Article

Methodological Tools for Investment Risk Assessment for the Companies of Real Economy Sector

Tetiana Zholonko [1,*], Olesia Grebinchuk [1], Maryna Bielikova [2], Yurii Kulynych [3] and Olena Oviechkina [4]

1   Robert Elworthy Economic and Technology Institute, Kropyvnytskyi, Chikalenko str., 3,
    25000 Kropyvnytskyi, Ukraine; grebin_huk@i.ua
2   Department of Administrative Law, Yaroslav Mudryi National Law University, 77 Pushkinskaya Street,
    61024 Kharkiv, Ukraine; m_biel_88@ukr.net
3   Department of Finance, National University of Food Technologies, 68 Volodymyrska str., 01601 Kyiv, Ukraine;
    kulynych_y@ukr.net
4   Department of Economics and Entrepreneurship, Volodymyr Dahl East Ukrainian National University,
    Central Avenue 59-a, 93400 Severodonetsk, Ukraine; ovech@ua.fm
*   Correspondence: liliyaf@yahoo.com

Abstract: Methodological approaches to investing in companies and reducing the negative impact of risks that are formed at the macro and micro levels are considered in the article. The algorithm for expressing investment risks through related risks and conducting an investment risk assessment as a group process is defined. It has been determined that the defining features of investment risks are the environment, duration, and scope of the project, risk position, profile, risk appetite, consequences, capacity, and results of the impact on the investment project. An investment risk accounting system is formed, which is represented by a set of organized structural elements that perform functions related to planning and implementation of a set of measures that identify, assess, monitor, and control risks to minimize negative consequences and enhance opportunities. A method of forming a real portfolio of investment projects considering the dynamic risk factor has been developed.

Keywords: investment risks; investment project; risk assessment; risk-forming factors; chain process; system of equations

1. Introduction

One of the most important aspects of the stable development of the national economy is the dynamic growth of investment potential and investment attractiveness. The structure of investments and efficiency of their use determine the results of economic activity and competitiveness of companies in the real sector of the economy. The real investment is realized through investment projects in practice. In turn, project implementation involves many different risks. This phenomenon is accounted for the high volatility of the economic and political situation in the country, instability in the financial sphere, the emergence of new types of real investment projects and forms of their financing (see Helliar et al. 2002). As a rule, many companies do not pay sufficient attention to the assessment and insurance of investment risks, and often there are no specialized divisions in the management structure to deal with these issues. In addition, the lack of information, analytical and methodological support for the assessment and identification of risks determine the relevance of this topic of scientific research.

2. Materials and Methods

We define the methodology of this study through the risk management and consideration of a set of methods, techniques, and measures that predict the occurrence of risk events and take measures to eliminate or reduce the negative consequences of such events for the company. The main task in risk management is to find an option that provides the

optimal combination of the risk and income, taking into account that the more profitable the investment project, the higher the level of risk in its implementation.

The methodological basis of the study is based on the following methodological approaches and variations:

(1)   The approach of a holistic field of risks. Within this approach, the system of principles of risk management, and above all, the principles of systematicity, comprehensiveness, and integrity is realized, which requires the creation of a risk management system of the investment project, which means a set of measures to prevent possible risks, minimize their negative consequences and prevention of re-implementation. Thus, in the works of Cagliano et al. (2012), Kmec (2011), Yen (2004), the risk management system is recognized as a "set of organizational, methodological, and automated tools used in the process of identification, measurement, regulation, control and monitoring of risk, and aimed at preventing possible risks, minimizing their negative consequences and preventing re-implementation." Lappe and Spang (2014), Liurui and Traian (2019), Lončar (2011) define the banking risk management system as a set of measures, methods, and techniques of bank staff that provide a positive financial result in the presence of uncertainty in the activity, as well as to predict the occurrence of risky events and takes measures to avoid or reduce the negative consequences.

(2)   System approach. It forms a system of investment risk management, which should be considered as part of the management function, which includes a set of organizational structural elements that perform functions for planning and implementing a set of measures to identify, assess risks, develop measures, and use risk response tools, and monitor and control risks in order to minimize the negative consequences and strengthen the favorable opportunities as a result of their action. The main task of the investment risk management system is to maintain the level of risk of the project within the established limits according to the accepted level of risk tolerance and to ensure on this basis the reliability and stability of future cash flows for the company (Lui and Yu 2010; Mohamed and McCowan 2001).

(3)   Integrated approach. Depending on the complexity of the investment project and the number of identified risks within the functioning of the risk management system and project integration management, risk management should be based on the implementation of an integrated approach, according to which the management organization should provide compliance with the risk profile, the established level of risk appetite based on the portfolio (integrated) risk analysis. Within the methodology, four approaches to the following risk analysis, grouped according to the degree of integration of risk management with business, are identified: (a) Minimum integration, which is to focus on significant risk events and manage significant (critical) risks; (b) limited integration, which consists in managing not individual risks but groups (categories) of risks, which are structured according to certain features; (c) partial integration, the use of which focuses on business goals and the risks associated with achieving them; (d) full integration (integrated approach), which is that risk management is considered in terms of a systems approach, based on the strategy and business objectives of the investment project (Junkes et al. 2015; Seyedhoseini and Hatefi 2009; Wilkinson and Elahi 2003).

From the papers (Cvetkovic 2002; Kwak and Pirvu 2018; Simić et al. 2011; Krkoska and Schenk-Hoppé 2019) we can highlight that investment risks include the following sub-risks: Missed profit risk; risk of reducing profit; risk of direct financial losses. The missed profit risk is a risk of indirect financial loss (loss of profit) as a result of the unfulfillment of any action (e.g., insurance, hedging, investing, etc.). The risk of reducing profit may result from a decrease in the amount of interest and dividends on portfolio investments, deposits, and credits. The risk of reducing profit includes the following varieties: Interest and credit risks (Kerzner 2001).

The main tasks of risk management are to find possible alternatives to the development of events, to assess the probability and consequences of their occurrence, and to eliminate risk factors or minimize them.

3. Results

3.1. Consideration of the Risk Factor in the Investment Sphere

Facing various risks is a common threat for any investor in today's market economy. Mostly, investing in the production of certain goods or services, the investor cannot have full confidence in the public recognition of the results of this production. In practice, such recognition depends on a successful combination of different factors, so investors risk making a profit lower than expected, or even incur losses. Thus, the study of investment risks, identifying the factors that cause them, and calculating possible losses are important issues that need to be considered by a modern company when deciding to invest in a particular area of production or commercial activity. That is why the ability to assess investment risks is a necessary factor in the company's activities.

This study aims to analyze the field of investment risks for modern companies in the real sector of the economy and to develop a methodology for forming a real portfolio of investment projects considering the dynamic risk factor (Dey 2001).

The development and use of a multifactorial risk model for investment in the real sector of the economy will help to identify with sufficient accuracy the impact of various factors on investment risks. This model can show the share of different factors in the total volume of investments, as well as to reflect the change in the shares in different periods of the socio-economic development of the country. But it is difficult to determine the level of risk in a changing economic situation using a multifactor investment risk model. A more detailed solution to the problem of forecasting investment risks in the real sector of the economy is to create an assessment system that would include not only statistical methods, but also probability theory and microeconomic analysis methods (Smith et al. 2005; Wang and Yuan 2011). Consideration of a complete set of risk factors is essential for a more accurate risk assessment. The set of risk factors should reflect all conditions of the external and internal environment of investment projects (Nokes and Fulton 2019) creating potential losses.

The classification of risk factors in the investment activity of companies is presented in Table 1.

Table 1. Classification of risk factors for investment projects.

Risk Factors Groups			Risk Factors
1	Socio-political risks	1.1.	Political instability
		1.2.	Ethnic or religious conflicts
		1.3.	Level of crime
		1.4.	Population's attitude to the forms of ownership
		1.5.	State tax policy
		1.6.	Degree of the monopoly restriction
		1.7.	Population's attitude to the entrepreneurship
		1.8.	Protection of competition
2	Macroeconomic risks	2.1.	Stability of the economic system
		2.2.	Level of state regulation
		2.3.	Phase of the business cycle
		2.4.	State of the financial system
		2.5.	Reliability degree of the macroeconomic information
		2.6.	Level of population's income
		2.7.	Entrepreneurial activity
		2.8.	Business culture (habits, traditions, norms)

Table 1. *Cont.*

	Risk Factors Groups		Risk Factors
3	Microeconomic risks	3.1.	Ownership form
		3.2.	Share of the company in the market
		3.3.	Financial status of the company
		3.4.	Personnel potential of the company
		3.5.	Investment attractiveness
		3.6.	Organizational management system
		3.7.	Innovative potential
		3.8.	Production process management
4	Legal risks	4.1.	Degree of the legislative base perfection
		4.2.	Degree of the arbitration production perfection
		4.3.	Responsibility for breach of contractual obligations
		4.4.	Degree of the internal market protection
		4.5.	Customs policy
		4.6.	Tariff agreements
		4.7.	Licensing policy
		4.8.	Protection

Source: Created by the author.

3.2. Expression of the Investment Risk through Related Risks

The total level of the risk investment in the real sector of the economy is obtained in the process of multiplying individual levels of risk, expressed in percentage points:

$$R_{inv} = R_{inv} \times R_{inf} \times R_{com} \times R_{pol} \times R_{rad} \times R_t \times R_e \times R_p \times R_{ur} \qquad (1)$$

where

R_{inv}—investment risk in the real sector of the economy;
R_{inf}—inflation risk;
R_{com}—commercial risk;
R_{pol}—political risk;
R_{rad}—risk of accidental death;
R_t—technical risk;
R_e—economic risk;
R_p—price risk;
R_{hours}—"uninsured" risk.

However, if $R_{inv\,=\,1}$, it means that the investment risk in the real sector of the economy is 100%. (i.e., each of the factors is equal to 1). It means that the project can already be called a failure.

When $R_{inf} = 0$, the risks with probability percentage = 0 should be excluded, i.e., they don't impact on the investment risk. If all the factors are equal to 0, which is not the case in a real situation, it means that there is an ideal environment for investing in this object at the moment. On the whole, this assessment cannot be considered adequate because it does not reflect all the peculiarities of the economic situation (Virine and Trumper 2008).

There is a strong notion of "risk-free" investment or "zero risk" in the economic literature. An investment is considered a risk-free if its income is guaranteed. The problem of determining the probability of an unfavorable investment outcome can be solved as a statistical task of modeling the complex dynamic systems. The essence of the statistical modeling method can be seen in the simplified fragment of the model of investment attractiveness of the project. Suppose that this project provides the production of one product, the gross profit from sales can be described by the following system of equations for *i*-th step of the operating period (Smith et al. 2005):

$$
\begin{aligned}
&Pva[i] = Pro[i] - Ss[i]; \\
&Pro[i] = V[i] \times S[i]; \\
&Ss[i] = (1 + Kpr) \times \{(1\_kft) \times Fot[i] + Mz[i] + Am[i]\}; \\
&Mz[i] = Zr[i] + Zc[i].
\end{aligned}
\qquad (2)
$$

where

Pva—the gross profit;
Pro—sales value;
Ss—production cost;
Kpr—coefficient of other costs in the cost;
Kft—payroll deduction ratio;
Mz—cost of material costs;
Am—amortization costs.

Let's for values: Cost of the unit of the finished products (*S*), payroll (*Fot*), cost of resources (*Zr*), cost of raw materials (*Zc*) used in the above equation, in advance in the preparation of the initial data, the functions *g [k,i]*, are defined, which calculates the values of these parameters by the steps of the calculation period and the mean square deviations corresponding to them—*MSD [k,i]*, and for the volume of output—the predicted values (*V[i]*) by the steps of the calculation period and *MSD*, then it may be recorded the system of equations to calculate current values:

$$
\begin{aligned}
V[i] &= Vt[i] + MSD[k,i] \times Kn[k]; \\
S[i] &= S_o \times g[k+1,i] + MSD[k+1,i] \times Kn[k+1]; \\
Fot[i] &= Foto \times g[k+2,i] + MSD[k+2,i] \times Kn[k+2]; \\
Zr[i] &= Zro \times g[k+3,i] + MSD[k+3,i] \times Kn[k+3]; \\
Zs[i] &= Zso \times g[k+4,i] + MSD[k+4,i] \times Kn[k+4].
\end{aligned}
\tag{3}
$$

where *So*, *Foto*, *Zro*, *Zso* are values of these parameters at the beginning of the estimated *i*-th period; *Kn* is a random variable having a normal distribution law. It varies from 1 to *Tp*, and *Tp* is the number of parameters to be changed.

As a rule, when calculating, it is assumed that all the studied values obey the normal law of distribution. For each case, the type of distribution law can be established using existing methods of mathematical statistics.

Using the model of the investment attractiveness evaluation of the project considering the system of Equation (1), new values of each criterion of efficiency and profitability of capital investments and efficiency estimation of the equity are determined for each implementation. After performing the next implementation, these values are recorded and accumulated. After finishing the specified number of implementations, statistical processing of the obtained results is conducted, which obtains the nominal values of the required criteria and their *MSD*. The necessary number of implementations is determined by two criteria:

(1) Compliance with the average value of the criterion determined by the statistical model, its value, calculated by the nominal values of the initial data.
(2) Stability of *MSD values* obtained for multiple implementation values.

Similarly, the probability of an adverse outcome by any criterion used to evaluate the investment attractiveness of the project can be determined.

The criteria are of particular interest, and its values are expressed in percentage: Internal rate of profit, the margin of financial stability, dividends which can be paid to shareholders. Two probability values can be calculated for these criteria, as well as for the "Investment Outcome" criterion: (1) Probability that the value of the test discount or dividend payout to shareholders will not exceed the bank interest rate for the loan; (2) probability that their values will have at least some positive values other than 0.

The experience of evaluating the investment attractiveness of projects demonstrates that probability estimation of unfavorable investment results requires the development of the software package to approximate the basic parameters of the initial data using both the least squares method for linearization functions and static polynomials, and methods of nonlinear programming for optimization of complicated systems. Undoubtedly, the values of the risk levels for classification: High, medium, low should be clarified during

the accumulation of the analysis results of the investment attractiveness of the projects for the criteria used and support of real projects during its operation (Table 2).

Table 2. Value of the risk probability level.

Risk Level	Value of the Confidence Interval	Probability of the Adverse Result
High	>2.4	<0.01
Medium	1.29 … 2.4	0.01 … 0.1
Low	<1.29	>0.1

Source: Created by the author.

3.3. Methods for Assessing the Feasibility of Investing and Forming a Portfolio of Projects

Given that the impact of a particular investment project on the investment portfolio is a change in the company's liquidity, we propose such an approach to the process of forming a portfolio of real investments. The proposed approach uses the Heming distance apparatus (Berg 2010 and includes the following steps).

The first step. In this step, based on internal reporting data, the main indicators of the company's financial condition should be calculated. So for each of the *n* forecast periods, taking into account the fact that the portfolio of actual investment projects included the *i*-th evaluation project ($i = \overline{(1, l)}$). Based on the projected financial statements, the company's financial condition should be calculated (Dallas 2006). This step must be repeated l times for each evaluation project.

In the third step, matrices for diagnosing the financial condition of the company (X^i) should be built:

$$X^i = \begin{vmatrix} X_{11}^{ip} & X_{12}^{ip} & \dots & X_{1k}^{ip} \end{vmatrix} \tag{4}$$

where X_{1j}^{ip}—is the status indicator of the *j*-th indicator for the *i*-th evaluation project in the *p*-th period; and:

$$X_{1j}^{ip} = [\lambda_j] \begin{cases} 1,\_if\_X1_{2j}^{ip} - X1_{2j}^{p} > 0, \\ X1_{2j}^{ip} = 0,\_if\_X1_{2j}^{ip} - X1_{2j}^{p} = 0, \\ X1_{2j}^{ip} = -1,\_if\_X1_{2j}^{ip} - X1_{2j}^{p} < 0. \end{cases} \tag{5}$$

where:

- λi—indicative function, which takes one of two values: "-1"—the optimal value of the *j*-th indicator goes to a minimum;
- "$+1$"—the optimal value of the *j*-th indicator goes to the maximum or is set within the specified limits;
- $X1_{2j}^{ip}$—the value of the *j*-th indicator in the *p*-th period, taking into account the fact that the portfolio of actual investment projects includes the *i*-th investment project;
- $X2_{2j}^{p}$—the value of the *j*-th indicator in the *p*-th period, taking into account the fact that only real investment projects are included the portfolio.

Next, you should calculate a generalized indicator of the financial condition of the company, taking into account the evaluated project:

$$\widetilde{X}^i = \frac{\sum\limits_{p=1}^{N} \sum\limits_{j=1}^{K} X_{1j}^{ip}}{N + K} \tag{6}$$

where:

- $\widetilde{X}^i$—a generalized indicator of the financial condition of the company, taking into account the fact that the portfolio included the *i*-th evaluation project (the value of the indicator $\widetilde{X}^i$ is in the range from -1 to $+1$);

- 　N—number of evaluation periods;
- 　K—number of indicators.

If the value is $\widetilde{X}^i < 0$, then the i-th project does not participate in the further analysis. Next, go to the interval [0;1] for $\widetilde{X}^i$:

$$\widetilde{X}^{i1} = \frac{\widetilde{X}^i}{2} + 0.5 \tag{7}$$

where:

- 　$\widetilde{X}^{i1}$—a generalized indicator of the financial condition of the company, taking into account the fact that the i-th evaluation project included in the portfolio (in the interval [0;1]).

The second step. The calculation of the above indicators is based on the process of discounting (bringing cash flows to present value), which in turn requires the determination of an adequate discount rate. We believe that the results of the evaluation of investment projects are correct insofar as the discount rate is chosen correctly. If the discount rate is inadequate, decisions to approve or reject the project will be unreasonable and unjustified (Espinoza 2014). The proposed method of assessing the investment attractiveness of projects is based on the use of discount valuation methods, which are based on the following universal ones: Opportunity capital costs, inflation, and the risk of not receiving tomorrow's currency. To calculate the discount rate, we suggest using the following ratio:

$$DZ_i = DB + \alpha_1 \times PR_i + \alpha_2 \times PN_i + \alpha_3 \times PM_i \tag{8}$$

where:

DZ_i—discount rate of the i-th project;
DB—return on risk-free investments factor;
PR_i—the i-th project risk factor;
PN_i—the company's illiquidity factor in the implementation of the i-th project, and PM_i—factor of financial instability of the i-th project;
$\alpha1$, $\alpha2$, $\alpha3$—factors of importance regarding influence of risk, illiquidity, and financial instability on the size of the discount rate (calculated based on statistical data or set by experts).

To take into account the sensitivity of the investment project to changes in the economic environment when assessing the risk of factors that have a decisive impact on the profitability of the project, it is necessary to give different acceptable values (Bernard and Ghossoub 2010). As a result, we obtain a vector of risk factors of the investment project, which corresponds to different states of the economic environment. To calculate the factor of financial instability, it is proposed to use the following ratio:

$$PM_i = 1 - K_i \tag{9}$$

where:

K_i—the factor of financial stability of the i-th project, and the factor of financial stability of the project, respectively, should be determined as follows:

$$K_i = \frac{WND_i - DN_i}{WND_i} \tag{10}$$

where:

- 　WND_i—internal level of profitability of the i-th project;
- 　DN_i—discount rate unspecified i-th project.

$$DN_i = DB + \alpha_1 \times PR_i + \alpha_2 \times PN_i, \tag{11}$$

where:

- DZ_i—discount rate of the i-th project;
- DB—return on risk-free investment factor;
- PR_i—the i-th project risk ratio;
- PN_i—the company's illiquidity factor in the implementation of the *i*-th project;
- $\alpha_1, \alpha_2, \alpha_3$—factors of importance regarding influence of risk, illiquidity, and financial instability on the size of the discount rate (calculated based on statistical data or set by experts).

It should be noted that the value of DZ_i should be calculated separately for each period of project implementation and in different conditions of the economic environment. It should also be noted that the forecast interest rate of banks on deposits in the national currency takes into account the projected rate of inflation.

To make decisions on selecting the optimal investment project, taking into account the sensitivity of investment projects to changes in the economic environment should build a game model. According to the concept of game theory, the decision-making situation is characterized by a set:

$$\{X, \Theta, F\}, \tag{12}$$

where:

- $X = \{x_1, x_2, \ldots x_m\}$—the set of decisions of the management subject;
- $\Theta = \{\Theta_1, \Theta_2, \ldots \Theta_n\}$—the set of states of the economic environment;
- $F\{f_{kj}\}$—evaluation function (matrix), defined on $\Theta x X$ and that takes values from space R^1, where $f_{kj} = f(xk, \Theta_i), k = (\overline{1, m}), j = (\overline{1, n})$.

The decision-making matrix is presented in the form of Table 3, and f_{kj} —the profitability index of the *k*-th investment project in the *j*-th state of the economic environment.

Table 3. Decision-making matrix for selecting the optimal investment project considering the sensitivity of investment projects to changes in the economic environment.

Investment Project	The State of the Economic Environment			
	Condition 1	**Condition 2**	...	**Condition *n***
Project 1	f_{11}	f_{12}	...	f_{1n}
Project 2	f_{12}	f_{22}	...	f_{1n}
...	...	...	...	...
Project *m*	f_{1m}	f_{1m}	...	f_{1mn}

Since in our case the evaluation functionality f_{kj} is used to optimize profitability, it is defined in the form F^+:

$$F = F^+ = \left\{ f_{kj} \right\}, \tag{13}$$

that is, the evaluation functional *F* has a positive ingredient:

$$\max_{x_k \in X} \left\{ f_{kj} \right\} \tag{14}$$

The third step. We will look for a solution to the game model based on the Bernoulli-Laplace criterion (in complete ignorance of the law of distribution of economic conditions), which says that the optimal solution $x_{ko} \in X$ is considered to be one for which:

$$B^+(x_{ko}, p) = \max_{x_k \in X} \left[\sum_{j=1}^{n} p_j \cdot f_{kj}^+ \right] \tag{15}$$

where: p_j—the probability of the j-th state of the economic environment, and $\sum_{j=1}^{n} p_j = 1$ and $p_j \frac{1}{n}$.

The proposed approach to the economic assessment of investment attractiveness of projects will allow a comprehensive approach to solving the following problems:

- to evaluate the effectiveness of the investment project considering its impact on the portfolio;
- to take into account the change in the illiquidity of the company in the implementation of the investment project;
- to take into account the financial instability of the project as a special manifestation of risk;
- to resolve the "conflict" of the criteria "internal level of profitability" and "net current income";
- to take into account the uncertainty and the risk caused by it;
- to diversify the portfolio of investment projects and choose the optimal one;
- to take into account changes in the economic environment.

A promising area of research is to consider ways to possibly reduce project risk in the economic assessment of investment attractiveness of projects.

4. Discussion

Effective analysis of investment risks involves a combination of the formalized approach and empirical methods. If it is used properly, it can serve as an effective tool to identify the sources of risk and the most critical factors, to evaluate and prevent potential problems, to save resources, and achieve higher quality. It is very important to have experience and practices which allow, on the one hand, to use proven schemes and approaches, and on the other hand, to apply them carefully in each case.

Further research in this area can be conducted in the direction of the risk identification and analysis, followed by decision-making on investment risk mitigation and prevention measures aimed at minimizing risk events, reducing the probability of adverse results, minimizing negative effects and potential consequences. These are works on risk identification and analysis.

5. Conclusions

Summarizing, we emphasize that the most effective mean for the qualitative assessment of investment risk is the proposed method of chain process of identifying and monitoring risks, which identifies a wide range of risk factors affecting the activity of companies, as well as to evaluate the degree of their impact. The properly designed risk map is a basis for further quantitative evaluation of risks, as well as it is a convenient aid in choosing the way to reduce risk. The use of the proposed methodology for evaluating the effectiveness of investment projects has shown that it carries out the comprehensive analysis of projects and decision-making based on a large amount of information, which is a necessary condition for their accuracy and validity. It has been determined that the methods and approaches considering the magnitude of the probability, severity, and (additionally) possibility of detecting harm or loss should be used for the quantitative assessment. Data veracity is important for the quality and reliability of the results, thus, the expert assessment of events and risk formation is of great importance here.

Conflicts of Interest: The authors declare no conflict of interest.

References

Berg, Heinz-Peter. 2010. Risk management: Procedures, methods and experiences. *Reliability and Risk Analysis: Theory and Applications* 1: 79–95.

Bernard, Carole, and Mario Ghossoub. 2010. Static portfolio choice under Cumulative Prospect Theory. *Mathematics and Financial Economics* 2: 277–306. [CrossRef]

Cagliano, Anna Corinna, Alberto De Marco, Sabrina Grimaldi, and Carlo Rafele. 2012. An integrated approach to supply chain risk analysis. *Journal of Risk Research* 15: 817–40. [CrossRef]

Cvetkovic, Nirco. 2002. Investment strategy of companies. *Belgrade: The Institute of Economic Sciences*. [CrossRef]

Dallas, Michael F. 2006. *Value and Risk Management: A Guide to Best Practice*. Hoboken: Blackwell Publishing Ltd. ISBN 978-1-405-12069-2.

Nokes, Derek, and Lawrence Fulton. 2019. Analysis of a Global Futures Trend-Following Strategy. *Journal of Risk and Financial Management* 12: 111. [CrossRef]

Dey, Prasanta Kumar. 2001. Decision support system for risk management: A case study. *Management Decision* 39: 634–49. [CrossRef]

Espinoza, R. David. 2014. Separating Project Risk from the Time Value of Money: A Step toward Integration of Risk Management and Valuation of Infrastructure Investments. *International Journal of Project Management* 32: 1056–72. [CrossRef]

Helliar, Christine V., Aalasdair A. Lonie, D. M. Power, and C. D. Sinclair. 2002. Managerial Attitudes to Risk: A comparison of Scottish chartered accountants and U.K. managers. *Journal of International Accounting, Auditing & Taxation* 11: 165–90. [CrossRef]

Junkes, M. Bernadete, Anabela P. Tereso, and Paulo S. L. P Afonso. 2015. The Importance of Risk Assessment in the Context of Investment Project Management: A Case Study. *Procedia Computer Science* 64: 902–10. [CrossRef]

Kerzner, Harold. 2001. *Project Management*. Hoboken: John Wiley & Sons Ltd., Available online: https://books.mec.biz/tmp/books/55F1OL4WQC7HL2OBCGHS.pdf (accessed on 1 February 2021).

Kmec, Peter. 2011. Temporal hierarchy in enterprise risk identification. *Management Decision* 49: 1489–509. [CrossRef]

Krkoska, Eduard, and Klaus Reiner Schenk-Hoppé. 2019. Herding in Smart-Beta Investment Products. *Journal of Risk and Financial Management* 12: 47. [CrossRef]

Kwak, Min Suk, and Traian Pirvu. 2018. Cumulative Prospect Theory with Skewed Return Distribution. *SIAM Journal on Financial Mathematics* 9: 54–89. [CrossRef]

Lappe, Marc, and Konrad Spang. 2014. Investments in Project Management are Profitable: A Case Study-based Analysis of the Relationship between the Costs and Benefits of Project Management. *International Journal of Project Management* 32: 603–12. [CrossRef]

Liurui, Deng, and A. Pirvu Traian. 2019. Multi-Period Investment Strategies under Cumulative Prospect Theory. *Journal of Risk and Financial Management* 12: 83. [CrossRef]

Lončar, Dragan. 2011. Applicative Model for Appraisal of Investment Projects Based on Real Options Methodology. *Serbian Journal of Management* 6: 269–82. [CrossRef]

Lui, Hongkai, and Yingjie Yu. 2010. Analysis about Risk Evaluation Based on Venture Investment Project. Paper presented at 2010 3rd International Conference on Information Management, Innovation Management and Industrial Engineering, Kunming, China, November 26–28.

Mohamed, Sherif, and Alison K. McCowan. 2001. Modelling project investment decisions under uncertainty using possibility theory. *International Journal of Project Management* 19: 231–41. [CrossRef]

Seyedhoseini, Hosseini SM, and Mohammad Ali Hatefi. 2009. Two-Pillar Risk Management (TPRM): A generic project risk management process. *Transaction E: Industrial Engineering* 16: 138–48.

Simić, Nataša, Verica Vratonjić, and Ivana Berić. 2011. Methodologies for the evaluation of public sector investment projects. *Megatrend Review* 8: 113–29. [CrossRef]

Smith, Nigel J., Tony Merna, and Paul Jobling. 2005. *Managing Risk in Construction Projects*. Hoboken: Blackwell Publishing Ltd. [CrossRef]

Virine, Lev, and Michael Trumper. 2008. *Project Decisions: The Art and Science*. London: Management Concepts. ISBN 978-1-56726-217-0.

Wang, Jiayuan, and Hongping Yuan. 2011. Factors affecting contractors' risk attitudes in construction projects: Case study from China. *International Journal of Project Management* 29: 209–19. [CrossRef]

Wilkinson, Angela, and Shirin Elahi. 2003. Description of the Riskworld project process. *Journal of Risk Research* 6: 343–64. [CrossRef]

Yen, Yen Yee. 2004. *Investment Risk Management*. Hoboken: John Wiley & Sons Ltd. ISBN 978-0470849514.