Risks of the human resources in the GEMS framework[1]

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Introduction

Risks linked the human resources play a determining role in the business life. A lot of risk component has a human resources related component (for example professional risk group). In terms of some business aspects, like projects or individual works, the human risk component is said to be the most determining one [*Akintoye – Macleod*, 1997].

The field of risks, related to human resources is a fairly underestimated area from the academic and from the business view as well. The main reason for that is the subjective risks are hard to quantify. Risks related to human resources are also uneasy to handle with mathematical methodologies. This article describes a psychological approach to the risks of human resources. This approach understands risks as potential error possibilities (focusing only on possible negative outcomes) and attempts to reduce them.

Overview of the Generic Error Modelling System (GEMS)

This methodology was developed by James Reason, its theoretical approach makes it interesting. Basically it is inspired by the psychology, but mostly, it can be considered as a human risk classification system. However, its practical application has not proven yet, the model's validation is sufficient.

The human error based risk understanding classifies risks in two groups: the risk of planning errors (for example plans with internal inconsistency, plans, which ignore relevant elements or plans which lack sufficient depth) or the risks of implementation (for example professional mistakes, moral risks or errors due to inattention). In contrast with this grouping, the GEMS model suggests a better applicable, three factor classification.

Its logical framework has three levels, which can be well identified in the praxis too: (1) the skill-based errors, (2) rule-based errors and the (3) knowledge-based errors [*Reason*, 1990].

The model's main assumption is that the human errors follow patterns, which have psychological reasons. This is what makes the human errors classifiable. Classification helps us reducing the appearance of the human errors [*Reason*, 1990].

The skill-based errors are characteristic for the well-practiced, automatic activities. The reasons for skill-based errors are mostly inattention or overconcentration. A typical skill-based error is if the project manager forgets an important deadline due to his work overload.

The other two levels, the rule-based and the knowledge-based errors appear in case of defects in the cognitive solution seeking process. Consciousness is characteristic for these two latter levels, while the skill-based errors lack the consciousness. A typical example for a rule-based error when there are two applicable work protocol and the wrong one is chosen. The simplest example for a knowledge-based error is misbehavior due to lack of knowledge, like underestimating the amount of required resources or costs in the project planning phase, because the optimistic approach of the management.

The skill-based and rule-based errors happen among cognitive schemas, while the knowledge-based errors can be explained by the logic of the trial-error methodology. It means the lack of knowledge and experience and the employee is force to try new solutions, methodologies and ideologies. Due to these characteristics the knowledge-based errors mostly can not be predicted,

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which means, that the knowledge-based errors are characteristic for uncertainty, while the skill-based and the rule-based errors can be more or less predicted.
The GEMS model's three level error typing system is in line with the experience: in the case of the skill-based error avoidance professional knowledge is a not enough help, but the senior experts, as they have a stronger experience basis, make less skill-based error. Experts have more cognitive schemes within their fields, so we can say that they can come up with better solutions for certain problems [*Atkinson – Hilgard*, 2005].
It worth observing the cause of error types from the different levels of GEMS model. The first approach highlights the internal psychological factors, like the cognitive bias or the attention related problems. Among internal factors the source of such errors can be external factors as well, for example the complexity of the task or the contextual effect of the problem or other external disturbing factors. On the two lower levels of GEMS model, naming the skill-based and the rule-based errors the attention related problems, the applied cognitive scheme or the strength of the automatism are determining factors. The knowledge-based errors follow different patterns. In case of knowledge-based errors there are no routines to use, so in each case the main cause is the lack or the bias of the knowledge. Another determining factor is the limits of the cognitive activity itself. The third aspect is the role of the external factors, which can enhance the error possibility, for example due to mental overload, communicational problems can occur; there is no feedback, which can lead to negative outcomes.
It is important to mention the role of the change on the various error levels: on the skill-based level sometimes the change itself is the cause for the error. If one applies a working pattern and the circumstances change the employer ignores it and the error happens. On the knowledge-based level the change changes the context and there is not available right solution scheme. If the solution scheme is missing, a new routine is needed, but there is no one-track way to find a new suitable routine. This means a relevant risk, as due to the lack of reference the success of the solution cannot be well predicted.

Table 1: Comparison of the three error levels of the GEMS model

Dimension	Skill-based errors	Rule-based errors	Knowledge-based errors
Type of activity	Routine actions	Problem-solving activities	
Focus of attention	On something other than the task in hand	Directed at problem-related issues	
Control mode	Schemata (automatic processors)	Stored rules (automatic processors)	Limited conscious processes
Predictability of error types	Largely predictable, „strong but wrong" errors		Variable
Ratio of error to opportunity of error	Absolute numbers are high, these constitute a small portion of the total number of opportunities of error		Absolute numbers are small, but opportunity ratio high
Influence of situational factors	Low to moderate; intrinsic factors likely to exert the dominant influence		Extrinsic factors likely to dominate
Ease of detection	Detection usually fairly rapid an effective	Difficult and often only achieved through external intervention	

Relationship to change	Knowledge of change not accessed at proper time	When and how anticipated change will occur unknown	Changes not prepared, for or anticipated

Source: Reason [1990], p. 64

There is not a classical economic model in the background of the GEMS model. Psychology hides in its background. In the psychological context humans does not optimize with mathematical calculations (as it is considered in the economic models), but humans optimize through thinking, which is enabled by the context-specific pattern matching ability. Among this thinking pattern appear typical human errors, which are classified by the GEMS theory.
The GEMS claims that the individual looks for the same solution path in case of each problem: first, he tries to apply their experiences and uses one of his previous solutions, which have already worked before in similar situations. The advantage of this solution seeking methodology is that the solution is already tested. The implementation of these well-working solutions can speed up the problem solving process. As these kinds of solutions are automatized, the development of new solutions with the trial-errors process is not needed. During the decision process the current problem is compared to the context, and if one finds a fitting cognitive scheme, the routine will be applied. If this routine does not work, then the individual tries the next fitting rule, which was suitable for such situation in the past.
Reason (1990) supposes that human beings are furious pattern matchers. It is an empirically proven fact that humans see pattern even though there is no pattern in the reality. Human beings use patterns and frameworks, which help interpolating missing data [*Kahneman*, 2013].
According to GEMS model's logic the skill-based level is highly characteristic for implementation of routine-based activities in well-known situations. On the second level, on the rule-based level one applies a routine for solving the current problem. It the chosen routine fits the current circumstances more or less, and then it is applied. It means the humans are seeking sufficient solutions, not optimize. Humans return back to the routine level as fast as possible.
If there is no routine-based availability for the problem solution, humans are looking for analogies, - this is what takes the situation to the knowledge level. If situation x resembles situation z, and in the case of situation x scheme y was a right solution, then it can be assumed, that in situation z scheme y will be a right solution. At least, it can be considered that the solution was found through the trial-error methodology, based on the existing mental models.
It is essential to mention that the knowledge-based solution seeking enhances the repertoire of solution routines. Thus in this case that professional knowledge can be understood as a greater rule conglomeration. The GEMS model's framework covers the same field as the decision theories. However, the decision theories focus on the positive outputs, while the GEMS with the error model focuses on the negative outcomes.

Summary

The study gives a brief overview of the GEMS model, which is one approach of the human risks with psychological background. The model offers a classification for the human errors. According to the basic model three levels are known and analyzed. One is the skill-based error group, two, the rule-based error group linked to the planning phase and three, the knowledge-based error level, which is the most significant one in terms of projects. This latest error type occurs more frequent in the projects due to the individual tasks. The first two levels are characteristic for a stable technological background, where the individual has a work routine, like in the case of manufacturing companies.

References

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