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THE METHODOLOGY OF ANALYTICAL AND EVALUATING FORMS (AHF) AND LOGISTICAL AUDIT EVALUATION

The article deals with building of logistic audit. In the article there is described the possible usage of the academic science for logistic audit. The authors deal mainly with building of logistic audit with help of AHF. In range of AHF there have been discovered the issues of quantification of information received during the audit and after it followed processing of this information. There have been described the aspects of creation of questionnaire items and usage of scales as well as the possible methodology of validity and reliability verification in audit, and the possible constant failure, which are usual common and the building of questionnaires.

At the end of the text a suggestion it is stated for the possible way of logistical audit development.

1. LOGISTICAL AUDIT - Introduction

In last few years, logistical audit has been often discussed [13], [14], [15], [16]. This topic is perceived in many different ways in professional circles. The reason of such diverse perception is, firstly, the fact that the audit as such does not have exactly defined structure and it has not been used in practice in the extent that would make this audit take shape. Secondly, already existing logistical audits are created ad hoc and these are mainly company audits established to control the implementation of management systems based on the standard used by such company and already applied in other enterprises. Thus, audit loses its generality and its deployment is also limited due to the fact that it is intellectual property.

The diversity of audit perception and thus also its usage in logistics by various specialists and organisations causes the diversity of its deployment and processing from its formal and content perspective.

For practical purposes a tool able to give truthful picture of the state of company logistics is required. In connection with everyday solving of problems to ensure the run of the company it is not easy to stay detached and be able to look at things comprehensively.

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This ends in the situation, when the management of company logistics loses its routing and concept or conditions changed and it is necessary to adjust to new ones. Logistical audit should be a mean helping to perceive company logistics as a whole and, at the same time, bear in mind its individual parts and study its every detail. For these purposes, a database of audit processes or ADP [16] was developed. This database includes all company logistical processes and forms the basis for logistical audit. This set of logistical processes has to be given the form usable for audit purposes and take into consideration its application in practice.

The most suitable method of AHF processing seems to be many years proven questionnaire method. This method was initially developed for the purposes of sociological surveys. However, its alterations have been successfully used in other fields of social and natural sciences.

„The questionnaire is a research (or survey), development and evaluation (especially diagnostic) tool for mass and fairly fast identification of information related to knowledge, opinions and standpoints of respondents to the real or potential state using written questions in order to acquire statistically applicable information on the given object. As indicated by its name, the questionnaire method is based on questions.” (Švec, 1998, p. 15) „It is a group of questions put together based on content, logistical and psychological principles and used for gathering statements of selected people (respondents) to issues subject to research. The questionnaire can be filled in by a researched person or the questioner based on respondents answers.” (Jacz, 1982) "The questionnaire consists of elements called questionnaire items. Each item further consists of stimulating (most commonly question-based) section and answer section. The stimulating section of the questionnaire item can have several forms, e.g. the form of an interrogative or declarative sentence (in the first or second grammatical person using formal or informal addressing.” (Švec, 1998) Well-established and consistently prepared questionnaire can be a relevant source of information on a specific problem. A sound questionnaire is crucial for any survey success. Inappropriate questions, their incorrect order, inadequately selected scale or inappropriate form of such questionnaire can be the reason of such survey failure. In order to check the suitability of the form of the questionnaire it is wise to perform a pilot research on a smaller number of respondents selected from the target group.

When preparing a questionnaire one is to firstly consider its validity. [1]

All the above aspects are taken into consideration when developing an AHF. Logistical audit should be a standardized analytical and evaluating process - the evaluation of quality and performance of the company logistical system. This resulted in the establishment of a full-bodied system for logistical audit performance – KLAP (Komplexný systém logistického auditu podniku - Comprehensive System of Company Logistical Audit) [Malindžák, D., Marková, Z. 2009]. For the purposes of KLAP, AHFs were prepared and AM were measured and evaluated and a thousand of logistical processes were analysed (hierarchical system of 10 areas x 10 companies x 10 processes).

The analytical form is a special type of the questionnaire containing extra fractions and parameters.

2. AHF PREPARATION

When preparing a questionnaire, it is necessary to consider that its form determines the subsequent method of quantification. The history and the practice related to questionnaire

application specified several principles to respect in order to develop good quality AHF for logistical audit.

All key questions for research implementation and progress should be clear in advance. These include the subject of research, human resources, budget, confidentiality, and required depth of research. The nature of answers, their interpretation, fact and subjective opinion preferences should be predefined. It is important to avoid unnecessary questions causing extra losses and costs since they task respondents' minds and need to be intellectually evaluated thus representing loss for the solvers. The respondent must be able to react on given questions. He/she must be well-based or an expert in the field in question. Just like the field of information must correspond with the interpretation of questions, the respondent's field of references must correspond with the object of research. Both, the method of quantification and statistical apparatus to use, have to be clear in advance. The structure of AHF must adhere to the above apparatus. Inevitable for smooth audit performance is the interconnection of typology, scales, question types and method of result processing.

The formulation of questions must be simple. They cannot contain words of multiple meaning, foreign words, negatives and the meaning of questions must be simple and easy to understand. We always ask one thing at a time. The range of potential answers for individual items must cover the entire scale. By the use of the "Other" item we avoid the chance that the respondent would not be able to select an answer or situation corresponding to his/her preferences. Categories must be defined in such a manner that they would not overlap or exclude each other. Thus, it would not be possible to have several potential answers to the same question. Questions must be formed in such a manner that they would be understandable for the whole sample of respondents. Colours, charts or pictures can be disruptive. Numbering, however, is desirable. For further processing of questionnaires clear instructions must be determined.

Apart from the above stated criteria, AHF also contains some other aspects defined in connection with the nature of the researched field.

- Respondents do not have to answer if they do not know the answer or do not want to answer. If so, such answer is not included in the evaluation of this process. As logistical audit is based on the integrated, system-based interpretation of logistics – the logistical system of a company with several hierarchical levels, the structure of the group includes employees from various hierarchical levels of the company (from top management up to workers).
- Since logistics also deals with relations – the coordination of process activities i.e. strings, we deliberately select respondents from various fields. For instance, in order to evaluate the level of the strategy of company maintenance, maintenance employees, top management (in connection with the strategy), production people representing maintenance customers and economists, who are able to evaluate maintenance cost, should be questioned.
- In order to evaluate logistical processes (or logistical aspects) the following types of evaluation are used:
 - a) Logistical evaluation yes - no;
 - b) Multiple choice (selecting from several answers) of a single evaluation;
 - c) Multiple choice (several correct evaluations);
 - d) Hierarchical answer (e.g. yes - no alternative);

- e) Percentage-based evaluation (0 % ÷ 100 %);
- f) Scale-based evaluation (e.g. 1 ÷ 10);
- g) Real (quality-based) evaluation, excellent, very good, good, satisfactory, sufficient, insufficient.
- Only experts in the field of logistics can develop AHFs since a large-scale and profound knowledge of process correctness is required.
- Logistical processes are evaluated in individual steps and within individual hierarchies:
 - a) processes evaluated by respondents individually or in group;
 - b) evaluation of the processes using audit, examining the correctness of evaluation of individual processes by respondents;
 - c) evaluation of the process using audit on the basis of b);
 - d) evaluation of functions on the basis of process evaluation (c), into which the function or activity is broken down or from which it consists;
 - e) evaluation of fields, on the basis of the evaluation of functions (d), from which the fields consist;
 - f) overall evaluation of the audited company;
 - g) submitting evaluation to the company management;
- Some of the processes - the correctness of their application can be different for various enterprises. For instance, which type of maintenance strategy is applied in your enterprise: a) TPM, b) RCM

The correct answer can be either a) or b) based on the type of the enterprise. This must be known to the auditor based on the theoretical logistical reference standard [6]. The theoretical reference standard contains processes, procedures, methods etc. of the ideal logistical system applied in the given enterprise. It is this reference standard that is used to compare respondents' answers against.

For the most types of evaluation, selected evaluation ranges or scales are used. That is the reason, why we focused in detail on the scale-based evaluation of logistical processes.

3. SCALING AND ITS POSITION IN LOGISTICAL AUDIT

The scale in logistical audit is used as a direct converter of quality-based evaluation from individual logistical processes to quantity-based evaluation. By the use of a scale it is possible to define, where the process under evaluation is from the perspective of a set of the same processes. Scales also help to define, where the enterprise under evaluation is when compared with similar enterprises.

In order to be able to create scales we need to somehow record information of process properties. Direct observation and appropriate form of recording of the observed should catch process behavioural aspects. Rating scales are then the tool for this process evaluation. Evaluation is one of three scale properties. The second scale property is their retrospectivity. Rating is the process of summarizing previous insights acquired during process observation. It is post-hoc measurement.

The third scaling property is scale creation. The scale is used to express a certain quantity. Through the scales we try to capture various intensity or quality of behavioural aspects of certain phenomena.

The following is used as a criterion for scale classification:

- Empirical operations used for assigning numbers to observed phenomena;

- Formulation of mathematical properties of individual scales;
- Statistical techniques used for acquired data processing;

Scales represent a tool often used in questionnaires. Their task is to assign a certain value to properties and phenomena. [2]

4. BASIC METHODOLOGICAL ISSUES RELATED TO SCALING IN THE PROCESS OF LOGISTICAL AUDIT

One of the basic issues is the definition of the same distances between categories forming the continuum of the scale. This must also be considered when working with logistic audit. One of the basic issues is also the question of semiotic distance of terms. This relates, for example, to defining whether the distance between the “very good” and “more or less good” category is the same as the distance between the “more or less good” and “more good than bad” category. By the assignment of numbers to individual statements we make their order that expresses descending quality clearer. It is a difficult task to create a scale in such a way that there will be the same distance between categories.

Another issue arising in terms of scale creation is their sensitivity. How many categories are required for the results to have discriminative sensitivity and sufficient statement value. The relation between the number of categories and discriminative sensitivity is non-linear. A large number of alternatives reduces the sensitivity and is connected with already-mentioned issue of the same distances.

5. ITEM

Under the item elements forming the scale are understood. Items are used to test processes being scaled. Items can have various forms. They can be questions given to the respondent or evaluation of the observation of employee activities by an observer or analysis of objective data. From this perspective items are divided as follows:

- Subjective, i.e. items formed by the statement of a person related to his person or to somebody else;
- Objective, i.e. items arising from objectively captured aspects of the observed process;

If we want to select items that would form the full scale it is necessary to adhere to the following preconditions.

- Selected items must express major signs of the phenomenon under review. The analysis must define whether individual items are appropriate or whether they do not focus on one side of the observed process. The analysis must show that the item does not include several problems. Without theoretical pilot survey incorrect results related to scaling can be easily achieved since items do not capture the reviewed process. To define the discrimination ability of items and to define their formulation explicitness, there are precise procedures to use.
- Items must unambiguously capture the phenomenon under review. Each item must be clearly formulated so that everybody would be able to understand it and it would be understood in the same way under any circumstances, regardless the context of the environment or respondent in the case of subjective-type items. The same applies to the unambiguousness of acquired data and answers. These must be understood and captured so as to express what they state in connection with the

process under review. In order to examine the unambiguousness of items in general or items, on which many conflicting opinions exist, a criterion based on inter-quartile deviation was developed. This method can be used for logistical audit built on the basis of respondent answers.

- Items must be sensitive enough to differentiate between individual levels of phenomena under review. This talks about their discrimination ability. The given item must be able to define, whether the given phenomenon is positive or negative or into what extent. First of all, however, it is necessary to find out, whether the item has any discrimination ability. If the reaction on the given item remains neutral within the range of reaction or if it is not possible to give a statement to or opinion on the given item, such item does not have any discrimination ability. This ability can be tested in such a way that the item is presented to respondents together with generally known opinion on the issue in question. If respondent answer does not correspond with this generally known opinion, the item does not have any discrimination ability. In order to express numerical value of item discriminating ability, t-test can be used as a part of the pilot survey. Here the value $t \geq 1.75$ is sufficient. Items that reach the given value can be used. This, however, applies only if, out of the initial group of respondents, marginal 25% is included from both groups of opinions. The remaining 50 % of respondents are not included in the t value calculation.
- The selected item must be able to capture all substantial forms of relations towards the phenomenon under review (from one pole of possible reactions to its opposite pole). If this principle is breached it can result in partial data acquisition and thus only a part of the reviewed phenomenon width would be captured.

6. VALIDITY AND RELIABILITY OF SCALING METHODS

If we are considering the use of scales for the purpose of logistic audit it is also important to consider such scale validity and reliability.

6.1. Reliability

If we are considering the use of scaling methods in logistics it is important to start considering such methods validity and reliability.

- Repetition test

In connection with this method, the scale is used several times, yet minimum twice and reached results are compared with each other. By this comparison we will get information on the constancy of results in time. The risk of this method of reliability verification is the possibility of result change due to the time passed. The process or phenomenon can develop in time or the opinion on the phenomenon under review can change due to new knowledge.

- Division test

This type of test is performed in such a manner that the phenomenon is evaluated using the entire scale. When examining, however, the scale is divided into two halves, e.g. into odd and even items and we check the degree of conformance. This method gives us information on internal consistency of the scale. This method is not suitable for scales with a small number of items as the division such small number of items can lead to a great random error.

- Parallel test or balanced form

This method lies on the boundary of the two above-mentioned methods. Its application requires the comparison of equally valuable versions of the same scale. When using the both versions at the same time, we get closer to the method of testing by division. If the versions are submitted with some time difference, we get the method of reliability testing, which is closer to the test of reliability by repetition. This form is particularly demanding since its results are open to doubt due to the fact that it cannot be checked sufficiently in advance whether the both versions of the scales are identical enough.

6.2. Validity

Validity checks, into what extent the test really measures what we would like it to measure. Some sources state that the validity of the research method can be verified if, on the basis of data acquired by this method, future results can be predicted. More suitable method is the alternative, in the case of which the data acquired by scaling are verified on two different samples of respondents. One sample consists from randomly selected people, the second group from specifically defined people, who are assumed to have strong view upon the matter.

Another method is to compare the results acquired by scaling with results acquired by some other method or, and this is even more suitable for the purpose of logistical audit, using preconditions arising from the subject analysis of the matter. The necessary precondition for this is that the A method is verified and reliable and on the basis of this method the B method is verified. Results of controlling (A method) in the company compared with the suggested scale (B method) can be used as the reference standard.

- Content validity

This is a quantity expressing whether the content of the test corresponds with the characteristic we want to measure. If we assume that we want to measure some characteristic, then this characteristic reveals itself somehow. In other words, the test acts as a representative selection of signs characteristic for the phenomenon under survey.

An example is the building of a knowledge test. The aim of this test is to check the degree of knowledge of the tested for the whole area using a relatively small number of selected questions (representative group of questions).

- Criterion validity

Criterion validity is defined through the determination of a standard for the criterion selected. This is followed by its comparison with the achieved result.

7. CONSTANT ERRORS IN THE AUDIT

What is also important to consider in connection with logistical audit are various types of errors that might occur when creating audit and influence acquired results and their interpretation.

7.1. Halo effect

It is an effect, in the case of which partial properties are examined based on the overall impression. If such overall impression is positive, so is the partial evaluation. This effect can be hardly avoided. In its case, examined dimensions are mixed. This effect occurs mainly when examining characteristics that are difficult to define and poorly bounded.

7.2. Logical error

Individual processes are examined in one direction on the basis of the fact that these processes relate, either objectively or subjectively, on the basis of the reviewer's opinion. Thus the correlation between the reviewed processes is artificially increased.

7.3. Knowledge impact

Processes and phenomena the reviewer knows well are examined in a stricter manner.

7.4. Close association error

The spatial or time proximity of two reviewed inputs leads to the fact that these are reviewed in a similar manner. When preparing a questionnaire, it is not necessary to state the relating items next to each other and vice versa. Moreover, these questionnaires should be submitted to various reviewers with items in different order.

7.5. Central tendency error

Many reviewers hesitate to use the entire scale, including extreme values of the scale and their evaluation is based around the mean value. The higher degree of missing knowledge of the reviewed object and the matter the higher is this tendency.

7.6. Reviewed style

This is a tendency of individual reviewers to evaluate phenomena in one direction only. This error is particularly dangerous in the case of commutative scales.

7.7. Time error

This is the review of phenomena in time, when phenomena less frequently occurring in time are underestimated and phenomena more frequently occurring in time overestimated.

8. CONCLUSION

Scales are formed by testing certain property of subjects using a set of questions. Acquired data is then used to form a scale, based on which it is possible to define standard division and position of the measured property of the subject under review.

If we compared logistical processes of an enterprise to the properties of the subject, it would be possible to claim on the basis of this parallel that by the observation of parameters of individual processes and by the comparison of acquired results and theoretical reference standard, it is possible to define the position of these processes on the scale. For purposes of logistical audit, the reviewed property actually represents the reviewed process. Our next task will be to define the most suitable method of scaling that would be compatible with the enterprise logistics and theoretical reference standard.

The goal of preparing logistical audit as a comprehensive tool for company logistical process evaluation is a very demanding task. It is demanding not only due to the fact that company logistics affects each and every aspect of an enterprise, which makes it very extensive, but also due to that fact that auditing is the field running across several scientific disciplines. These are economics, from which audit originates and all logistics

processes. For audit establishment it is necessary to use sociological and psychological tools and for its evaluation statistical tools need to be applied. This article only briefly describes everything that has to be considered when establishing audit, logistical questions excluded. It also describes what cannot be missed in order to achieve good results. Logistical audit is still under development. Its character, however, as it is understood today, is defined. Its form will gradually become clearer by its application in practice.

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METODOLOGIA FORM ANALITYCZNYCH I EWALUACYJNYCH (AHF) ORAZ EWALUACJA AUDYTÓW LOGISTYCZNYCH

Artykuł podejmuje problematykę oceny audytów logistycznych. Autorzy przedstawiają konstrukcję tego rodzaju audytów z wykorzystaniem AHF. Prezentują metodologię badania ich wiarygodności i możliwych błędów, które mogą się pojawić przy konstruowaniu kwestionariusza.