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Research article[1]

Enterprise Environmental Risks and Their Minimization: The Role of the Institutional Environment

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Abstract

In the context of innovation adoption and structural shifts in the economy induced by digitalization, managerial decision-making processes are becoming increasingly complex. Identification and assessment of various risks, including environmental risks, play an increasingly important role. This article examines the concepts of economic and environmental risks, their interrelation, and systematizes environmental risks for enterprises. It also explores the role of the institutional environment in mitigating uncertainty and preventing environmental risk realization and reviews existing practices for qualitative and quantitative risk assessment.

Keywords: sustainable development, enterprise environmental risks, institutional environment

Introduction

The active adoption of Fourth Industrial Revolution innovations, acceleration of technological changes, and qualitative shifts in global economic configuration caused by digitalization have complicated traditional approaches to economic activity. This complexity extends to managerial decision-making, where the identification and assessment of diverse risks increasingly influence business and societal outcomes. The cumulative complexity of resource-ecological problems emerges as entrepreneurs seek competitive advantages, amplifying potential negative effects and increasing societal risks across all domains.

Annual Global Risk Reports by the World Economic Forum highlight resource, environmental, and climate risks among the top ten global priorities. International agreements (e.g., the Paris Climate Agreement) and national strategies (e.g., Environmental Safety Strategy, Climate Doctrine, Energy Strategy) emphasize the modernization of the institutional environment as essential in preventing, managing, and mitigating environmental risks [1–4]. Institutions establish formal and informal rules for both the state and businesses, reducing uncertainty and risk for all stakeholders.

Enterprises face economically significant resource-ecological and climate risks due to environmental legislation and risk management indicators. Export-oriented businesses must consider not only national but also international institutional frameworks. Environmental risk management is crucial for enterprises to reduce potential economic costs, including emissions payments, fines, and litigation, and for the state to protect environmental welfare and public health.

The aim of this article is to analyze institutional conditions and assess their impact on environmental risk management and uncertainty reduction, focusing on recent institutional changes and their effect on the entrepreneurial sector.

Risk and Uncertainty in Economic Theory

Risk and uncertainty occupy a central position in economic theory. Classic economists such as John Stuart Mill, Thomas Malthus, and Johann von Thünen recognized risk premiums as a component of entrepreneurial profit. Frank Knight distinguished between measurable risks and unmeasurable uncertainties, highlighting the role of uncertainty in differentiating contract income from residual profit [5]. Modern approaches define risk and uncertainty from subjective or evaluative perspectives [6].

In this article, risk is understood as the probability of potential losses or foregone income due to adverse events. Uncertainty refers to insufficient information to identify risks within an enterprise's operating environment [7]. Institutions reduce uncertainty by establishing rules and frameworks that influence the expected outcomes of decisions. This redistribution of probability densities mitigates both positive and negative consequences of potential events.

Environmental Risks

The UN Environment Programme (UNEP) provides comprehensive descriptions of societal environmental risks but lacks dynamic tracking of risk evolution. The World Economic Forum's annual risk reports emphasize environmental and climate risks as highly destructive and likely to occur. Russia's Energy Strategy until 2050 identifies climate change and international environmental policy as key external challenges and recommends incorporating climate and hydrometeorological risks into project lifecycle assessments.

Environmental risks affecting enterprises can be categorized as [1, 9, 10]:

1. Risks originating from enterprise activities;
2. Risks arising from policies that create environmental uncertainty;
3. Risks from external environmental factors.

Enterprise-generated environmental risks (categories 1 and 2) are transformed into economic risks through mechanisms such as fines, taxes, and regulatory compliance costs, consistent with the Pigouvian tax principle. Extended producer responsibility, implemented in Russia since 2017, expands the application of the "polluter pays" principle to post-consumer waste.

Methods for Assessing Environmental Risks

Environmental risk assessment integrates qualitative and quantitative approaches. Quantitative methods remain narrow, often focused on specific technologies, environmental assets, or damages. Experts emphasize the importance of complete datasets for evaluating probabilities, consequences, and losses [13–16]. Bayesian networks offer promising methods for assessing interrelated risk factors and machine learning applications.

Institutional standards, such as the U.S. EPA Guidelines for Ecological Risk Assessment (1998) and Australia's Relative Risk Model (2006), provide structured assessment approaches, often incorporating Monte Carlo simulations for uncertainty analysis. Russian standards (GOST R 54135–2010 and GOST R 14.09–2005) formalize environmental risk management procedures and are applicable to both government bodies and enterprises. Public indices, such as the Environmental Performance Index and Russia's National Environmental Rating, offer benchmarks but are limited in objectivity and data continuity.

Quantitative assessments often rely on estimated damages or fines, as comprehensive public statistics are limited. Effective institutional frameworks, such as property rights delineation and producer responsibility mechanisms, are crucial for uncertainty reduction and environmental risk mitigation.

Conclusion

This article differentiates risk from uncertainty and defines environmental risk as a specific type of entrepreneurial risk. Environmental risk arises from enterprise activities and encompasses potential economic losses due to environmental damage and third-party liabilities. Institutional frameworks play a key role in risk transformation and uncertainty reduction, both through legislation and proactive state initiatives. Existing risk management practices focus on individual environmental factors, but insufficient attention is given to institutional modernization as a preventive measure. Current qualitative and quantitative assessment practices rely heavily on ratings, which only indirectly reflect environmental performance. Recommendations include improving enterprise risk management and enhancing quantitative evaluations across Russian regions.

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