
Development of Risk Insurance Area for Russian High-Technology Enterprises

O.N. Dmitriev¹, S.V. Novikov²

Abstract:

It has been proved that the operation of a high-technology entity is an area significantly disturbed by manifestations of various adverse factors. Therefore, the underlying causes of negative effects are visible with a possibility of adverse effects – namely threats.

A significant number of threats generate risky situations of the same nature as risk generating impacts that can be identified by the description of stochasticities. The problematic nature and the critical nature of the insurance area for Russian high-tech production market operators have been analyzed.

At the same time the inevitability of a transition to a new level of the organization of their insurance coverage as Russian companies become integrated into the global economy has been justified.

Conceptual, instrumental, and other major obstacles to the adoption of intellectual technologies of risk insurance have been highlighted. An original conceptual view of several methodological and implementation project decisions for the area in question have been proposed.

Keywords: *Internationalization of economy, threat, risk, insurance system, anti-threat management, risk management, insurance decisions support system.*

¹PhD (Engineering), Full Doctor of Economics, Professor of Management, Professor at High-Technology Industry Production Management and Marketing Department, Moscow Aviation Institute (National Research University), E-mail: olegdmitriev@yandex.ru

²PhD of Economics, Acting Director in Scientific Research of the Institute of Engineering and Economics, Moscow Aviation Institute (National Research University), E-mail: ncsrn@mail.ru

1. Introduction

Insurance related to a certain extent, to economic, technological, and other risks has become one of the fundamentally new management areas of the Russian economy. It is worth noting that the Russian economy has been facing new grave problems in the last five years, which were due to its coming under foreign sanctions, and its attempts to adopt import substitution, and to secure several self-sufficiencies.

The above statement is true for practically all present-day Russian economy sectors, but it primarily concerns the high-technology manufacture area – a problem attributed to the fact that high-tech products are normally high-risk items, while their operators, manufacturers, and designers are in crisis and in unstable positions, whereas the scale of the respective prices, costs, and losses is considerable.

Considering the newness of the situation and its peculiarity to the domestic economy, a set of problems arises, primarily in managerial problems related to risk loss insurance. Those losses are incurred by not only the designers, manufactures, operators and their subcontractors, but also by the so-called “third parties” of whatever nature. The issues in question are burning issues for the whole country, as well as for companies and specific individuals, which necessitate the importance of addressing those issues by government and corporate groups (e.g., economy sectors, sub-sectors, associations, corporate groups etc), conventional high-tech complex enterprises (including scientific research institutes, design offices, quantity production plants, exploitation operators, repair plants), and newly incorporated dedicated companies – insurance companies. Unfortunately, the Russian insurance and dedicated theoretical research areas are not yet utilizing intellectual management technologies of a highly advanced Decisions Support Systems (DSS) level.

It is worth noting that exceptionally high importance is being currently attributed to insurance decision support problems all over the world. In fact, here are several journals on computational methods application to insurance decisions support, with researchers having extensive expertise and initiatives that must definitely be put to practice. It is self-evident that no productive partnership with foreign counterparties is possible under vulnerability to risks. Moreover, promoting isolationism is predictably counterproductive in the face of the inevitable advent of the post-industrial society. Based on the above, respective managerial innovations are undoubtedly a topical issue.

2. The motivation behind the development of an insurance operation area

The Soviet-era high-tech design, manufacture, and operation neither implied nor required advanced insurance operations, especially those conducted on a commercial basis. In the USSR, insurance was operated implicitly by the centralized economic planning and distribution system, with any losses either compensated centrally or ignored. As the market economy went through its formative stage, risks were viewed

as an inevitable and an indispensable “price to pay” for doing business. Back then, however, minimum insurance was still considered acceptable for several sectors, e.g., the aerospace area and the sea area. Tectonic changes are in progress and around Russia now, which, in the light of the issues under discussion, are as follows (Bodrunov *et al.*, 2002; Kanashchenkov *et al.*, 2013; Gorbunova, 2016):

- Practically all enterprises, including commercialized government-run ones, have become standalone responsible entities;
- Instability and uncertainty are increasing sharply in finance and economy, in the legal, political, military areas, in science and technology;
- Most foreign partners and established Russian businesspersons, as well as banks, will not cooperate with Russian enterprises unless the latter are able to provide advance insurance plans;
- Ever-increasing direct and indirect (exerted via government agencies) competitive pressure on Russian high-technology manufactures – on both global and domestic markets. As a result, insurance has become one of the determining factors in the competitiveness of enterprises, their employees, and products (end articles and services);
- Favorable conditions for reinsurance, among other things, due to the Russian national currency striving towards free convertibility;
- Insurance business activities have been given formal legal definition (as stated in dedicated insurance laws and their respective bylaws).

Significant numbers of failures and preconditions for aviation accidents and incidents due to design and manufacture flaws are the underlying cause of actual risks of unacceptably heavy losses, including those faced by domestic aviation industry. Moreover, great numbers of claim reports suggest that suppliers who are knowingly at fault account for most failures and accidents. It is fair to assume that the actual number of accidents is at least a few times as high as that reported by official statistics, considering that employees and enterprises sometimes neglect to submit claim reports of failures, and some companies neglect reporting in general.

Increased numbers of casualties of aviation accidents and incidents, and the increasing graveness of injuries causing heavy expenses are a major contribution to additional costs incurred by enterprises at fault. The problem is not so acute for the Russian civil aviation that pivots on leasing imported aircraft; however, risks incurred by the rest of the Russian high-technology manufacturers are rather high – both probabilistically and in terms of their extent. Therefore, any damage inflicted by an aviation company failing its obligations is actual and heavy.

Accordingly, it is fair to assume that a uniform and advanced insurance coverage space for Russian companies, including their coverage as importers and exporters, will inevitably form. Thus, there exists an objective stimulus for the insurance business covering high-technology area to develop in Russia, as well as interest in seeking potential insurers.

This potentially extensive segment of the insurance market remains underdeveloped, though quite profit-making, as far as one can judge from the Russian insurance market in general. Consequently, we have every reason to state the following:

- There exist several potent, objective, and indispensable factors that necessitate the preparation and execution of insurance operations of high efficiency in the high-technology business areas;

- The demand of insurance services is considerably below the actual need of such services due to limited funds that potential insureds have at their disposal, the newness of insurance business to companies, a comparatively short and underpowered expansion of insurers and a negative impact from macroeconomic factors;

- A considerable part of the problems that the Russian insurance is facing is strongly linked to or even fully predetermined by faulty initial information, and lack of or unacceptably poor quality of feasibility studies behind insurance managerial decisions;

- Some of the problems typical of the existing global insurance market are still uncommon in Russia (including fraudulent initiations of insurance cases in order to receive insurance bonuses, which commonly occurs in the global practice).

- Radical measures need to be prepared and taken to prevent those problems.

It is important that marketing and insurance operations become tightly interwoven. Moreover, as a rule, insurance operations are essentially marketing operations; in other words, they are an integral part of a general process of studying, forming, and satisfying the demand of a line of products manufactured by high-technology market operators – both domestic and global.

There exists another methodologically important factor that is worth noting: insurance is, by definition, targets minimization of losses from impacts that are of stochastic nature or can be interpreted as accidental or random. It is self-evident that we, to a certain degree, are laboring under categorical misconception. For instance, birds sucked into a jet engine is clearly a natural accident, while sabotaging any aviation stock is clearly not a random accident. However, the current insurance system tends to attribute implicit randomness to the latter cases by using a posteriori statistical data interpreted as processing results of a supposedly random sample of events.

Therefore, threat insurance, and not risk insurance, is still an untapped loss minimization area, which would mean a departure from canonical management under stochastic conditions and adoption of still untapped tools of anti-loss management under uncertainties. Accordingly, this would imply radical transition from risk impact insurance to threat insurance, which, among other things, would take radical revision of insurance laws both in Russia and worldwide, and, derivatively, the methodological and instrumental basis under insureds and reinsureds activities.

One more important fact is that insurance conventionally and exclusively covers financial losses – monetary risks, while other risks are not insurable; though they do exist explicitly, they are not even classified as non-monetary losses, neither are fully reflected financially and economically.

3. Major problems of the insurance business area

Risk insurance for the domestic high-tech complex faces several problems, among which the following take their toll on the insurance area:

- Difficulty attracting insurants – primarily, high-technology enterprises (including scientific research institutes, design offices, and quantity production plants), as well as operators – both domestic and foreign, commercial companies, and government agencies. Combined with several other issues, a comparatively low demand of insurance services, inevitably leads to an artificial rise of the bottom limit of the demand prices by insurers;

- Newness of insurance business to all potential parties to it, which also reduces demand, with the managerial staffs of domestic companies lacking tradition and being unaware of benefits proofs of the practicality of insurance;

- A few legal obstacles to the advancement of insurance business, including those linked to the irrational taxation system;

- The existence of practical difficulties managing insurance stock (and, in a broader context – insurance operations) under rapid inflation;

- Underdeveloped information environment being deliberately kept considerably distorted and unreasonably closed;

- Problematic reinsurance, with global insurance “titans” like Lloyd’s® and AIG® that objectively follow in the wake of the global politics, and, to a certain degree, are natural monopolist counterparties to Russian insurers, and necessarily being strategic reinsurers to Russian insurance companies;

- The Russian insurance market being closed to foreign insurance companies due to respective legal restrictions;

- Lack of developed insurance management tools and qualified dedicated experts even in insurance companies, let alone “ordinary” insurers.

In the light of the above, it is fair to state that, on one hand, crisis manifestations in economy reduce insurance market activity and, on the other hand, passive attitude towards insurance operations aggravates stagflation tendencies due to more loss components, bankruptcies and payments suspensions. Therefore, the vicious recursion in question must be broken by supporting the advancement area for the insurance business, lifting unnecessary restrictions, and revealing its stagnant mechanisms.

Accordingly, a campaign to stimulate demand and to improve support of insurance operation decisions must be given top priority. It is obvious that dynamic advancements in those two areas are only possible if effective managerial

technologies for insurance business at all levels and for all entities that operate on insurance market are developed.

4. Primary way to attract insurants

We see raising awareness of practicality of insurance against consequences of respective risks among insurants' managerial staff as the only workable way to attract insurants. It is noteworthy that risk function insurance (so-called risk function of insurance business) benefits to an enterprise, because:

- It prevents or compensates the enterprise for any possible losses inflicted by any faux-pas of its own, through the fault of other individuals or companies, as well as through occurrence of force-majeure events;
- It adds to the enterprise's positive public image as a reliable business partner, which is an internationally accepted practice;
- It improves the enterprise's competitiveness.

The attractiveness of insurance as a way of preventing damage (preventive function) is secured by a possibility of accumulating funds to prepare and to take measures to reduce risks (primarily, in terms of operation security), thus reducing the insurant enterprise's own dedicated damage-preventing costs. Insurance is also productive as means of saving (due to its so-called saving function), because a properly made insurance agreement may protect an enterprise's idle cash from inflation.

Insurance subjects also play an important role if chosen properly. That said, the present-day Russia needs and offers a possibility of insurance subjects and conditions – both conventional and unconventional in terms of the global expertise. We see it advisable that high-technology manufacturing enterprises choose all the three conventional insurances, namely, individual insurance, property insurance, and liability insurance.

Individual and property insurance allow risk transfer in general as a part of generally accepted conventional insurance types. An extensive broadening of the insurance area has been proposed for service consumers and third parties by introducing the additional insurances, namely:

- Against insolvent or fraudulent product customers, including government agencies;
- Against negligent or fraudulent subcontractors;
- Against penalties for delivery quality being below quality standard provided contractually or for delivery failure;
- Against enterprise's reorganization or restructuring by court;
- Against unfair competition;
- Against being subject to antimonopoly sanctions due to involuntary monopolization;

- Against bankruptcy;
- Against loss of funds or property made part of authorized capital of a third-party company;
- Against damage incurred through intellectual property right or copyright violation;
- Against damage due to fraudulent transactions by third-party individuals or companies, including fraudulent stock market operations, forgery of bonds and securities, etc;
- Against damage due to defamation, or some other typical insurance cases.

Besides, well-developed civil liability insurance to counterparties and international, national, and local governing agencies must be practiced, including tax liabilities insurance. The diversity of insurance package policies on offer and easily tailored to operation conditions of a specific insurant enterprise is of special attractiveness. The very insurant enterprise is objectively interested in more diverse insurers, as this decreases insurance rates and increases insurance bonus limits.

5. Improving support of managerial decisions as to insurance operations, preparation and conduction

High-technology area insurance is only efficient if it is:

- 1) an evolving whole system;
- 2) based on the fundamental principles listed below:
 - It targets well-balanced benefit to both insurers and insureds, with at least, midterm prospects considered;
 - It combines issues related to technological, commercial, and other risks;
 - It covers nearly the entire list of all possible insurance types and conditions;
 - It implements management coordinated between government agencies and companies;
 - It promotes marketing policy to the insurance market in an active and competent manner;
 - It supports bona fide domestic insurers;
 - It makes decisions based on modern computerized economic and information technologies that utilize computational simulation of risk mediums, and utilizes fully-functional cybernetic feedback circuit (Dmitriev, 2017);
 - It applies “strength balance” and “equilibrium” principles to respecting counterparties’ interests, e.g., in making decisions as to insuring against suppliers and product operators (customer) risks;
 - It develops information infrastructure to provide continuous information monitoring of the risk area and behaviors of market participants.

Managerially, efficient insurance based on the above principles, provides:

- A sharp reduction of losses sustained by each of the operating insurers against any adversary loss-making events, possible intensification of investments into its development, improved competitiveness of an enterprise and products it supplies;

- A considerable reduction of uncertainties and randomness of managerial decisions made, which leads to the same beneficial effects as above.

Practically, the mechanism of the unacceptability of possible losses (and not always actual losses) due to insurance is as follows. An enterprise that neglects insurance does not sustain predictable insurance costs but becomes subject to a possible risk of losses. If the enterprise opts for services provided by an insurance company, the former is to pay for those services, while becoming entitled to a considerable or even a full compensation when an insurance case occurs. Even if an insurance plan is such that insurance installments paid by an insurant enterprise equal to the very potential damage loss, it still benefits the insurant company, as it sustains the loss “in a planned manner” and “in installments.” However, the more insurants there are, the higher is an objective probability that the insurance installment costs sustained by each of them become lower than the absolute possible damage loss. The above considerations necessitate, in particular, that the parties listed below conduct comprehensive feasibility studies to support decision and insurance operations:

- National, and, possibly, territorial governing bodies (agencies and organizations);

- Dedicated insurance companies – insurers;

- Insurant companies.

6. Proposed general organizational ways (directions) of conception implementation

It has been proposed that several innovative sanitation measures (each of those measures should be supported by feasibility studies, whenever necessary, based on a specific state of affairs) should be taken at government level:

- Obligatory insurance against officially listed liabilities must be introduced;

- Reinsurance by voluntary requests from insurance companies must be imposed as duty on an existing or a dedicated government agency;

- Activity of insurance companies must be obligatorily licensed, the formation and allocation of reserve funds made subject to strict monitoring;

- Government regulation of management that involves elevated economic and technological risk areas by, e.g. certification of companies, service staff and products must be introduced;

- Government support (e.g., in the shape of government guarantees) should be provided to foreign investors into the Russian insurance business and promotion of best practices. The Russian insurance market should be opened to foreign insurers gradually and reasonably;

- Companies should be directly encouraged to extend their insurance operations – primarily, by exempting funds earmarked for progressive insurance from taxes. Appropriation of reasonable insurance payments to product costs must be authorized. By the same token, it would be beneficial to limit fiscal pressure on insurance companies, related to their income and property assets taxation;

- The current Russian insurance laws must be elaborated, and harmonized them with applicable global laws;

- Measures must be taken to centralize economic regulation of risks.

7. Using high technologies to support insurance managerial decisions

Adoption of a proper definition of anti-risk management shall be the first step. Entities, in their normal course of businesses, face or may face events when so-called risks emerge or occur. Unfortunately, while extensively using the term “risk,” the Russian law avoids defining it explicitly.

So, let us introduce a definition of risk of our own, based on legally codified guidelines for risk responses. Risk is defined as a possible amount of decrease in the monetary equivalent of a property cost, to which an entity holds title (usually, proprietary right) – that is, a possible amount of loss.

The current Russian law defines losses sustained by an affected entity as expenses that the affected entity has incurred or will incur to restore its violated rights, or as depreciation of property due to its destruction or altered parameters (actual damage), or as lost profits that the affected entity would have earned in the normal course of business, unless its rights would have been violated (lost profits). The Russian law also fails to provide an exhaustive answer to the question whether risks are connected to moral injury (of an individual). The violation of rights in question can be caused by various environment components, its parties to a legal relationship, material items, a management object, or a managing system.

It is obvious that a risk can be postponed until any moment that the interested party (party at risk) finds appropriate; prevented and/or compensated for, in part or in full. Any risk is necessarily random, including its dependence on certain influential factors, on a random or a determined time moment when a possible risk occurs, and on a necessarily accidental occurrence of violation of rights. Probabilistic formalization of a risk R can be written down as:

- As a random process $R(t)$;

- As a system of dependent random values with a set sequence of occurrence $\{R, Y, T\}$;

- As a random function:

$$R = R [x_1, \dots, x_m, T, Y(T)],$$

where:

R is the risk value;

x_1, \dots, x_m are the influential factors;

T in a general case, is a random time moment when a possible violation of right occurs;

Y is a random event – an occurrence of violation of rights, a Boolean random value.

A dedicated management area that studies risks as a special state indicator class is called “risk management”. It is noteworthy that a risk, firstly, is a standalone random component of a financial and economic performance value and is a stochastic component of financial and economic status, and, secondly, so are managerial decisions. Therefore, the managerial area in question can be fair (see, e.g., a case for crisis management Zolotova, 2017):

- Considered as a part of an ordinary management, where combined risk management occurs;
- Transferred into a standalone management system or subsystem, within which localized risk management occurs.

It is common knowledge that random value management is impossible so let us proceed to statistical characterization of risk:

- Mathematical expectation (expected value) of risk $M\{R\}$;
- Risk dispersion $D\{R\}$.

Naturally, in an ideal case, risk management implies solving a managerial problem such as:

$$\left\{ \begin{array}{l} M\{R\} \rightarrow \min; \\ D\{R\} \rightarrow \min \\ x_1, \dots, x_m \end{array} \right.$$

with a set of limitations imposed.

There exist three basic solutions to the above managerial problem:

- Optimization, by e.g., postponing the moment when a violation of rights is expected to occur until as late as possible;
- Minimization of a probability that a violation of rights will occur;
- Minimization of risk value when a violation of rights has occurred.

However, present-day research (Zolotova, 2017) suggests that there are two management types to minimize damage, namely, standalone and combined management, which transforms risk minimization from an end-in-itself into a clearer

goal – to make an enterprise's performance best possible, with several restrictions taken into account. Risk management, in turn, falls into two areas for each of the three solutions above:

- Risk prevention area (a priori area – prior to risk occurrence);
- Risk compensation area (a posteriori area – after risk occurrence).

The anti-risk managerial action area can be structured differently, by classifying it in terms of risk response stages, namely:

- Elimination of risk factors (e.g., reducing fraud risks by launching campaigns by law enforcement agencies to prevent crimes);
- Fending off adverse outside impacts in order to neutralize risk factors before threats transform into actual adverse actions or inaction (e.g., by establishing a counterclaim department);
- Imparting to the management object the property of being insensible to adverse outside impacts by transforming those objects into partly invariant objects (e.g., by building passive protection against natural disasters around hazardous manufacturing facilities);
- Neutralization of adverse alterations of a management object status due to a risk impact (e.g., by court recovery of damage from a party at fault).

Risk can be also classified:

- In terms of their underlying causes, e.g., there exist war risks, business risks, political, manmade, and natural ones;
- In terms of their time reference – single-time, periodic, and ongoing;
- In terms of duration of adverse effects – short-term, long-term, and ongoing;
- In terms of a possibility of repair of the good state of the management object – risk with either repairable or irreparable consequences;
- In terms of a scale of adverse impact – disastrous, major, minor, and negligible risks;
- In terms of the occurrence locality: internal and external (in relation to the management system) risks.

Identifying risks and their underlying causes and listing them is called risk inventory. Implementation of a general management circuit that implies formulation, formalization, and solution of a managerial problem, based on advisory information technology for management seems an acceptable managerial conception for risk management within the Russian business area (Dmitriev, 2005).

There exist a number of legal mechanisms that enforce on the counterparties the performance of their respective obligations. In accordance with those mechanisms, the performance of obligations can be secured by penalties, liens, mortgages,

warranties, bank guaranties, deposits, and other ways as provided by applicable law or under a contract.

Let us consider the organizational economic and managerial mechanism of insurance for the area in question. Insurance is a legal relationship intended to protect individual or corporate property interests upon occurrence of certain events (insurance cases) at the expense of monetary funds formed by insurance installments paid by insurers (insurance bonuses), that is, due to dedicated accumulation mechanisms. Insurance legal relationship has a contractual basis, though it may also legal enforcement as a legal binding. The parties to insurance system are:

- Insurers;
- Insurants;
- Reinsurants.

The idea of insurance is that insurants provide two types of statistically averaged balances between:

- Themselves, on determined insurance installments on one hand, and on determined own expenses, profits, and accidental insurance indemnities on the other hand;
- Insurers, on their determined insurance installments, accidental risks on one hand, and on determined insurance indemnities on the other hand.

The principal functions of insurance are:

- Preventive – as a part of risk-preventive measures taken by insurers;
- Accumulative – within the context of profit made by insurers due to the depositary aspect of insurance agreements;
- Compensatory – providing compensations for actual damage.

Management decision support by both insurance companies and insurant enterprises should be organized to imply a fully-functional cybernetic feedback circuit based on computational simulations of an enterprise and its stock performance at various lifecycle stages (Dmitriev, 2005).

8. Application of research results

We designed the prototype for the tools in cooperation with an expert group, which proved good for solving a series of managerial risk problems. DSS “ASTRA”, a suite for the preparation of managerial decisions (Rus. СИП “АСТРА”, - short for “Automated System for the Insurance Against Technical risks in the Aviation Area”) was designed to forecast managerial risks. The suite was founded on a system of imitational simulation of the performance of aviation fleet in operation (Dmitriev, 2002; Bodrunov *et al.*, 2003), and codified by a number of inter-industry practices

(those shared between aviation industry and civil aviation) and the OST (Branch Industry Standard) for Soviet Aviation Industry #1002641-88 “Airplanes and helicopters: The technology for the assessment of the demand concerning component and assembly units”.

DSS “ASTRA” proved to be good after years of application to comprehensive feasibility studies of anti-risk management at two leading aviation industry research institutes of Russia, and to feasibility studies of several managerial decisions at a major Russian civil aviation insurance company. The results were also presented at several academic conferences.

9. Conclusions

Based on the results, we can formulate the following principal statements, conclusions, and suggestions:

1) The present-day Russian high-technology area is vulnerable to a number of threats, with powerful risk factors identifiable.

2) Compulsory insurance is the one cure for risks. Insurance coverage must be extended to include not only the risk area, but the threat area also, the latter being of an uncertainty nature.

3) The very scale and the components of threats may change – and, presumably, become more extensive – in the face of inevitable internationalization of Russian industries. Russian enterprises may fail to integrate into the global economy and retain their good standing unless protected by advanced insurance systems.

4) The development and direct practical implementation of high-end intellectual managerial technologies by both insurers and insureds is critical to the advancement of the Russian high-technology complex. A complex knowledge-intensive Russian insurance area must be created, covering all enterprises and all regions as well as transactions conducted by Russian enterprises abroad. Any delay or mistaken choice of outdated reference systems will rob Russian enterprises of their influence and, in a best-case scenario, make them mere appendages to foreign companies.

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