Management of personnel risks in the organisation quality management system

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Abstract. The article deals with the risk-oriented approach to the management of personnel processes in the organization quality management system (QMS). The analysis of scientific points of view on the definition of the terms “risk” and “opportunities” applied to personnel processes showed a lack of unambiguity in their interpretation. There is also revealed absence of formalized methods of analysing and assessing personnel risks in management processes in accordance with the requirements of ISO 9000: 2015 standards. The solution to this problem is possible on the basis of SWOT-analysis proposed in this paper, adapted to personnel processes of organization’s QMS and the proposed procedure of statistical validity of the results. This approach allows to increase the reliability of the resulting research data.

1. Introduction
Many organizations, introducing and developing their QMS in accordance with the requirements of international standards ISO 9001: 2015, faced with a number of problems in applying risk-oriented thinking to the management of personnel processes [1].

This fact is explained, in particular, by formal approach to management of enterprise human resources, without taking into account its specific character, as well as by insufficient development of tools, technologies, models of analysis and assessment of personnel risks [1-2].

2. Analysis of researches and publications
The analysis of scientific literature in the subject area showed that introduction of risk management in the organization's QMS is characterized by the following disadvantages [1-6]: development of human risk management in the context of classical and neoclassical economic approaches, where the personnel is considered as a source of threat, danger, damage that does not allow organizations to maximize the usage of opportunities, created by human resources; practical absence of formal models of analysis and assessment of risks and opportunities in managing personnel processes.

The analysis of international and national standards from the point of view of applying the idea of personnel risks shows in particular: there is dominated classical economic approach, which considers the personnel as a source of threat (danger) (for example, GOST R ISO 22000–2007); there are fragments of economic neoclassic approach in which the personnel is a source of threat and the potential opportunities of achieving goals (FERMA (2002)); socio-economic approach is not well developed, where the personnel is a source of threats and ability to achieve the planned goals, and potential opportunities to exceed them (for example, GOST R ISO 9001–2015).
Standards ISO 9001: 2015, focusing organizations on management of QMS processes from the standpoint of risk-oriented thinking, do not contain requirements for using specific methods of risk analysis and assessment, and the organization can choose the tool that meets its requirements. However, with regard to personnel processes taking into account their specific character (human resources have the highest degree of uncertainty compared with other resources of the organization, as only personnel is able to influence managing activities, changing them [2]) proposed methods are not fully represented. At the same time, there are no methods aimed at assessing opportunities associated with the human resources.

Promising from the point of view of identifying opportunities created by personnel processes, is the method of SWOT–analysis, adapted for use in personnel management [6]. This tool initially includes accounting risks and opportunities of internal and external factors for the development of the organization, which allows to use SWOT–analysis as a completely independent model of analysis, assessment and selection of risk management strategies and opportunities of functioning of QMS processes in the organization. Traditional method of SWOT - analysis has some disadvantages associated with the lack of statistical validity of obtained results [3,4].

The analysis of appropriate papers shows that in situations, when risk-oriented approach to management of QMS processes, including personnel processes, is regarded as a condition and a conscious requirement for their effective functioning, developing the procedure of statistical validity of the results of SWOT - analysis is relevant and allows to avoid the identified disadvantages.

3. Problem statement
To eliminate the shortcomings in managing personnel processes of QMS of the organization in the context of a risk-oriented approach it is necessary:

- identify risks and opportunities associated with the operation of personnel processes;
- to adapt the method of analysis and assessment of risks and opportunities (SWOT – analysis) to the personnel processes recommended by ISO/IEC 31010: 2009;
- to develop a procedure of statistical validity of SWOT analysis results.

In this respect, statistical method of analysis and assessment of personnel risks and opportunities considered in this article is promising.

4. Analysis and assessment of risks and opportunities on the basis of SWOT - analysis
The proposed procedure of risk opportunity analysis on the basis of SWOT – analysis can be represented as follows (figure 1):

- A group of experts examines the phenomenon being studied and the influence of the factors on it: external threats (T) and internal weaknesses (W) of the object under study.
- For external threats (T) and weaknesses (W) of the object points are determine by experts, corresponding their impact on the studied phenomenon in the context of risks arising (the approach is based on the well-known FMEA–methodology) based on the recommended qualitative scale (table 1) for the following parameters [5]: probability of risk occurrences (O), significance of risk consequences (S), difficulty of risk detection (D).
- After receiving expert assessments S, O, D, priority risk number (PRN) for each factor is calculated by the formula \( PRN = S \cdot O \cdot D \).
- Critical limit (PRNcl) is set for priority risk number. In practice PRNcl is usually used within 100 to 125 (100 < PRNcl < 125) [5].
- A list of factors for which PRN exceeds PRNcl is composed. These factors (external threats (T) and weaknesses (W) of the object under study) are further used to determine the strategies of organization development on the basis of SWOT – analysis.
- Experts assess the factors of external opportunities (O) and internal strengths (S) of the object by their potential for creating opportunities for the organization development. The assessment is
performed based on the proposed qualitative scale (table 2) according to the following parameters: likelihood of opportunity occurrences ($O_o$); significance of opportunity impacts ($S_o$); ease of opportunity detection ($D_o$).

- Priority opportunity number ($PON$) is calculated for each factor by the formula $PON = S_o \cdot O_o \cdot D_o$.

![Figure 1. Algorithm of analyzing risks and opportunities of context factors of organization’s QMS on the basis of SWOT – analysis.](image)

| **Table 1. Recommended Scale of Points for Risk Factors.** |
|-----------------|-----------------|-----------------|
| **Significance of risk consequences, ($S_r$)** | **Probability of risk occurrences, ($O_r$)** | **Difficulty of risk detection, ($D_r$)** |
| Point | Characteristic | Point | Characteristic | Point | Characteristic |
| 1 | no | 1 | small | 1 | almost certain |
| 2 | very insignificant | 2 | very low | 2 | very good |
| 3 | insignificant | 3 | low | 3 | good |
Table 2. Proposed scale of points for opportunities.

| Significance of opportunity impacts, \( S_o \) | Likelihood of opportunity occurrences, \( O_o \) | Ease of opportunity detection, \( D_o \) |
|---|---|---|
| Point Characteristic | Point Characteristic | Point Characteristic |
| 1 | no | 1 | almost impossible |
| 2 | very insignificant | 2 | very low |
| 3 | insignificant | 3 | low |
| 4 | very weak | 4 | lower than moderate |
| 5 | weak | 5 | moderate |
| 6 | moderate | 6 | higher than moderate |
| 7 | significant | 7 | moderately high |
| 8 | very significant | 8 | high |
| 9 | dangerous with prevention | 9 | very high |
| 10 | dangerous without prevention | 10 | almost inevitable |

Critical limit \( PON_{cl} \) is set for priority opportunity number. \( PON_{cl} \) is usually used within \( 800 < PON_{cl} < 900 \) [6].

Factors for which \( PON \) exceeds \( PON_{cl} \) are revealed. These factors (external opportunities \( O \) and internal strengths \( S \) of the object under study) are further used to determine the strategies of organization development on the basis of SWOT – analysis.

5. Identifying the strategy of development of QMS processes in the organization on the basis of SWOT - analysis

Identifying the strategy of development of QMS processes of the organization can be represented by the following algorithm (figure 2) [7]:

- Strategies of organization development are formed on the basis of analyzing the factors creating risks and opportunities for QMS functioning by sorting out all possible combinations.
- Strategies are ranged taking into account the significance of their impact on the quality of the process under study of.
- Weight coefficient of each strategy is calculated by the formula: [8]

\[
g_i = \frac{mn - S_i}{0.5mn(n - 1)},
\]

where \( g_i \) – weight coefficient; \( m \) – number of experts; \( n \) – number of strategies; \( S_i \) – sum of expert assessments for each indicator.

- Significant weight coefficients are defined by the formula \( g_i > 1/n \).
- Kendall coefficient of concordance is defined to assess uniformity of expert opinions by the formula [8]
where \( S_i \) – sum of expert rank assessments for each indicator; \( \bar{S} \) – average sum of ranks for all indicators calculated as the following \( \bar{S} = \frac{1}{n} \sum_{i=1}^{n} S_i = 0.5m(n + 1) \),

\( m \) – number of experts; \( n \) – number of indicators; \( T_j \) – uniformity indicator calculated by the formula \( T_j = \sum_{j=1}^{n} (t_j^3 - t_j) \), where \( t_j \) – number of assessments with the same rank from \( j \)-expert; \( u \) – number of rank groups with the same assessment from \( j \)-expert.

\[
W = \frac{12 \sum_{i=1}^{n} \left( S_i - \bar{S} \right)^2}{m^2 (n^3 - n) - m \sum_{j=1}^{m} T_j}
\]

Figure 2. Algorithm of identifying the strategy to manage QMS processes on the basis of statistical validity of SWOT–analysis results.
To make data processing comfortable all calculations are tabulated (table 3). Significance of $W$ is assessed by criterion $\chi^2$ by the formula:

$$\chi^2 = \text{Wm}(n-1) > \chi^2_{(1-\alpha),f},$$

where $W$ – coefficient of concordance; $m$ – number of experts; $n$ – number of examined strategies.

If $\chi^2 > \chi^2_{(1-\alpha),f}$, where $f = (n-1)$ is a number of degrees of freedom, coefficient of concordance $W$ is statistically significant. Values $\chi^2_{(1-\alpha),f}$ are defined by statistical tables.

| Expert Code | Strategies, influencing process under study, $n$ | $\Sigma R_i$ | $T_j$ |
|-------------|---------------------------------|-------------|-------|
|             | $n_1$ | $n_2$ | ... | $n_{10}$ | $n_{11}$ |             |
| 1           | 6     | 2     | ... | 4       | 1       | 66    | – |
| 2           | 4     | 1,5   | ... | 11      | 1,5     | 66    | 6 |
| 3           | 7     | 2     | ... | 5       | 3       | 66    | – |
| 4           | 8     | 3     | ... | 4,5     | 1       | 66    | 6 |
| 5           | 8     | 3     | ... | 5       | 2       | 66    | – |
| 6           | 5     | 3     | ... | 4       | 1       | 66    | – |
| 7           | 5     | 2     | ... | 4       | 1       | 66    | – |

Data on statistical analysis of expert assessments

| $S_i$ | $s_i - \bar{s}$ | $\left(s_i - \bar{s}\right)^2$ | $g_i$ | $g'_{i}$ |
|-------|-----------------|--------------------------|-------|----------|
| 43    | 16,5            | -4,5                     | 0,08  | +        |
| $\bar{s}$ | -25,5           | -4,5                     | 0,16  | +        |
| 650,25| 20,25           | 992,25                   | 0,10  | +        |
| 992,25|                 |                          | 0,17  | +        |

Note: significant strategies, influencing the process under study, are marked by «+».

Consistency of expert's opinions is considered to be acceptable, if coefficient of concordance $W \geq 0.6$ and is statistically significant with confidence probability $P=1-\alpha$. If expert's opinions are inconsistent, then SWOT –analysis was done incorrectly and requires restudy and reconstruction.

As the result of this analysis there are revealed significant strategies that have a priority influence on the studied process. In our case there are four strategies ($n_2, n_3, n_9, n_{10}, n_{11}$). Besides, according to the assessment results the strategy is chosen with the biggest weight among them. In our example, this strategy is $n_{11}$.

6. Conclusion

The analysis of implementation of risk-oriented thinking in organization's QMS, in particular, application of the methodology of assessing risks and opportunities in personnel management on the basis of SWOT–analysis has shown the ambiguity of this process. The lack of tools to identify opportunities for an organization as a result of using its human potential, weak formalization of assessment methods of personnel risks and identification of process management strategies that reduce reliability of the results, make it necessary to develop methods for avoiding the identified drawbacks.

In this regard, application of SWOT - analysis based on statistical validity of the results, adapted to the specific character of personnel processes of organization’s QMS will allow to identify more correctly management strategies based on the analysis and assessment of personnel risks.

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