Selection of Organizational Structure of the Company in the Period of Digital Transformation Using the SCARF Model

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Abstract: The article is devoted to the problem of selecting the organizational structure of the company during its implementation of digital transformation of business processes. The hypothesis of the study was that consideration of the needs of decision-makers can and should influence the choice of organisational structure changes during the transition to digital transformation of business processes. The decision makers for managing the integration of digital technologies into key aspects of a company's business activities have been shown to be CIOs. Motivational filters that characterize the needs of CIOs according to the SCARF model were presented in a hierarchical combination along with the types of company strategies that can be implemented during the digital transformation of business processes. The SCARF model, the Saaty hierarchy analysis method and the mixed-methods strategy provided the methodological basis for the study. The results demonstrate a justified choice of optimal organizational structure based on the factors of organizational behavior of IT directors and strategic priorities of the company. The presented results can be used to justify the decision to change the organizational structure of the company and to assess the social needs of decision makers.

Key-Words: organisational structure, digital transformation, change management, organisational behaviour, motivational filters, strategic management, decision maker

Received: April 16, 2022. Revised: March 11, 2023. Accepted: April 7, 2023. Published: April 27, 2023.

1 Introduction

In a company, the management of business processes at the level of strategic and operational management is performed by empowered individuals who are directly responsible not only for the implementation, but also for the consequences of the management decision they make. In management theory, the term "decision maker" is commonly used to refer to such individuals [1]. Traditionally, they are project managers and heads of business units of the company.

It is now clear to all that digital transformation in a company is an activity with a strategic priority. Moreover, digital transformation can be defined in the company as a development strategy. By digital transformation, we propose to understand the process of transforming business processes by integrating digital technologies into key aspects of business activities. This definition provides a clear understanding of the concept in its applied, i.e. practical, aspect. If we talk about digital transformation as a fundamental change in the company's mission, it is a set of strategic updates and transformations to recreate value at different levels of management, primarily at the operational business process level, [2]. Digital transformation projects imply a radical change in management approaches, starting from the organizational culture and ending with the implementation of new technologies in the company. But first and foremost, digital transformation requires adapting the organisational structure of the company to implement the desired updates and transformations.

The aim of our research is to propose a solution to justify the choice of organisational structure of a company during the digital transformation of its business processes. In doing so, we suggest as a supporting hypothesis the assumption that a significant determinant of this choice is the consideration of the needs of the decision maker. The SCARF model [3], which considers groups of needs in the context of motivational filters of employee behaviour, was chosen as the methodological basis for the study to substantively discuss the needs of decision makers. According to the paradigm of this model, a number of needs are perceived by the human brain as critical, they determine the employee's behaviour style and his/her role in the company. When analysing the behaviour of any decision maker, we want to determine which or what motivational filters are dominant for him during the period of organisational change in the company. After all, the wrong, weak motivation will not be able to accompany the adoption of change, and may provoke employee resistance to the changes that will inevitably occur during the digital transformation of business processes. Therefore, in this study we aim to show the correlation between the critical needs of the decision maker, the company's chosen development strategy and its organisational structure. And we believe that the results of the study should be taken into account by the company when choosing its organisational structure, so that the digital transformation strategy can be successfully implemented.

For the purpose of our study, the digital transformation of a company's business processes is considered under the following constraints. First, we assume that digital transformation is not possible where all business processes are already digitised. Second, we assume that digital transformation is feasible in those companies that are at the stages of the life cycle "Adolescence" and "Prime" - we mean the sequence of stages of the company life cycle according to the methodology of I. Adizes, [4]. Thirdly, we accept as a constant that digital transformation projects can be implemented by any decision maker, provided that the task is properly set and sufficient competencies are available. Thus, we consider as the subject of the study a conditional company, which is in the "Adolescence" or "Prime" stage of its life cycle, where digitalization processes are far from being completed and for which any combination of decision maker as managers of digitalization projects of business processes is possible.

2 Problem Formulation

This kind of strategic change, such as digital transformation of business processes, needs adepts who transform the company's internal environment. These roles are filled by the decision makers - the heads of the IT departments in the company. They occupy leadership positions (IT directors) in positions such as Chief data officer (CDO), Chief information officer (CIO), and Chief digital transformation officer (CDTO). In their line of work and organisational structure, IT directors interact with decision makers in other business units as equals, but during digital transformation, the influence of IT directors on other decision makers increases because IT directors generate and control most of the changes during digital transformation of business processes.

The descriptive terminology of the roles of IT directors is very diverse and does not yet have clear boundaries, [5]. We can see evidence of this by examining competency models, job descriptions and job descriptions in companies. Terminological and semantic analysis of the texts reveals, in part, unique characteristics corresponding to the roles of IT directors. However, for the most part, such analysis reveals overlapping characteristics. We see a common landscape of their professional activities in IT departments as the reason for this. Such findings lead us to believe that the homogeneity of the role characteristics of the decision makers responsible for much of the change during a company's digital transformation stems from the homogeneity of the motivational filters that influence their behaviour in the company and their role in business process implementation.

The human resources ecosystem of any company cannot exist in a mode of uncertainty and develops in the vector that is set by the organisational structure of the company. And, of course, the roles of IT directors within an individual company are divided and their interaction is entirely determined by the type of organisational structure. But when we summarize the practices of IT directors in a single dataset, it becomes obvious that the problem of identifying the dominant need that determines his/her role and style of behavior does not have an unambiguous solution at the moment, [6], [7].

Before starting to evaluate the alternatives in the choice of organisational structure for a company in the period of digital transformation of business processes, the significant characteristics of the functional roles of IT directors were summarised. Given that we needed to highlight the role of IT directors in change management during the digital transformation phase of business processes, we used the traditional titles of IT director positions in the classification.

The Chief Information Officer (CIO) provides leadership in the development, delivery and implementation of technology as an enabler of business processes. In the strategic aspect of his work in a company, the CIO is responsible for implementing the Information Systems Strategic Plan - ISSP, [8]. His day-to-day activities include the end-to-end processes of designing the IT architecture and providing information and technology to ensure the effectiveness of business processes.

The Chief Architect (CA) is responsible for software design and key decisions regarding the organisation and changes to the IT architecture in the company. His day-to-day activities focus on the technical implementation of a variety of projects. Traditionally, the CA reports to the CIO and performs functions in accordance with his or her technical or functional specialization.

The Chief Digital Transformation Officer (CDTO) is also referred to as the Chief Digital Officer (CDO). CDTO coordinates the development and implementation of the digital transformation strategy of the company's business processes, [9]. Under his leadership, digitalization of the existing IT architecture and business process architecture is carried out. Realizing its expertise, CDTO develops new solutions, changes business models based on digital technologies, implementation of which will ensure improvement of efficiency of business processes. Its subject area is the implementation of digital technologies and adapting the company to changes in the digital infrastructure.

The Chief Transformation Officer (CTO) provides technical support for the changes initiated by the CDTO. The CTO aims to ensure the flexible and conflict-free integration of digital technologies into the day-to-day activities of the company's employees. Interacting with the CDTO, he monitors the processes of change adoption and is an adept of the concept of continuous change. He is also responsible for driving external business process transformation to improve business infrastructure and service quality.

The Chief Data Officer (CDO) drives data management systems and oversees communication between data owners and product managers across the business. As responsible for implementing the Data Management Strategy, the CDO implements a set of data management tools, [10]. The scope of its work includes both the operational issues of data quality incident statistics and the strategic issues of developing performance metrics for data management systems. The CDO implements most aspects of his or her work in collaboration with other CIOs, while also single-handedly leading data management projects. As data custodian, the CDO owns the business processes related to compliance and industry standards, and is also the CIO's partner in implementing any technical initiatives.

In the absence of authoritative corporate standards and practices recognised by the business community, each company determines the roles of CIOs within its organisational structure and establishes the order of interaction between them. However, it is indicative of a study that found that the need for coordination among IT directors (the paper focuses on the Chief Digital Officer position) exceeds the need for urgency for change, [11].

Obviously, employee needs (the subject of this study is directly social needs) are very diverse - they can be grouped, ranked and classified in many ways. We chose SCARF (Status, Certainty, Autonomy, Relatedness, Fairness) as a methodological framework. Groups of social needs expressing critical aspects of employee behavioural reactions are described in the model as follows:

- Status - the feeling of respect caused by one's position in the hierarchy;
- Confidence - the ability to predict consequences;
- Autonomy - a feeling of control over what is happening;
- Relatedness - feeling of security around others;
- Fairness - the perception of a fair exchange.

SCARF is chosen because the groups of needs represented in the model are generalised according to the importance of social pain, the awareness of which and the desire to avoid it would stimulate an employee to consciously interact with management. In other words, groups of needs recorded in the SCARF model are attributed to motivational filters that actively shape the employee's (a group of employees') way of acting - tools of direct influence on the employee's motivation.

But like any model that describes categories of social behaviour, the SCARF model has its limitations. While there are no explicit groups of antagonistic needs in the model, in practice needs can conflict with each other and can also be ranked by the degree of dominance in the employee's pattern of action. For the purposes of our study, such limitations should be seen as an advantage because it is important for us to identify a particular motivational filter or synergistic combination of filters in order to explicitly indicate the dominant status for organisational design choices. Therefore, the absence of reciprocal influence between needs groups in the SCARF model, as a parameter to work with the secondary analytical data, will increase the objectivity of the results obtained and help to interpret them unambiguously in line with the research objective.

Thus, the selection of the optimal organizational structure of the company for the period of digital transformation will be based on the identified dependence between the dominant need of decision makers responsible for managing changes in business processes and the chosen development strategy of the company.

Our research task is heuristic in nature - we have to build an intuitive predictive model. Therefore, to solve it, it is advisable to implement a research strategy such as a mixed-methods strategy [12]. In this strategy, the researcher collects qualitative data, analyses them, thus forming a scientific basis for the application of the quantitative method. Based on the results of qualitative data analysis, the researcher can test hypotheses, develop questions for a questionnaire, scales, can understand sensory moments and find new phenomena of the subject area, [13], [14]. This variant of research strategy is coded as "qual - QUAN", because when mixed, the qualitative method (qual) is a logical transition to the leading quantitative method (quan).

The second component of the research strategy was the expert method. Expert judgement is an indispensable method of assessing the qualitative attributes of an object under study and reducing them to quantitative values used for analysis and forecasting. We used the experience, knowledge and intuition of experts to develop a collective solution to the problem of selecting the optimal organisational structure in digital transformation of business processes.

Among the many expert methods, we singled out the hierarchy analysis method (Saaty method), [15]. This method was used to determine the relative importance of expert judgments with respect to all alternatives to solve the problem. For this purpose, the criteria for evaluating the alternatives were lined up by hierarchy levels. The mathematical apparatus of the method made it possible to construct priority vectors and thus select the optimal alternative among all the evaluated types of organizational structures.

3 Problem Solution

A mixed-methods research strategy was applied to map the investigated relationship between the SCARF decision maker needs groups, possible company development strategies and alternative types of organisational structure. As a result, the SCARF social need groups, the types of company development strategies that can be implemented in the "Adolescence" and "Prime" life cycle stages, and the types of organisational structures that place the highest demands on such organisational characteristics as adaptability and resource efficiency were assembled into a hierarchical structure. Matching a company's organisational structure to these characteristics is key to the successful implementation of digital business transformation.

The hierarchical structure of the components for mapping is presented in Table 1. It indicates the parameter codes that were further used to compile the matrices and perform calculations using the hierarchy analysis method.

Table 1 - Hierarchical structure of mapping components

Name	Characteristic	Accepted designation
	SCARF social needs groups	
Status	the feeling of respect caused by one's position in the hierarchy	S
Certainty	the ability to predict consequences	C
Autonomy	a feeling of control over what is happening	A
Relatedness	a feeling of security around others	R
Fairness	the perception of a fair exchange	F
	Types of company strategies	
Diversification Strategy	division of assets and capital between business functions	Dvf
Minimization cost Strategy	selecting the optimum value of production, promotion and sales volume	Mzc
Innovation Strategy	innovations in business functions, qualitative changes in business processes	Inv
Rapid Response Strategy	applying the principle of feedback in change management	Rrs
	Types of company structures	
Divisional	a full range of business functions in each division	D
Functional	focus on specialisation, centralisation, narrow control of business functions	F
Virtual	focus on core competencies, outsourcing for most business functions	V
Matrix	double subordination (within a function and within a project)	M

The coherence of a judgement is assessed by a homogeneity index (coherence index) or a homogeneity relation (coherence relation) according to the following formulas:

$$UO=UC=\frac{\lambda_{max}-n}{n-1} \quad (1)$$

$$OO=OC=\frac{UO}{M(uo)} \quad (2)$$

M(uo) is the average value of the homogeneity index of a randomly generated matrix of pairwise comparisons, which is based on experimental data. The value is a table value, the input parameter being the dimensionality of the matrix (table 2).

Table 2 - Average value of the homogeneity index considering the matrix dimension

n	1	2	3	4	5	7	8	9	10
M(ио)	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45

A value of OO ≤ 0.1 is used as acceptable. If OO > 0.1 for the matrix of pairwise comparisons, this indicates that the judgemental logic was violated by the expert when completing the matrix. If homogeneity needs to be improved in order to formulate conclusions, the expert may be asked to revise the data used to construct the matrix. However, in this case, the objectivity of expert judgement is reduced to achieve technical homogeneity of the data.

In our study, the homogeneity parameter was defined as desirable but not necessary, as the priority is the objectivity of expert judgement. Therefore, the expert was given the opportunity to make an assessment once, without correction. Thus, the expert had the opportunity to show his/her expertise, but could not influence the results of the hierarchical synthesis.

Algorithm for hierarchical synthesis.

(1) Priority vectors Wi with respect to the last level of the hierarchy were determined. For this purpose, pairwise comparison matrices [Ei] were constructed and maximum eigenvalues (to assess homogeneity of judgements) and principal eigenvectors (priorities) were calculated for each of the matrices.

(2) The pairwise comparison matrices for the higher levels were processed in the same way. These matrices were constructed in order to determine the preference of elements of a particular hierarchical level relative to elements of the level above.

Table 3 - Matrix of pairwise comparisons for the level above

	S	C	A	R	F
S	1	3	1	1/3	1/7
C	1/3	1	1	3	3
A	1	1	1	1/5	1/7
R	3	1/3	5	1	1
F	7	1/3	7	1	1

By summing the elements of each row, the sum of all the elements of the matrix was found:

$$Ws=\begin{pmatrix} 5,476 \\ 8,333 \\ 3,343 \\ 10,333 \\ 16,333 \end{pmatrix}$$

S=5.476+8.333+3.343+10.333+16.333=43.819

By normalising the vector Ws by dividing each coordinate by the value of S, an approximate value of the main eigenvector was obtained:

$$W=\begin{pmatrix} 0,125 \\ 0,19 \\ 0,0763 \\ 0,236 \\ 0,373 \end{pmatrix}$$

The approximate value of the maximum eigenvalue was found using the formula:

$$\lambda_{max}=E^{T}AW \tag{3}$$

$$(1\,1\,1\,1\,1)\begin{pmatrix} 1 & 3 & 1 & 1/3 & 1/7 \\ 1/3 & 1 & 1 & 3 & 3 \\ 1 & 1 & 1 & 1/5 & 1/7 \\ 3 & 1/3 & 5 & 1 & 1 \\ 7 & 1/3 & 7 & 1 & 1 \end{pmatrix}\begin{pmatrix} 0,125 \\ 0,19 \\ 0,0763 \\ 0,236 \\ 0,373 \end{pmatrix} = 7.04$$

When calculating the principal eigenvector and the maximum eigenvalue in this way, it may turn out that the matrix agreed in reality is inconsistent in computation and vice versa.

Normalised eigenvector: W=(0.125; 0.19; 0.0763; 0.236; 0.373)

λ_{max}=7.04

$$UC=\frac{7.04-5}{5-1}=0.51$$

OC=0.51/1.12=0.455

Table 4 - Matrix for S

	Dvf	Mzc	Inv	Rrs
Dvf	1	1	3	3
Mzc	1	1	5	7
Inv	1/3	1/5	1	1
Rrs	1/3	1/7	1	1

By summing the elements of each row, the sum of all the elements of the matrix was found:

$$Ws=\begin{pmatrix} 8 \\ 14 \\ 2,533 \\ 2,476 \end{pmatrix}$$

S=8+14+2.533+2.476=27.01

By normalising the vector Ws by dividing each coordinate by the value of S, an approximate value of the main eigenvector was obtained:

$$W=\begin{pmatrix} 0,296 \\ 0,518 \\ 0,0938 \\ 0,0917 \end{pmatrix}$$

The approximated value of the maximal eigenvalue was found by the formula (3):

$$(1\,1\,1\,1)\begin{pmatrix} 1 & 1 & 3 & 3 \\ 1 & 1 & 5 & 7 \\ 1/3 & 1/5 & 1 & 1 \\ 1/3 & 1/7 & 1 & 1 \end{pmatrix}\begin{pmatrix} 0,296 \\ 0,518 \\ 0,0938 \\ 0,0917 \end{pmatrix} = 4.041$$

Normalised eigenvector: W=(0.296; 0.518; 0.0938; 0.0917)

λ_{max}=4.041

UC=4.041-44-1=0.0137

OC=0.0137/0.9=0.0152

Table 5 - Matrix for C

	Dvf	Mzc	Inv	Rrs
Dvf	1	1	5	7
Mzc	1	1	3	5
Inv	1/5	1/3	1	5
Rrs	1/7	1/5	1/5	1

By summing the elements of each row, the sum of all the elements of the matrix was found:

$$Ws=\begin{pmatrix}14\\10\\6,533\\1,543\end{pmatrix}$$

S=14+10+6.533+1.543=32.076

By normalising the vector Ws by dividing each coordinate by the value of S, an approximate value of the main eigenvector was obtained:

$$W=\begin{pmatrix}0,436\\0,312\\0,204\\0,0481\end{pmatrix}$$

The approximated value of the maximal eigenvalue was found by the formula (3):

$$(1\,1\,1\,1)\begin{pmatrix}1 & 1 & 5 & 7\\1 & 1 & 3 & 5\\1/5 & 1/3 & 1 & 5\\1/7 & 1/5 & 1/5 & 1\end{pmatrix}\begin{pmatrix}0,436\\0,312\\0,204\\0,0481\end{pmatrix}=4.554$$

Normalized eigenvector: WMzc=0.436; 0.312; 0.204; 0.0481

λ_{max}=4.554

$$UC=\frac{4.554-4}{4-1}=0.185$$

OC=0.185/0.9=0.206

Table 6 - Matrix for A

	Dvf	Mzc	Inv	Rrs
Dvf	1	1/5	1/7	0
Mzc	5	1	1/5	1/3
Inv	7	5	1	1
Rrs	0	3	1	1

By summing the elements of each row, the sum of all the elements of the matrix was found:

$$Ws=\begin{pmatrix}1,343\\6,533\\14\\5\end{pmatrix}$$

S=1.343+6.533+14+5=26.876

By normalising the vector Ws by dividing each coordinate by the value of S, an approximate value of the main eigenvector was obtained:

$$W=\begin{pmatrix}0,05\\0,243\\0,521\\0,186\end{pmatrix}$$

The approximated value of the maximal eigenvalue was found by the formula (3):

$$(1\,1\,1\,1)\begin{pmatrix}1 & 1/5 & 1/7 & 0\\5 & 1 & 1/5 & 1/3\\7 & 5 & 1 & 1\\0 & 3 & 1 & 1\end{pmatrix}\begin{pmatrix}0,05\\0,243\\0,521\\0,186\end{pmatrix}=4.54$$

Normalized eigenvector: WF=0.05; 0.243; 0.521; 0.186

λ_{max}=4.54

$$UC=\frac{4.54-4}{4-1}=0.18$$

OC=0.18/0.9=0.2

Table 7 - Matrix for R

	Dvf	Mzc	Inv	Rrs
Dvf	1	1/3	1/3	1
Mzc	3	1	1/5	1/7
Inv	3	5	1	1/5
Rrs	1	7	5	1

By summing the elements of each row, the sum of all the elements of the matrix was found:

$$Ws=\begin{pmatrix}2,667\\4,343\\9,2\\14\end{pmatrix}$$

S=2.667+4.343+9.2+14=30.21

By normalising the vector Ws by dividing each coordinate by the value of S, an approximate value of the main eigenvector was obtained:

$$W=\begin{pmatrix}0,0883\\0,144\\0,305\\0,463\end{pmatrix}$$

The approximated value of the maximal eigenvalue was found by the formula (3):

$$(1\,1\,1\,1)\begin{pmatrix}1 & 1/3 & 1/3 & 1\\3 & 1 & 1/5 & 1/7\\3 & 5 & 1 & 1/5\\1 & 7 & 5 & 1\end{pmatrix}\begin{pmatrix}0,0883\\0,144\\0,305\\0,463\end{pmatrix}=5.704$$

Normalized eigenvector: W=0.0883; 0.144; 0.305; 0.463

λ_{max}=5.704

$$UC=\frac{5.704-4}{4-1}=0.568$$

OC=0.568/0.9=0.631

Table 8 - Matrix for F

	Dvf	Mzc	Inv	Rrs
Dvf	1	1/7	1/5	1/9
Mzc	7	1	1/3	1
Inv	5	3	1	1/3
Rrs	9	1	3	1

By summing the elements of each row, the sum of all the elements of the matrix was found:

$$Ws=\begin{pmatrix}1,454\\9,333\\9,333\\14\end{pmatrix}$$

S=1.454+9.333+9.333+14=34.121

By normalising the vector Ws by dividing each coordinate by the value of S, an approximate value of the main eigenvector was obtained:

$$W=\begin{pmatrix}0,0426\\0,274\\0,274\\0,41\end{pmatrix}$$

The approximated value of the maximal eigenvalue was found by the formula (3):

$$(1\,1\,1\,1)\begin{pmatrix}1 & 1/7 & 1/5 & 1/9\\ 7 & 1 & 1/3 & 1\\ 5 & 3 & 1 & 1/3\\ 9 & 1 & 3 & 1\end{pmatrix}\begin{pmatrix}0{,}0426\\ 0{,}274\\ 0{,}274\\ 0{,}41\end{pmatrix}=4.591$$

Normalized eigenvector: W=0.0426; 0.274; 0.274; 0.41

λ_{max}=4.591

$$UC=\frac{4.591-4}{4-1}=0.197$$

OC=0.197/0.9=0.219

Table 9 - Matrix for Dvf

	D	F	V	M
D	1	3	1	1
F	1/3	1	3	5
V	1	1/3	1	5
M	1	1/5	1/5	1

By summing the elements of each row, the sum of all the elements of the matrix was found:

$$Ws=\begin{pmatrix}6\\ 9{,}333\\ 7{,}333\\ 2{,}4\end{pmatrix}$$

S=6+9.333+7.333+2.4=25.067

By normalising the vector Ws by dividing each coordinate by the value of S, an approximate value of the main eigenvector was obtained:

$$W=\begin{pmatrix}0{,}239\\ 0{,}372\\ 0{,}293\\ 0{,}0957\end{pmatrix}$$

The approximated value of the maximal eigenvalue was found by the formula (3):

$$(1\,1\,1\,1)\begin{pmatrix}1 & 3 & 1 & 1\\ 1/3 & 1 & 3 & 5\\ 1 & 1/3 & 1 & 5\\ 1 & 1/5 & 1/5 & 1\end{pmatrix}\begin{pmatrix}0{,}239\\ 0{,}372\\ 0{,}293\\ 0{,}0957\end{pmatrix}=5.155$$

Normalized eigenvector: W=(0.239; 0.372; 0.293; 0.0957)

λmax=5.155

$$UC=\frac{5.155-4}{4-1}=0.385$$

OC=0.385/0.9=0.428

Table 10 - Matrix for Mzc

	D	F	V	M
D	1	3	1	1
F	1/3	1	3	5
V	1	1/3	1	5
M	1	1/5	1/5	1

By summing the elements of each row, the sum of all the elements of the matrix was found:

$$Ws=\begin{pmatrix}1{,}676\\ 4{,}286\\ 13{,}2\\ 20\end{pmatrix}$$

S=1.676+4.286+13.2+20=39.162

By normalising the vector Ws by dividing each coordinate by the value of S, an approximate value of the main eigenvector was obtained:

$$W=\begin{pmatrix}0{,}0428\\ 0{,}109\\ 0{,}337\\ 0{,}511\end{pmatrix}$$

The approximated value of the maximal eigenvalue was found by the formula (3):

$$(1\,1\,1\,1)\begin{pmatrix}1 & 1/3 & 1/5 & 1/7\\ 3 & 1 & 1/7 & 1/7\\ 5 & 7 & 1 & 1/5\\ 7 & 7 & 5 & 1\end{pmatrix}\begin{pmatrix}0{,}0428\\ 0{,}109\\ 0{,}337\\ 0{,}511\end{pmatrix}=5.253$$

Normalized eigenvector: W_{Inv}=0.0428; 0.109; 0.337; 0.511

λ_{max}=5.253

$$UC=\frac{5.253-4}{4-1}=0.418$$

OC=0.418/0.9=0.464

Table 11 - Matrix for Inv

	D	F	V	M
D	1	1	5	7
F	1	1	7	9
V	1/5	1/7	1	5
M	1/7	1/9	1/5	1

By summing the elements of each row, the sum of all the elements of the matrix was found:

$$Ws=\begin{pmatrix}14\\ 18\\ 6{,}343\\ 1{,}454\end{pmatrix}$$

S=14+18+6.343+1.454=39.797

By normalising the vector Ws by dividing each coordinate by the value of S, an approximate value of the main eigenvector was obtained:

$$W=\begin{pmatrix}0{,}352\\ 0{,}452\\ 0{,}159\\ 0{,}0365\end{pmatrix}$$

The approximated value of the maximal eigenvalue was found by the formula (3):

$$(1\,1\,1\,1)\begin{pmatrix}1 & 1 & 5 & 7\\ 1 & 1 & 7 & 9\\ 1/5 & 1/7 & 1 & 5\\ 1/7 & 1/9 & 1/5 & 1\end{pmatrix}\begin{pmatrix}0{,}352\\ 0{,}452\\ 0{,}159\\ 0{,}0365\end{pmatrix}=4.745$$

Normalized eigenvector: W_V=0.352; 0.452; 0.159; 0.0365

λ_{max}=4.745

$$UC=\frac{4.745-4}{4-1}=0.248$$

OC=0.248/0.9=0.276

Table 12 - Matrix for Rrs

	D	F	V	M
D	1	1	1/3	1/3
F	1	1	1/5	1/7
V	3	5	1	1

M	3	7	1	1

By summing the elements of each row, the sum of all the elements of the matrix was found:

$$Ws=\begin{pmatrix}2,667\\2,343\\10\\12\end{pmatrix}$$

S=2.667+2.343+10+12=27.01

By normalising the vector Ws by dividing each coordinate by the value of S, an approximate value of the main eigenvector was obtained:

$$W=\begin{pmatrix}0,0987\\0,0867\\0,37\\0,444\end{pmatrix}$$

The approximated value of the maximal eigenvalue was found by the formula (3):

$$(1\,1\,1\,1)\begin{pmatrix}1 & 1 & 1/3 & 1/3\\1 & 1 & 1/5 & 1/7\\3 & 5 & 1 & 1\\3 & 7 & 1 & 1\end{pmatrix}\begin{pmatrix}0,0987\\0,0867\\0,37\\0,444\end{pmatrix}=4.04$$

Normalized eigenvector: W=0.0987; 0.0867; 0.37; 0.444

λ_{max}=4.04

$$UC=\frac{4.04-4}{4-1}=0.0133$$

OC=0.0133/0.9=0.0148

(3) A hierarchical synthesis was carried out. The priority vectors of the W_E^A alternatives with respect to the elements of E_j^i at all hierarchical levels were determined sequentially. Priority vectors were calculated in the direction from lower levels to higher levels, taking into account the specific relationships between elements belonging to different levels. The calculation was done by multiplying the corresponding vectors and matrices.

$$\begin{pmatrix}0,239 & 0,0428 & 0,352 & 0,0987\\0,372 & 0,109 & 0,452 & 0,0867\\0,293 & 0,337 & 0,159 & 0,37\\0,0957 & 0,511 & 0,0365 & 0,444\end{pmatrix}\begin{pmatrix}0,296 & 0,436 & 0,05 & 0,0883 & 0,0426\\0,518 & 0,312 & 0,243 & 0,144 & 0,274\\0,0938 & 0,204 & 0,521 & 0,305 & 0,274\\0,0917 & 0,0481 & 0,186 & 0,463 & 0,41\end{pmatrix}=\begin{pmatrix}0,17265111063\\0,23531387061\\0,2928629198\\0,29930892807\end{pmatrix}$$

The maximum element in the matrix is 0.299. Consequently, the most important parameter in the selection will be M - matrix organisational structure. Note that the parameter V - virtual organisational structure has an approximation to the maximum value.

The results of the hierarchy analysis can be interpreted as follows. Innovative governance (which corresponds to a virtual organisational structure) is characterised by the problem of IT director`s interaction such as infrastructure fragmentation, especially when CDOs and CIOs interact, including the joint implementation of technical initiatives. Digital transformation projects in a company with a hierarchical management type (to which the functional organisational structure and divisional organisational structure correspond) face the obstacle of competition between IT directors for resources to support their activities rather than change.

For the resulting optimum choice, the matrix organisational structure, digital transformation projects in a company with an innovative type of management are not subject to these problems because of the benefits of integrating IT departments for coordinated decision-making while preserving the autonomy of local units.

4 Conclusion

The results of this study are significant as they have scientific value and implementation prospects. The scientific significance lies in the development of the field of application of mixed methods strategy for the study of complex behavioural systems and the development of decision-making theory. The objectivity of the results obtained is determined by the level of expertise of those involved in the study. Therefore, we accept that changes in the input data and the number of experts involved may result in changes in the assessment of homogeneity and consistency of expert judgements. However, we believe that this will not change the results of expert judgement in selecting the optimal organisational structure. In the applied aspect, the results of the study can be applied by company management to justify strategic decisions related to digital transformation of business processes, as well as in the use of organizational behavior management tools.

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Contribution of Individual Authors to the Creation of a Scientific Article (Ghostwriting Policy)

Natalia Mamedova working with the algorithm, carrying out the calculations
Elena Belyakova carried out control of the calculated data, verification of the results
Arkadiy Urintsov organised the work of experts, mapped expert judgements

Sources of Funding for Research Presented in a Scientific Article or Scientific Article Itself

No funding was received for conducting this study.

Conflicts of Interest

The authors have no conflicts of interest to declare that are relevant to the content of this article.