

Optimization Alternatives of Information Systems for Risk Management

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The focus of this article lies on synthesizing the requirements a risk management information system should meet in order to ensure an efficient risk management within a company, but also on presenting the architecture of the information system proposed by the author, from a structural point of view as well as from the background of the data integration alternatives.

Keywords: risk management, information systems for risk management

Not only the legal regulations of international importance released in the last years, such as the Sarbanes-Oxley Act (SOA), but also global factors like the crisis on stock markets influencing the world economy and therefore the ongoing increase of complexity in the business environment lead to a new importance for the risk management, especially for international corporations.

The main factor of success of risk management and thus for the company lies in the implementation of an efficient concept of risk management based on information systems that optimize the information flow.

The companies have to face the challenge of identification, assessment and control of the various types of risk. This issue is even more complicated for international companies, for which the risk management connected to investment projects in different countries include a range of new aspects. It requires to find the way to assist efficiently the decision-makers by implementing an information system for risk management who fits the business needs.

Just like for every information system, following issues have to be defined and specified:

- **the information requests**, which correspond to the output the system has to deliver. At this point is required the specification of qualitative and quantitative characteristics of the requested reports, including details about the informational content, output forms and layouts, generation conditions and deadlines as well as the identification of the reporting recipients (reporting target

persons) within the company management system;

- **the information sources**, this system input includes all information sources used to satisfy the information requests, representing internal or external sources for the company;

- **the necessary processing steps to obtain the output from the input**, including the methods (algorithms) of computing as well as the totality of equipments and resources involved which represents mainly the information system with its applications and modules.

Following this considerations we will proceed by outlining the requirements, the objectives such an information system for risk management should achieve, and by identifying the main architecture of the system.

Requirements and objectives of an information system for risk management

Even if the companies have different views and criteria regarding the information system for risk management according to the individual needs of each company, some basis requirements can be nevertheless applied as common to all enterprises.

In order to ensure the information assistance for the planning, regulation, realization and control of risk management activities it is not enough only to store the historical and actual data of loss regarding the risk situation. At the same time it is necessary to assist the whole process of risk management, beginning with the risk analysis and risk aggregation till the assessment of risk consequences and the reporting of

the comparison of planned and actual situation regarding the measures scheduled to control and reduce the risks. It requires also processing of economical data of the company that include not only the risks itself, but also for example the investments related to the prevention of risks.

Under these circumstances an information system for the risk management has to be integrated into the existing information systems landscape of the company and has to be able to access the other components of the company information system e.g. the accounting information solution.

In addition, it is necessary to implement a communication interface to ensure the information flow and the communication between the parties involved in the risk management process. To answer the requirements of the different user groups it is required to establish capabilities to report data from different points of view in different front-ends depending on the professional characteristics and the experience of the user group.

The main requirements addressed to an information system for risk management can be considered from various angles and can be differentiated in the following categories: [Gleissner & Romeike, 2005a; Gleissner & Romeike, 2005b]

- **Economic and methodological requirements**

- definition and availability of checklists to identify the main risks;
- realization of a “risk inventory” to overview the risks at any time;
- specification of priorities for the different risks – for example by defining and assigning classes of risk relevance to the business in cause;
- assignment of a certain person responsible for monitoring the risks – the so called “risk owner”;
- definition and assignment of organizational guidelines for each risk form – regarding the frequency of risk control;
- structured overview for the main risk prevention measures – for example, the existing insurance policies;

- determination of control, reduction or transfer measures for each risk – controlling of the control framework;
- harmonization of these measures with the risk control and with the enterprise planning system;
- flexibility in quantitative description of risks – such as different alternatives available for the probability distributions;
- risks correlation – in the course of time and between different risks, in order to be integrated in the simulation;
- mathematical methods to calculate the total risk position – risk aggregation, for example deployment of the Monte-Carlo simulation method;
- determination and calculation of risk indicators – such as the value-at-risk, standard deviation, net equity demand;
- identification of several alert indicators to warn in case of critical development of each risk;
- ability to extend the risk catalogue that are to be analyzed and to analyze all risk areas – e.g. financial risks, delivery risks, external risks etc.;

- **Technical requirements**

- ability to reflect different structures in the corporation;
- system logic to integrate the workflow;
- availability of actual data at any point in time;
- existing available interfaces to import and export data;
- availability of reporting functionalities for all risks at any level and adapted to the individual user needs - triggering of emails depending on the ad-hoc reports, report consolidation from different views;
- storage possibilities of historical data for all risks and risk control activities;
- generation of risk reports transparent also for external organization – banks, auditing firms, etc.;
- deployment of authorization concepts and data security concepts.

- **Requirements on investment safety in the software package service and costs**

- size and future strategy of the software producer;

- experience and know-how of the producer in information technologies;
- clients and existing references;
- guarantee of support services and of installation of the software package;
- license costs;
- costs for software personalization (*customizing*);
- installation, maintenance costs;
- costs for end-user trainings etc.

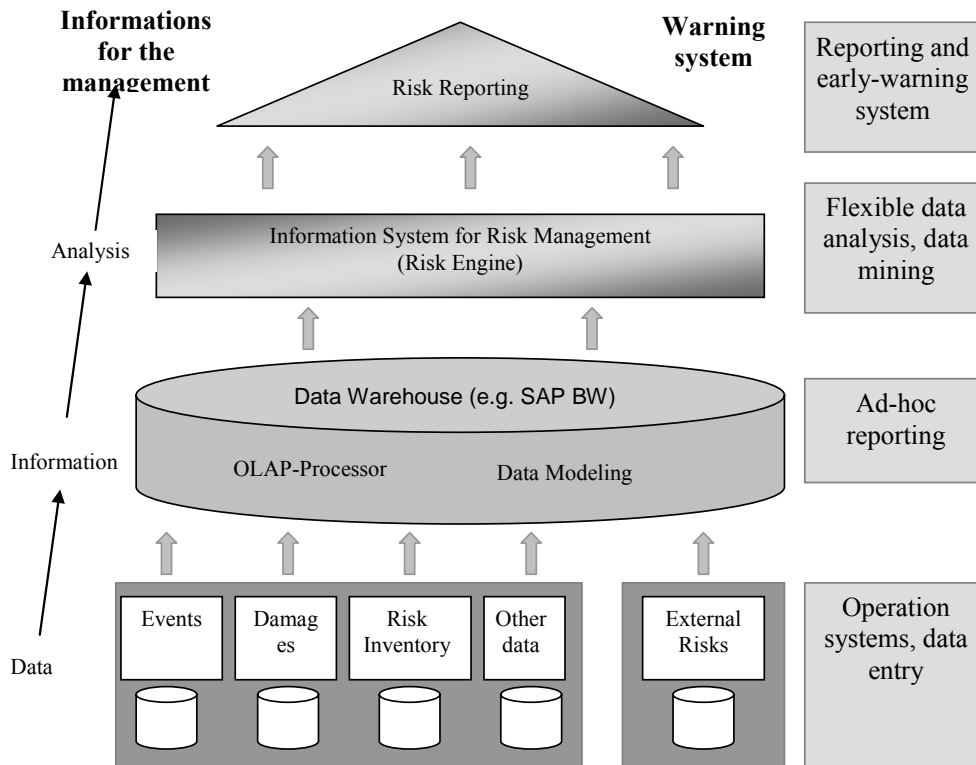


Fig.1. Data transformation into relevant information during the decision-making process

Risk management concerns first of all the management of information. Very often, the necessary data exists already in different areas somewhere in the enterprise. Hence the main requirement on an information system for risk management represents the generation, the guarantee and the maintenance of a continue information and communication flow between different organizations and functional units within the company, as well as the unified processing of data according to the requirements of risk management within an information architecture similar to the one represented in figure 1.

A proposal for the architecture of the information system for the investment risk management

Looking at the information system as a whole, the general architecture is practically synthesized in figure 1. There we can see

the most important components of the information request and of the information basis (internal and external), as well as the main tools, methods and support technology categories, in order to transform the informational inputs in outputs such as risk reports. These risk reports represent the core of the early-warning system and also the necessary synthetic information to support decision-making in the investment risk management system.

Further we focus on the architecture of the proposed informatics solution, which is represented in figure 2. Beside the identification of data source systems and of the obtained results as output of the information system, this architecture emphasizes the following modules for this risk management information system:

- the module «**Access to Data Source Systems**», which contains the transfer procedures from both internal and external data-

bases. Mostly is the case of relational databases, using relational database management systems. This module is in charge of the transfer of the primary data necessary for the identification (e.g. market analysis studies, statistical macroeconomic data or external risk reports) and for the assessment of risks (e.g. historical data from the planning or accounting and controlling system of the company) in the next module;

- the module «**Risk Identification and Assessment**» deploys the risks database and the other data source systems mentioned above to identify, to enable an inventory of risks, to describe and to assess the risks (e.g. using probabilistic distribution functions);

- the module «**Risk Aggregation and Consolidation**» includes all procedures which synthesize the primary data by aggregating and/or consolidating them, depending on the specific requirements for the identification of different types of risk, such as the impact on company's investment projects, for instance of international nature;

- the module «**Simulation**» is designed to apply the specific methods of models for random variables, such as the Monte-Carlo simulation, in order to determine the total risk position and to specify its characteristics using statistical indicators and visualization tools (e.g. histograms);

the module «**Early Warning**» is in charge of monitoring the development of risk factors and of warning the decision-makers in time about alarming developments by using appropriate risk reports.

One of the main issues which have to be solved in the process of designing an own solution for the risk management information system is to choose the right data management solution, including the adequate development of the administration system for the resulted data repositories. Considering the general architecture represented in figure 2, the proposed information system differentiates three main data categories:

- **internal data** (named generic as «internal DB» meaning internal databases), which

include data repositories for actual and historical data. These data repositories can be organised in different databases of different types or can be integrated in a data warehouse;

- **external data** (named generic as «external DB» meaning external databases), can represent some data repositories available from business partners as result of sharing information or public available databases, e.g. of legal or economic nature, that can be accessed on subscription basis;

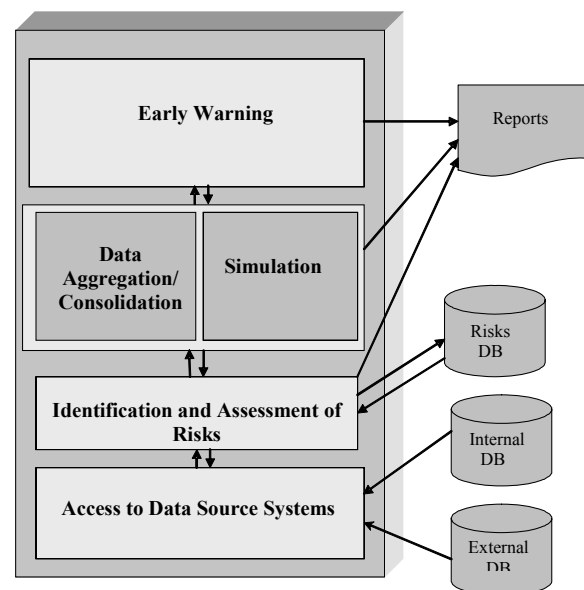


Fig.2. The architecture of the information system for risk management

- **risk specific data** (named generic as «Risks DB» meaning the database for the different existing risks).

The access to the data in the first two categories lies in the responsibility of the module «Access to Data Source Systems» mentioned in figure 2. Related to these categories have to be mentioned that there are different data access methods, depending on the type of database management system used to create and maintain these data inventories. The majority of the deployed databases nowadays use relational database management systems. For this reason the developers, depending on software platform they use, have access to different types of relational data source connection technology, such as ODBC (Open DataBase Connectivity) or OLE DB for the systems based

on Microsoft platform and JDBC (Java DataBase Connectivity) for the systems based on Sun platform. For data inventories organized on non-relational database management systems or some legacy systems existing in the company, access solutions can be individually designed on XML basis (eXtended Markup Language), which became one of the reference solutions in the enterprise data integration. [Basu & Chanchani, 2006]

The data in the third category can be organized according to the relational data model [Popescu, 2001]. Here the company can choose between various relational database management systems according to the preferred database type:

- desktop databases deployed mainly on stand-alone workstations or local networks, such as Microsoft Access [Prague et al., 2003] or
- server databases such as Microsoft SQL Server [Syverson, 2002] or Oracle [Velicanu et al., 2002].

The decision-making regarding the design of the system landscape for the risk management has to consider the general requirements mentioned in this article, their importance is nevertheless weighted different in each company.

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