Risk management in system modeling

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The goal of the project

- Using OPM to not only show the system`s functionality, but also as a tool to manage the planning process
- Adding to the model details about the risks of each process
  - Including the affects of the risk on the process
    - Cost
    - Duration
  - Proposed solution for each risk
    - Dealing with the risk
    - Avoiding the risk
- Furthermore Taking into consideration the affects of the phase of the process on the different elements of the system, and the changes it has on risks.
Risk management

- **Risk management** is the identification, assessment, and prioritization of risks.
- **Risks**: the effect of uncertainty on objectives, whether positive or negative.
  - Risks can come from uncertainty in financial markets, project failures, legal liabilities, credit risk, accidents, natural causes and disasters as well as deliberate attacks from an adversary.
Identification

- **Identification**: After establishing the context, the next step in the process of managing risk is to identify potential risks.

- risk identification can start with the source of problems, or with the problem itself.

  - **Source analysis**: Risk sources may be internal or external to the system that is the target of risk management.

  - **Problem analysis**: Risks are related to identified threats, for example: lightning striking an aircraft during takeoff may make all people onboard immediate casualties.
Assessment

**Assessment:**

- Once risks have been identified, they must then be assessed as to their potential severity of loss and to the probability of occurrence.
- These quantities can be either simple to measure
  - in the case of the value of a lost building,
- or impossible to know for sure
  - in the case of the probability of an unlikely event occurring.
- Therefore, in the assessment process it is critical to make the best educated guesses possible in order to properly prioritize the implementation of the risk management plan.
Prioritization

- **Prioritization**: the most widely accepted formula for risk quantification is:
  - **Rate of occurrence** multiplied by the **impact of the event** equals **risk**
- both the above factors can change in magnitude depending on the adequacy of risk avoidance and prevention measures taken and due to changes in the external business environment. Hence it is absolutely necessary to periodically re-assess risks and intensify/relax mitigation measures as necessary.
Literature search - modeling risks (1)

  - In spite of our ability to create and design safer systems, we still witness a wide variety of mishaps and accidents in different levels.
  - Do we have the means to reduce significantly the rate of accidents, using existing modeling languages and existing models?
  - As it turns out very difficult due to the dynamic technology environment

- **Conclusion**: we must model all possible risks.
The existing risk management systems consists of a number of models,
each separately in charge of different risk factors and merged in a very long process
- planners
- managers
- operators
this method of risk management is not adequate to the modern dynamic environment which we live in these days.

**Conclusion**: There is a need for one general modeling system, in which the different risk aspects will be combined.
Current risk models concentrate on possible plan deviation caused by human factors.

Need to be replaced by modeling system behavior in different situations, which are caused by deviations, including system status after certain risks have been realized.

Modeling different objects' attributes which are changing during different processes.

The risk levels will be determined subjectively by competent factors. This kind of modeling approach was found very intuitive by cognition and decision making researchers.
The article presents the concepts of supply chain vulnerability and its managerial counterpart supply chain risk management. It is suggested in the article to distinguish four basic constructs:

- supply chain source
- risk consequences
- risk drivers
- risk mitigating strategies.
Assessing the risk sources for the supply chain

- Environmental risk sources comprise any uncertainties arising from the supply chain environment interaction.
- Organizational risk sources lay within the boundaries of the supply chain parties.
- Network-related risk sources as the third category arise from interactions between organizations within the supply chain.

**Conclusion:** we must divide the possible risks into categories.
Literature search- risk management(3)

- Identifying the risk concept of the supply chain by defining the most relevant risk consequences
- Risk consequences are the focused supply chain outcome variables
  - Cost
  - Quality
- The consequences focused in a specific supply chain context form the managers supply chain risk concept
- **Conclusion:** we must identify the risk consequences that are specific to the industry.
Track the risk drivers in the supply chain strategy

Risk drives are "calculated risks" that a company takes in order to:

- improve competitiveness
- reduce costs
- increase or maintain profitability.

Risk mitigating strategies are those strategic moves organizations deliberately undertake to mitigate the uncertainties identified from the various risk sources.
Methodology

- First, we must categorize our possible risks to different categories of the private case.
- As a part of our research we found that the best way to do so is to concentrate on the possible sources for risks at that field.
Methodology (2)

- we shall assess the degree of the risks
- using characteristics that could be countrified and thus prioritized
- pick characteristics that are general and could be used to describe all of our risks.
- the degree of the risk would be described by:
- the picked characteristics and valued based on prior knowledge, experience and expert assessment.
General model example
Methodology (3)

- Risk Management part is described as a set of suggested actions that needed to take place.
- Prioritize the risks.
- Inspection of risks, which means:
  - a. How often to do checkups on the possible sources of the risks.
  - b. The period of time that the proposed solution for the risk stays relevant and
  - c. Decide on the frequency to reassess the degrees of the risks and their effects, cost and time wise on the main process.
An example – cement production

- We decided to do a risk management model on a leading industrial cement company.
- The cement production process has 9 main stages in which the raw materials transfers into cement.
- Each process has many possible risks and can be measured in terms of cost and duration.
1. Raw material which consists mainly from red soil and chalkstone is extracted from a quarry.
2. The raw material as big as a piano is carried by heavy trucks to a shredding machine which shreds it to rocks at a size of a soft ball.
3. The material is transported automatically to the plant, where they are analyzed for a specific composition preparation.
4. Then the material is going through a vertical grinding machine, and now is as the size of a golf ball at the most.
5. The grinded material is then transferred to the pre-heater, after it goes down through all its’ parts, the material reaches a temperature of approximately 750 degrees Celsius.
6. Than the material goes through a spinning cylindrical furnace, after which it reaches a 1500 degrees temperature. The result is clinker. If the clinker is not hot enough it travels back to the beginning of the cylindrical furnace.
7. The clinker then travels to the next station while he is being cooled by large fans, it reaches a 60 degree temperature.
8. It arrives to a spinning crashing machine, which shreds the clinker to powder. The new material is called "Portland cement". The material that wasn’t shredded enough travels back to the beginning of the station.
9. The cement is then packed and distributed.
Spin grinding – in zoom
Spin grinding – Risks

- Grinding [0,7] days
- Effectiveness Grinding
- Clincker not Grinded Enough
- Ball’s Replacing
- Worn Metal Balls

- Cost
  - degree 1
  - degree 2
  - degree 3
- Time
  - degree 1
  - degree 2
  - degree 3

Goal
Definition
Literature
Methodology
Example
Ball`s Replacing – in zoom

Goal: Stop Grinding
Definition: Checking Metal Balls
Literature: Relace with New Balls
Methodology: Employee
Example: Computer system

Ball's Replacing

Stop Grinding
Checking Metal Balls
Relace with New Balls

Employee

Process Engineer

Statistics

Metal balls

effective

Worn

Grinding

[0.7] days

Worn Metal Balls
Goal

Definition

Literature

Methodology

Example

Raw material transporting – in zoom
Road Accident risk – out fold
Risks - unfold

- Environmental risk
  - Power failure: Environmental risk
  - Road accident: Environmental risk
  - War: Environmental risk

- Organizational risk
  - Raw material defect: Organizational risk
  - Worker injury: Organizational risk
  - Clinker not ground enough: Organizational risk
  - Pre-heating degree fall: Organizational risk
  - Main heating body damaged: Organizational risk
  - Worn metal balls: Organizational risk
Conclusion

- We have developed a methodology for risk management using the OPM model
- We presented an example for a possible use of the methodology and suggested a way of using the model as part of the management process
- Future research should be done
  - Current tools of OPCAT are limited
    - Using simulation to provide further information about risks
    - Adding accurate measurements to the characteristics
    - A way to add the aspect of time and change of modeling automatically
  - Risk management is not general and is unique in every field
Thank you for listening

Questions?