

PAPER • OPEN ACCESS

Analysis and Risk Evaluation on the Case of Alteration, Revitalization and Conversion of a Historic Building in Gdańsk

To cite this article: Beata Grzyl *et al* 2017 *IOP Conf. Ser.: Mater. Sci. Eng.* **245** 082049

View the [article online](#) for updates and enhancements.

Related content

- [A risk evaluation model and its application in online retailing trustfulness](#)
Ruyi Ye and Yingcheng Xu
- [Two novices venture into science](#)
- [An improved method for risk evaluation in failure modes and effects analysis of CNC lathe](#)
N Rachieru, N Belu and D C Anghel

Analysis and Risk Evaluation on the Case of Alteration, Revitalization and Conversion of a Historic Building in Gdańsk

Beata Grzyl¹, Adam Kristowski¹, Emilia Miszewska-Urbańska¹

¹Gdansk University of Technology, Faculty of Civil and Environmental Engineering, Narutowicza 11/12, 80-233 Gdańsk, Poland

beata.grzyl@wilis.pg.gda.pl

Abstract. Each investment plan, including the one concerning a building, is exposed to the consequences of various types of threats taking place. Therefore, in the case of some large-scale, atypical and complicated building ventures, some actions included in the procedure of risk management should be taken (identifications, analysis, measurements, control and supervision of the risk). This will allow for the risk to be eliminated or limited. While preparing a building venture, an investor does not possess full information about the course of events on each stage of investment completion. The identification of the above-mentioned unknowns, subjecting them to quantification and specifying the method of dealing with them, allows an investor to increase the effectiveness of the intended plan. The enterprise discussed in this article and analyzed in the context of risk, concerns alteration, revitalization and conversion for office purposes of two buildings located in Gdańsk at 1 and 2 Lastadia Street. These buildings are situated on the area of historical urban layout of Gdańsk, in the northern-eastern part of Stare Przedmieście District (Old Suburb), about 800 meters south from Długi Targ Street and 200 meters west from The Old Motława River. The investor is “Gdańskie Melioracje Ltd.”, a limited liability company, which belongs to the Council of Gdańsk. In order to increase the effectiveness of the intended investment venture, while organizing the investment process, the investor commissioned preparation of an analysis and risk evaluation connected with the above-mentioned intention. Based on an on-site visit, the opinions of experts, who have been involved in the process of the preparation of the investment, studies of the available monographies about the technical condition of the buildings at 1 and 2 Lastadia Street and their own experiences, the authors identified 54 types of relevant risks, which have been systematized into 10 subject groups (among others- investor’s risk due to the designing process, location of the investment, third party or investor business activity, force majeure, political, legal, financial, technical). The scope of the study includes the identification, analysis and risk evaluation connected with planning and completion of alteration, revitalization and conversion of a historic building located at 2 Lastadia Street for the office purposes. The risk has been analyzed from the investor’s perspective. The authors used a method of preliminary analysis and risk evaluation PHA (Preliminary Hazard Analysis) and the expert method.

1. Introduction

Each investment plan, including the one concerning a building, is exposed to the consequences of various types of threats taking place. Therefore, in the case of some large-scale, atypical and complicated building ventures, some actions included in the procedure of risk management should be taken (identifications, analysis, measurements, control and supervision of the risk). This will allow for the risk



to be eliminated or limited [1-3]. While preparing a building venture, an investor does not possess full information about the course of events on each stage of investment completion. The identification of the above-mentioned unknowns, subjecting them to quantification and specifying the method of dealing with them [4, 5], allows an investor to increase the effectiveness of the intended plan.

The enterprise discussed in this article and analyzed in the context of risk, concerns alteration, revitalization and conversion for office purposes of two buildings located in Gdańsk at 1 and 2 Lastadia Street. These buildings are situated on the area of historical urban layout of Gdańsk, in the northern-eastern part of Stare Przedmieście District (Old Suburb), about 800 meters south from Długi Targ Street and 200 meters west from The Old Motława River. The investor is “Gdańskie Melioracje Ltd.”, a limited liability company, which belongs to the Council of Gdańsk. In the article, only the conclusions of the analysis conducted for the building located at 2 Lastadia Street have been presented.

In order to collect data the quality research has been applied. It was based on the opinions of experts, who have been involved in the process of the preparation of the investment and analysis of the documentation connected with the preparation of the investment, including many technical expert evaluations. Additionally, direct observation has been used.

2. Presentation of the investment, scope of the intended investment activities for the building of a former Municipal Secondary School at 2 Lastadia Street

The building located at 2 Lastadia Street is listed on the Pomeranian Province Register of Historic Monuments. It was erected in 1834-38 based on a design of an outstanding Prussian architect Karol Fryderyk Schinkel. Since 1939 it housed the Municipal Secondary School. During the war, the building was completely burnt down, then in 1949 its rebuilding involved the reconstruction of ceilings and staircases and laying a new steel construction of the roof. Until 2009, the building accommodated Food and Chemical Industry School Complex. Currently, the building is not being used due to its poor technical condition. Technical evaluations [among others: 6-9] performed in the period 2004-2015, indicate numerous serious problems of a technical nature and absence of an extensive repair programme leading to the eradication of progressive degradation of the building at 2 Lastadia Street and the neighbouring dwelling building of 1 Lastadia Street (figure 1).



Figure 1. The building of the former Municipal Secondary School at 2 Lastadia Street and the dwelling building of 1 Lastadia Street

The dwelling house at 1 Lastadia Street was added to the former Secondary School at 2 Lastadia Street in about 1908. The results of performed expert technical evaluations [among others: 6-9] indicate that the dwelling building does not have a construction order which is independent and has expansion joints. It has been “tacked on” to the existing building of 2 Lastadia Street by joining of the foundations and the structural walls of both buildings. The dwelling house of 1 Lastadia Street, does not have its own gable from the side of the Secondary School building. The gable of the Secondary School building was used to lean the ceilings of the dwelling house (in the building of the Secondary School, the ceilings are leaned against the longitudinal walls). The findings of the expert opinions, which were carried out show, that these buildings were positioned in a different way. Taking the above-mentioned building actions and changing the external and surroundings conditions in which the buildings were erected, resulted in current catastrophic technical state of the building at 2 Lastadia Street [among others: 9]. No gable in the dwelling house results in the shifting of the centre of gravity of load combination in relation to the basement plan. As a result, there is uneven pressure on the stilts and subsiding of the building with an inclination of 25-30 cm [6]. The conclusions of the expert evaluations [6, 7] indicate that the ceilings of the dwelling house, originally leaning on the gable of the Secondary School building, lost their support as a result of the inclination of the building and are currently working on cantilevers. The joining of both properties results in subsiding and progressive degradation of the Secondary School building. In order to save the historic building at 2 Lastadia Street, “Gdańskie Melioracje Ltd.” has been considering a possibility (subject to a permission of Pomeranian Province Conservator of Monuments) of conducting demolition of the dwelling house situated at 1 Lastadia Street (private property, presently in the course of buyout by the Town of Gdańsk). This solution will allow to carry out the extensive reinforcement and repairs to foundations and protecting them against uneven sinking.

3. Analysis, assessment and determining of the risk level connected with the preparation and completion of an investment plan

In order to increase the effectiveness of the intended investment venture, while organizing the investment process, the investor commissioned preparation of an analysis and risk evaluation connected with the above-mentioned intention. Based on an on-site visit, studies of the available monographies about the technical condition of the buildings at 1 and 2 Lastadia Street and their own experiences, the authors identified 54 types of relevant risks, which have been systematized into 10 subject groups (among others- investor’s risk due to the designing process, location of the investment, third party or investor business activity, force majeure, political, legal, financial, technical). The scope of the study includes the identification, analysis and risk evaluation connected with planning and completion of alteration, revitalization and conversion of a historic building located at 2 Lastadia Street for the office purposes. The risk has been analyzed from the investor’s perspective. The authors used a method of preliminary analysis and risk evaluation PHA (Preliminary Hazard Analysis) and the expert method [10, 11]. The PHA method, which describes the level of probability and result (the extent of damage) of the investment venture risk, enables the qualitative evaluation of the risk level. The method is conducted in 4 fundamental stages:

1. Determining the scope of activities which are being risk- assessed (10 causal groups of risk have been identified),
2. Compiling a list of the identified threats (whilst maintaining the division into 10 casual groups of risk)
3. Finding the risk level by defining the level of probability (on a scale 1-5) that a particular type of risk “P” will happen and the level of potential consequence (damage, likely losses), which is the effect of a particular kind of risk “S” (on a scale 1-5),
4. Calculating the risk is expressed by risk level “W”, assuming that $W = P \times S$.

The experts also suggested the relevant conduct strategy, i.e. the preventive measures (reducing or eliminating every risk type) for the identified types of risk, considering its levels (on the range of 1-25). In this way, the authors have referred to the fundamental stages of the conduct strategy of a company, which is confronted with a risk, i.e. they used the consecutive steps as part of a procedure of risk management.

In table 1, the authors present the selected risk types, which were established on the basis of the performed analysis. They have been linked to the stage of the investment preparation and completion and have been considered serious.

Table 1. The most relevant types of risk from the investor's perspective, established on the basis of the method of preliminary analysis and risk evaluation (PHA) and the expert method along with a suggestion of action strategy

Risk	Risk level	Suggested actions	Commentary
A construction disaster of the building at 2 Lastadia Street (e.g. collapse of the building while conducting construction work or considerable deterioration of its technical condition due to loss of construction stability)	20	Application of high quality security; monitoring of the settling and the technical state of the construction	Findings of the expert opinions [6-9]. The geodetic expert opinion and the test measurement of the selected building elements [12] confirm the poor technical condition of the building at 2 Lastadia Street, which results in the high probability of a construction disaster. A construction disaster is defined as a sequence of unfortunate events, which have tragic consequences for people (death/disability) and the building (collapse) and very serious financial effects.
Significant threat of a construction disaster of the building at 2 Lastadia Street, as a result of a very poor technical condition and potential probability of a construction disaster of the building at 1 Lastadia Street taking place	20	The necessity to take immediate actions leading to the elimination of the risk	Findings of the expert opinion [12] indicate a high probability of a construction disaster taking place to the building at 1 Lastadia Street
The changes, e.g. of the design, or the requirement of completion of some additional work, have a negative influence on the completion date of an enterprise and leads to the increase of its cost	20	The verification of the design documentation by an external body; current check of the work progress and the budget	The scale and scope of additional work is difficult to estimate at the stage of planning the building completion
Unpredictable obstacles, complications, archeological discoveries, difficult water and land conditions (settling of the ground, reinforcement necessity), the potential	16	Water and land check	The result could be a significant extension of the time spent on the completion of the building work and an increase of costs, which is

change of the positioning method of the building structure (additional costs)			difficult to estimate at this stage of the design
Encountering archeological and mine sites	16	Contracting out search and sapper's work	
The building's safety level is reduced due to permanent worsening of the technical condition of foundations, walls and ceilings	16	Application of high quality security; monitoring of the settling and the technical state of the construction	
A change in price that was set in the contract (the estimate settlement or a necessity of some additional work completion)	16	Verification of the contractor's proposal and a potential acceptance	Ambiguous scope of building work can result in a difficulty in finding a specialist contractor, who would guarantee the appropriate workmanship
Hindered access to a loan, no subsidy or full funds in case of some additional work	16	Controlling of costs and self-insurance (financial reserve)	
Design documentation is incomplete, contains errors and contradictions; vital changes in the scope of work caused by lack of opportunity to establish full and certain initial data for the design and calculations	12	Verification of the design documentation by the ordering party, contractor, estimator, supervisory inspector, external verifying body; weekly consultative meetings	Incomplete information on the basis of designing can potentially mean the increase of disruptions in the process of building work completion
Low qualifications and limited experience of the employees of the designer, resulting in a necessity of implementation of innovative and unique technologies	12	References: placing the specific requirements in SIWZ	Atypical range of work may result in lack of optimal technological and architectural solutions
Hidden faults	12	Current and random checks	
Unclear and unstable state of law e.g. changes of law regarding the technical and environmental conditions and fire regulations in the investment process after the planning permission has been obtained	12	Acceptance	

4. Conclusions

In consideration of the high level of complication in case of various activities connected with alteration, revitalization and conversion of a historic building located at 2 Lastadia Street in Gdańsk for the office purposes, the investor has decided to carry out the identification of major risks and the evaluation of the probability and effects of their appearance. At this stage of the investment planning, the fundamental elements of the procedure of risk management have already been used. These were identification, analysis and quantification. The great significance of the actions connected with the risk diagnosis should be emphasized. They have a considerable influence on a change of thinking among the

participants of the enterprise about the potential threats in subsequent stages of the investment. Consequently, it contributes to the establishment of conscious reaction and improvement of the quality of planning and investment completion. It can be assumed that extensive knowledge of the employees of “Gdańskie Melioracje Ltd.” about the risk and its potential consequences [13], together with the professional investment planning (including the correct reserves in the schedules and estimates) will contribute to the success of the investment aim.

The research and evaluation of risk based on the expert method and PHA, in addition to the analysis of expert opinions and evaluations made available by “Gdańskie Melioracje Ltd.” [6-9, 12] substantiate formulation of statements and conclusions listed below.

1. The general technical condition of the building located at 2 Lastadia Street (among others - degraded foundations, numerous changes in the construction of the brick walls and ceilings are due to the changes in land and water conditions, long-term exploitation, biological corrosion of the wooden foundation stilts, intensive motor traffic) is unsatisfactory and poor in places [8, 9], which results in the high likelihood of a construction disaster while conducting construction work in the building. The very poor condition of the building at Lastadia 1 also constitutes the potential cause of a construction disaster for the building at 2 Lastadia Street. The strong dynamic effects caused by intensive motor traffic on Podwale Przedmiejskie Street create an additional element, which increases the risk of a construction disaster. Comments regarding the risk caused by the technical condition of the building at 1 Lastadia and 2 Lastadia Street are reflected in the results of the analysis included in table 1.

2. The likely reasons for the uneven settling of the buildings at 1 and 2 Lastadia Street and the worsening of the technical state of the building at 2 Lastadia Street are as follows. Firstly, the joining of the building at 1 Lastadia Street with the dwelling building at 2 Lastadia Street and supporting its ceilings against the gable of the building at 2 Lastadia Street. Secondly, the lack of a separate construction system of both buildings and their joints. Thirdly, no independent foundations, foundation walls and a gable [8, 9]. Moreover, the presence of the building at 1 Lastadia Street significantly impedes of the access to the renovated (strengthened) foundations of the building at 2 Lastadia Street [8]. It can be assumed that carrying out renovation work in the building at 2 Lastadia Street without the specialist protection may considerably increase the risk of a construction disaster or cause damage to the building.

3. The risk of additional and replacement works taking place is increased by the following factors. Firstly, scope of work that is impossible to establish in a precise way. Secondly, the very poor technical condition. Finally, a necessity to perform many repairs connected with the revitalization of the building at 2 Lastadia Street, which are difficult to predict. These factors have been confirmed by the conclusions of the analysis presented in table 1. Consequently, there is no possibility to quantify a building estimate for the above actions accurately. The decision of performing the actions connected with alteration, revitalization and conversion of a building at 2 Lastadia Street for the office purposes should have a rational economical approach.

References

- [1] B. Grzyl, “The risk of building contractors in public procurement,” *Inżynieria i Budownictwo*, vol. 11, pp. 644-646, 2014.
- [2] B. Grzyl, M. Apollo, “Construction contract in the aspect of the risk division between the parties,” *Inżynieria Morska i Geotechnika*, vol. 6, pp. 838-843, 2015.
- [3] C. L. Pritchard, “Risk management in projects. Theory and practice,” *Management Training & Development Center, WIG-PRESS*, Warszawa, 2002.
- [4] M. Apollo, E. Urbańska-Galewska, “Model of Risk Assessment (MORA) concept for the investment part of urban regeneration projects,” *Environmental Engineering, Proceedings of the International Conference on Environmental Engineering, ICEE*, vol. 9, Vilnius Gediminas

- Technical University, Department of Construction Economics & Property, 2014.
- [5] M. Apollo, M. Kemblowski, "Observation value analysis – integral part of Bayesian diagnostics," *Procedia Engineering* 123, pp. 24-31, 2015.
 - [6] "Evaluation regarding technical condition of the building housing Food and Chemical Industry School Complex and a residential house at 1 and 2 Lastadia Street in Gdańsk," conducted by Consulting and Designing Centre Dexbud Ltd, author: construction expert Władysław Zaborowski, Gdańsk, September 2004.
 - [7] "Technical expert evaluation regarding the technical condition of the former Food and Chemical Industry School Complex," conducted by Arpro Designing Studio Ltd, author: Bartłomiej Gursztyn, Msc, Eng., Gdańsk, October 2011.
 - [8] Technical expert evaluation "Concept of foundations enforcement in the general public building of 2 Lastadia Street in Gdańsk," a monograph - Marcin Blockus, PhD, Eng., Gdynia, December 2014.
 - [9] "Construction and building - technical expert evaluation of the former school seat at 2 Lastadia Street in Gdańsk," Engineer Office Leszek Niedostatkiwicz, author: Leszek Niedostatkiwicz, PhD, Eng., Gdynia, January 2015.
 - [10] K. M. Jaworski, "Construction design methodology," *PWN*, Warszawa, 2009.
 - [11] Project Management Institute, "A guide to the Project Management Body of Knowledge (PMBOK GUIDE)," 5th edition, Polish edition, 2013.
 - [12] The geodetic expert opinion, "The test measurement of the selected building elements," Henryk Lenartowicz, Eng., Gdańsk, 2015.
 - [13] B. Grzyl, "The distribution of risk in the contract for construction works in the area of public procurement," *Logistyka*, vol. 3, pp. 1711-1715, 2015.