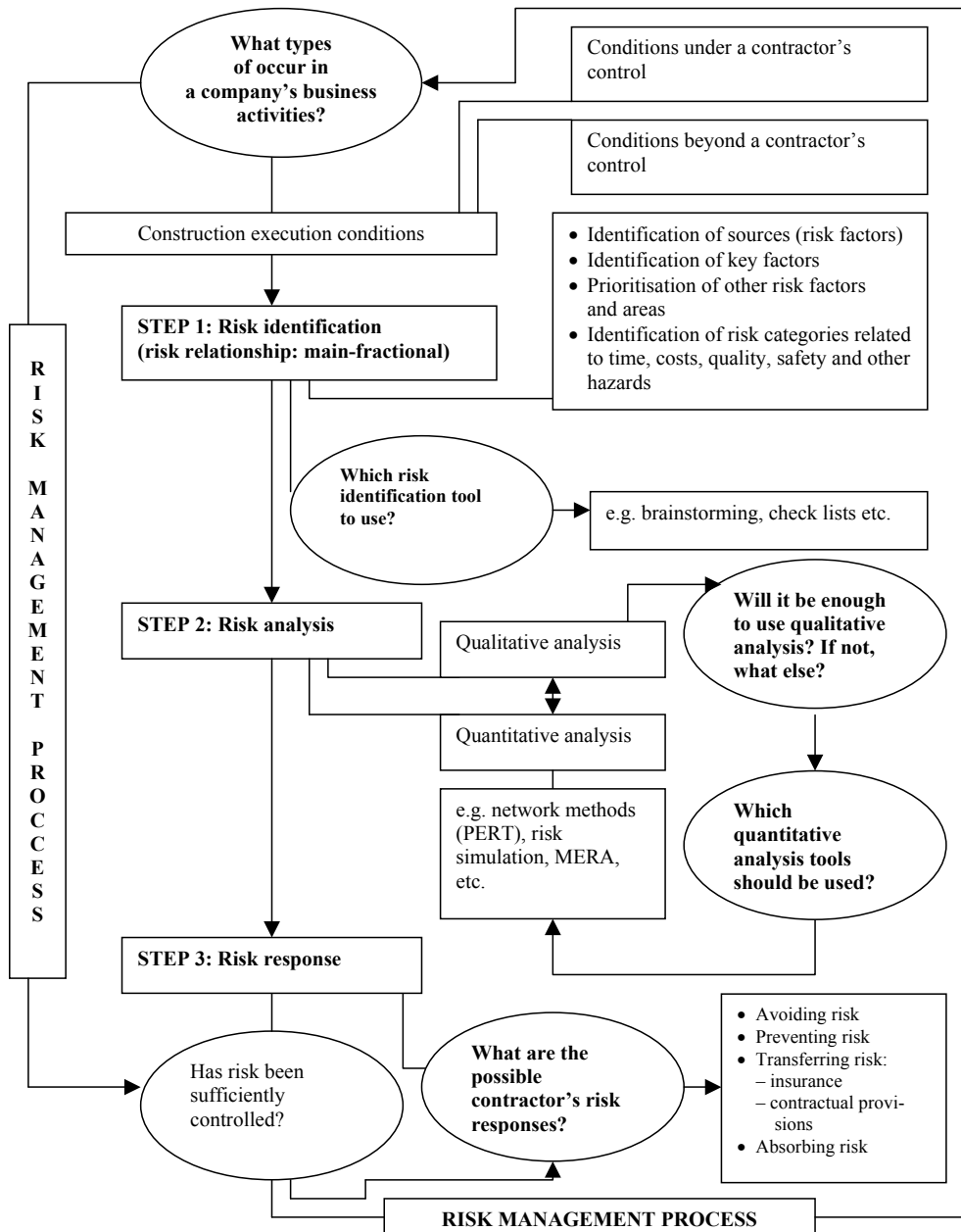


Fig. 1. Risk management process in a construction company

Source: P. Tworek: *Ryzyko wykonawców...*, p. 184.

the risk has to be identified and evaluated (Steps 2 and 3). Risk identification is a critical stage in this respect. If risk is identified incorrectly at the beginning of the process, i.e. by ignoring particularly important types of risk, which may occur at later stages, the contractor may face a very dangerous situation, i.e. losses incurred during the implementation of the investment project may be so huge that the entire construction work will not be profitable. Therefore, risk at this stage should be managed with particular care, using the appropriate methods. Such methods as brainstorming, check lists, site inspections etc. are frequently used in business practice. (Brainstorming is the most popular method among contractors.) After risk identification, another crucial stage is risk analysis (Step 2), which results directly from the method of risk definition. Since risk is believed to be a quantitative category, it can be assessed, more or less adequately, using appropriate methods and tools, including risk simulation. A particularly popular method is the Monte Carlo risk simulation method. One can also take advantage of such methods as e.g. Sensitive Analysis, MERA method (Multiple Estimating Risk Analysis), MORRIB (Risk Evaluation Method for Construction Project Execution), ICRAM (Model for International Construction Risk Assessment), RAMP (Risk Analysis and Management for Projects) etc.¹⁸ Network methods, e.g. PERT and CPM are very popular in Polish practice. Using these methods we can, first of all, determine the likelihood of risk, and, secondly, assess its impact on project costs and the duration of its execution and, thirdly, evaluate its potential consequences. Any deviations in this respect should be considered in risk terms; in order to quantify risk the contractor may also follow the qualitative approach, based on a risk description. Qualitative analysis, however, has a much lower value for the final evaluation of risk in the construction industry. Nevertheless, it's employed by numerous contractors all over the world, due to its simplicity. Summing up, regular risk management helps you:

- identify, assess and rank risks making your risks explicit,
- focus on the major risks for your project,
- make informed decisions on your provisions for adversity, e.g. mitigation measures,
- should the worst happen, minimise potential damage
- control the uncertain aspects of construction projects,
- clarify and formalise your role and the roles of others in the risk management process¹⁹.

¹⁸ See more: D. Skorupka: *Zarządzanie ryzykiem projektu w inwestycjach budowlanych*, Wydawnictwo Akademii Świętokrzyskiej im. J. Kochanowskiego, Kielce 2007, pp. 69–81. See also: C. Boothroyd, J. Emmett: *op.cit.*, pp. 34–36.

¹⁹ P.S. Godfrey, W. Halcrow: *Control of Risk. A Guide to the Systematic Management of Risk from Construction*, Construction Industry Research and Information Association, London 1996, p. 9.

Conclusion

Due to the character and specificity of construction and assembly production, risk management within the operations of construction companies is a challenging but indispensable task. Risk occurring in an investment and construction process cannot be ignored due to its possible consequences. Many contractors have gone bankrupt because of risk. Therefore, risk in a construction company needs to be managed, not only within the area of its business activities but also within its investment projects and financial activities. The company's implementation of a risk management system will allow it to save money, on one hand, and will improve the company's efficiency, on the other hand. Consequently, risk management contributes to enhanced goodwill, which is the overriding goal of every company.

Bibliography

- A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*, Fourth Edition. Management Training & Development Centre, Warszawa 2009.
- Allocation of Insurance-Related Risks and Costs on Construction Projects*, Construction Industry Institute CII, Insurance Task Force. Publication 19-1, November, Austin 1993.
- Boothroyd C., Emmett J.: *Risk Management. A Practical Guide for Construction Professionals*, Witherby & Co., London 1996.
- Bunni N.G.: *Risk and Insurance in Construction*, Spon Press Taylor & Francis Group, London–New York 2003.
- Butryn E., Piskozub W.: *Ubezpieczenia inżynieryjno-techniczne*, Poltext, Warszawa 2003.
- Carter B.: *Construction Risk Management*, University of Oklahoma, Webpage: <http://cns.ou.edu/Bill/files/research/Risk%20Management.doc>.
- Construction Risk Management*, Webpage: <http://www.pitb.gov.pk/downloads/Construction%20Risk%20Management.doc>.
- Edwards L.: *Practical risk management in the construction industry*, Thomas Telford Ltd., London 1995.
- Godfrey S.P., Halcrow W.: *Control of Risk. A Guide to the Systematic Management of Risk from Construction*, Construction Industry Research and Information Association, London 1996.
- Hayes E.R., Perry G.J., Thompson A.P., Willmer G.: *Risk Management in Engineering Construction*, Thomas Telford, Ltd., London 1986.
- Minasowicz A.: *Efektywność i zarządzanie finansami w budownictwie*, Poltext, Warszawa 2009.
- Rachunkowość w zarządzaniu ryzykiem w przedsiębiorstwie*, red. E. Nowak, PWE, Warszawa 2010.
- Revere J.J.: *Construction risk. A Guide to the Identification and Mitigation of Construction Risks*, 1st Books Library, Bloomington 2003.
- Skorupka D.: *Zarządzanie ryzykiem projektu w inwestycjach budowlanych*, Wydawnictwo Akademii Świętokrzyskiej im. J. Kochanowskiego, Kielce 2007.

- Tworek P.: *Podział ryzyka w procesie realizacji przedsięwzięć inwestycyjnych w świetle badań ankietowych*, [in:] *Współczesne kierunki inwestowania – formy i efekty*, ed. H. Henzel, Akademia Ekonomiczna im. K. Adamickiego, Katowice 2005.
- Tworek P.: *Ryzyko wykonawców przedsięwzięć inwestycyjnych*, Akademia Ekonomiczna im. K. Adamickiego, Katowice 2010.
- Tworek P.: *The 'all risks' insurance in Polish construction industry*, Ekonomická Univerzita v Bratislave, Bratislava 2009.

Dr Piotr Tworek
Uniwersytet Ekonomiczny w Katowicach
Katedra Inwestycji i Nieruchomości

Summary

The operation of integrated risk management systems in construction and assembly companies requires a high degree of expertise from the individuals responsible for risk. Contractors need to be professionally prepared to manage risk. As risk in the construction industry is a multi-functional category that they are required to demonstrate both general knowledge of the construction business and a knowledge of Construction Risk Management (CRM). The presented article is devoted to this issue and its aim is to describe the problems of risk management in the construction industry for practical use.

PODSTAWY ZARZĄDZANIA RYZYKIEM W BUDOWNICTWIE (CRM). WYRANE PROBLEMY TEORETYCZNE I PRAKTYCZNE

Streszczenie

Funkcjonowanie w przedsiębiorstwie budowlano-montażowym zintegrowanego systemu zarządzania ryzykiem wymaga od osób odpowiedzialnych za ryzyko specjalistycznej wiedzy w tym zakresie. Przede wszystkim pracownicy tacy muszą być przygotowani pod względem merytorycznym do zarządzania ryzykiem. Ponieważ ryzyko w budownictwie jest kategorią interdyscyplinarną wymagane jest od nich posiadanie zarówno wiedzy ogólnej dotyczącej budownictwa jak i znajomości dziedziny wiedzy Construction Risk Management (CRM). W szczególności omówieniu tej kwestii poświęcono niniejszy artykuł, którego celem jest przybliżenie problematyki zarządzania ryzykiem w budownictwie jako wiedzy praktycznej.