

DOI: 10.46340/eujem.2020.6.2.15

Khalleefah Ahmed Mohammed Saed

ORCID ID: <https://orcid.org/0000-0002-1655-6842>

Simon Kuznets Kharkiv National University of Economics, Ukraine

ASSESSMENT OF THE IMPACT MADE BY THE DIGITAL TRANSFORMATION OF THE ACCOUNTING SYSTEM ON THE DECISION-MAKING SYSTEM OF THE ENTERPRISE

The fourth industrial revolution has brought new challenges into the economic entities' life, due to increasing the volume of information and accelerating the decision-making process. Given this, a hypothesis was put forward about the necessity to estimate the readiness level of the accounting system to the digital transformation. The purpose of the article is to develop an approach that could estimate the impact of the digital transformation on an enterprise accounting system and could improve the way of making strategic and operational decisions. The two sets of indicators for estimation of the enterprise readiness to digital transformation and estimation of the maturity level of the accounting organization have been offered. The strategic matrix for the interpretation of the result of the offered indicators level estimation has been presented. This strategic matrix was based on the parametric method of the indicators normalization. The fuzzy inference logic was used for the initial calculation of the offered indicator values.

Keywords: digital transformation, management accounting, fuzzy-logic, accounting information, decision-making system.

Introduction. Legislative accounting in many countries is the basis for decision-making by interested users. For example, according to Ukrainian law that regulates accounting and financial reporting¹, the main aim of accounting is to give the information to the different types of interested users. To be fair it must be said that not all countries legislation declares such orientation of accounting information. However, accounting information is the main source for making any types of decision. Depending on your country's accounting model, only the prevailing orientation of accounting information can be changed. It is well known the existence of different accounting model², such as British-American model (mostly based on the influence from professional accounting organization) and Continental European Model (has a tremendous reliance on government and connections with banking sector). Although the main aim to provide financial information about the economic entities' activities is only shown in the British-American model, the Continental European Model also could help in making the decision. The Continental European Model is oriented on the priority of tax collection, controlling the accounting rules established by the government, end on the usage of the unified national plan of accounts. So, this accounting model mostly oriented on satisfying the informational requests from external stakeholders. Despite this fact, both accounting models are facing new challenges of the fourth industrial revolution. Thus, they require some improvement that could allow accelerating the decision-making process within the enterprise management. This type of improvement is impossible without understanding the possibility of the enterprise to provide the digital transformation of its accounting system. The objective existence of request for quantitative assessment of enterprise readiness for accounting transformation has determined the goals and relevance of the article.

¹ Закон про бухгалтерський облік та фінансову звітність в Україні, 1996 (Верховна рада України). Офіційний сайт Верховної Ради України <<https://zakon.rada.gov.ua/laws/show/996-14>> (2020, May, 27).

² Eromonse, P. E. (2017). Accounting models: a conceptual review. *International Journal of Marketing & Financial Management*, 5 (6), 29-35.

Literature review and problem statement. The digital transformation of business has dramatically influenced the accounting toolkit, and the description of this influence has a significant representation in the researches in the accounting field. However, several directions for improvement of existed researches could be mentioned. Firstly, the digital transformation in connection with the researches in the accounting field usually represented through the improvement of the accounting information system. The works of B. Romney¹, L. Turner², and G. Bodnar³ could be shown as an example of a given situation when the researches should be directed to the development of accounting methodology and not to the technical instruments of accounting process realization. Thus, sometimes describing only the way of how is accounting software works is presented as scientific results. For example, B. Romney³ gives a comprehensive solution for the enterprise resource planning system (ERP) implementation without displaying accounting transactions. L. Turner⁴, in his work, has presented a bunch of flowcharts that represented the deploying of the enterprise business-process architecture. All of these research works require further improvement by displaying changing the accounting logic under the digital transformation and decision-making process complication. From this point of view B. Aslanertik⁴ proclaimed that the Accounting 4.0 approach has appeared. Unfortunately, just only a declaration of this approach does not give any advantages to the enterprise. It is necessary at least to give the enterprise the possibility to understand the level of its readiness to implement the Accounting 4.0 approach. Moreover, this understanding has to be based on a precise quantitative evaluation.

Secondly, talking about enterprise management improvement, it has to take into account the existence of a data-driven approach in decision-making. According to the research works of R. Lourenço⁵ and M. Hora⁶, a data-driven decision-making approach (DDDM approach) has shifted attention from human experience and intuition to using facts and data. Given this, the understanding of what information could be obtained from the accounting system is not enough for making a good decision. The occurrences of new objects for accounting observation has also to be considered. Although these new objects occurrences require some changes in the accounting organization, the existed research works in DDDM make no emphasis on the necessity of these changes.

Thirdly, there also have occurred some changes in accounting techniques associated with increasing the amount of information. A lot of way to establish connection between the information technology and accounting process has presented in the D. Mancini⁷ and in K. Corsi⁸ researches. All these research proposals are right and quite crucial due to the importance of information in a turbulent environment. At the same time, each economic entity is crucial to estimate the compliance between the level of accounting organization and requirement to the proposed technologies, which is not completely done in the existing research.

Thus, according to the given background, the urgent task to estimate the impact of the impersonal changes experienced by the accounting process onto the decision-making system has appeared. Such assessment is needed foremost to improve the level of accounting organization in the enterprise, increase the maturity of accounting processes. A significant result of such an assessment might be an increase in the confidence of the decision-makers in accounting information due to approximating credentials to the actual needs of information users. In this case, the fiscal role of accounting information in favor of DDDM is reduced.

¹ Romney, B. M., Steinbart, P. J. (2018). *Accounting Information Systems*. USA: Pearson.

² Turner, L., Weickgenannt, A. B., Copeland, M. K. (2017) *Accounting Information Systems: The Processes and Controls*. USA: John Wiley & Sons.

³ Bodnar, G. H., Hopwood, W. S. (2013) *Accounting Information Systems*. USA: Pearson.

⁴ Aslanertik, B. A., Yardımcı, B. (2019). A Comprehensive Framework for Accounting 4.0: Implications of Industry 4.0 in Digital Era. *Blockchain Economics and Financial Market Innovation Financial Innovations in the Digital Age*. Switzerland: Springer, 549-563.

⁵ Lourenço, R., Piotrowski, S., Ingrams, A. (2017), Open data driven public accountability. *Transforming Government: People, Process and Policy*, 11 (1), 42-57.

⁶ Hora, M. T., Bouwma-Gearhart, J., Park, H. J. (2017). Data driven decision-making in the era of accountability: Fostering faculty data cultures for learning. *The Review of Higher Education*, 40 (3), 391-426.

⁷ Mancini, D., Dameri, R.P., Bonollo, E. (2016). *Strengthening Information and Control Systems. The Synergy Between Information Technology and Accounting Models*. New York: Springer.

⁸ Corsi, K., Castellano, N. G., Mancini, D. (2017). *Reshaping Accounting and Management Control Systems. New Opportunities from Business Information Systems*. Switzerland: Springer.

The aim and objectives of the study. The purpose of the article is to develop an approach that could estimate the impact of the digital transformation on an enterprise information system, which is supported by financial and managerial accounting. Receiving the mentioned approach gives the enterprise management the possibility to improve the way of making strategic and operational decisions. Given this, the article objectives are revealed in developing the sets of indicators for estimation of the enterprise readiness to digital transformation and estimation the maturity level of the accounting organization. Developing the strategic matrix for getting the interpretation of the result of the offered indicators level estimation is also presented as one of the article objectives.

Main results. Achieving the article goal is based on the hypotheses of necessity to estimate the maturity level of accounting and the business processes digitization of the enterprise, which will allow, based on the correlation of such estimates, to develop a project to improve the accounting organization. As we can see from Figure 1, increasing the enterprise readiness for digital transformation could lead to the improvement of accounting information quality. In case of Figure 1, its connection with the set of principles for appropriate accounting information processing that developed by the International Federation of Accountants (IFAC)¹ has to be noticed. Although these principles designed for E-accounting in meaning of online accounting and digital transformation is quite wider concept, it is necessary to use mentioned IFAC recommendation but with some improvement. These improvements compose of linking the principles and loops of the system dynamics model presented in Figure 1.

Some of the relations and loops from Figure 1 require a more detailed explanation. For example, increasing the number of intangible assets within the total assets could show that the company is buying the software and business intelligence technology, which is necessary for DDDM. During describing the correlation between the accounting maturity level and enterprise's readiness for digital transformation, it comes in handy to estimate the level of accounting conservatism. There are many explanations of accounting conservatism, and analysis of the existed interpretation is not relevant to the purpose of this study. However, it can be argued that conservatism in accounting complicates the digital transformation due to the need for more thorough data verification. Given this, Figure 1 contains the indicators of VAT and income tax rates in comparison with other enterprises. These indicators could indirectly characterize the level of conservatism. Besides, the amount of information fixed in the accounting system has been put into Figure 1 due to the existence of a wide variety of other times of information (marketing research, results of strategic monitoring, etc.) that could be used in DDDM. The percentage of required elements that presented in accounting policies has been offered as one more additional characteristics. Here we are talking about requirements from the accounting law and in terms of forming the information needed to make decisions.

Although the scheme on Figure 1 has proved the importance of data-driven approach, the quality estimation for accounting maturity level is still required. Since it requires quantifiable estimates that are almost impossible to obtain, the use of fuzzy logic is suggested. It has to be noticed that fuzzy logic is used for making the decision based on incomplete information or accounting information under the uncertainty condition. The author proposes to use fuzzy logic for determining decisions about choosing the variant of the accounting transformation. The usage of Fuzzy logic technology within the decision support system and in connection with the accounting information were presented, for example, in A. Dorokhov² research work. Further research will be based on the same technic and the same software, but with the different economic explanations. Any assessment primarily involves the set of indicators formation. The offered collection of indicators, which is based on Figure 1 and divided into two groups, is presented in Table 1.

¹ International Federation of Accountants (2002) *E-Business and the Accountant*. New York: International Federation of Accountants.

² Dorokhov, A., Dorokhova, L. (2011) Fuzzy model in Fuzzytech environment for the evaluation of transportation's quality for cargo enterprises in Ukraine. *Transport and Telecommunication*, 12 (1), 25-33.

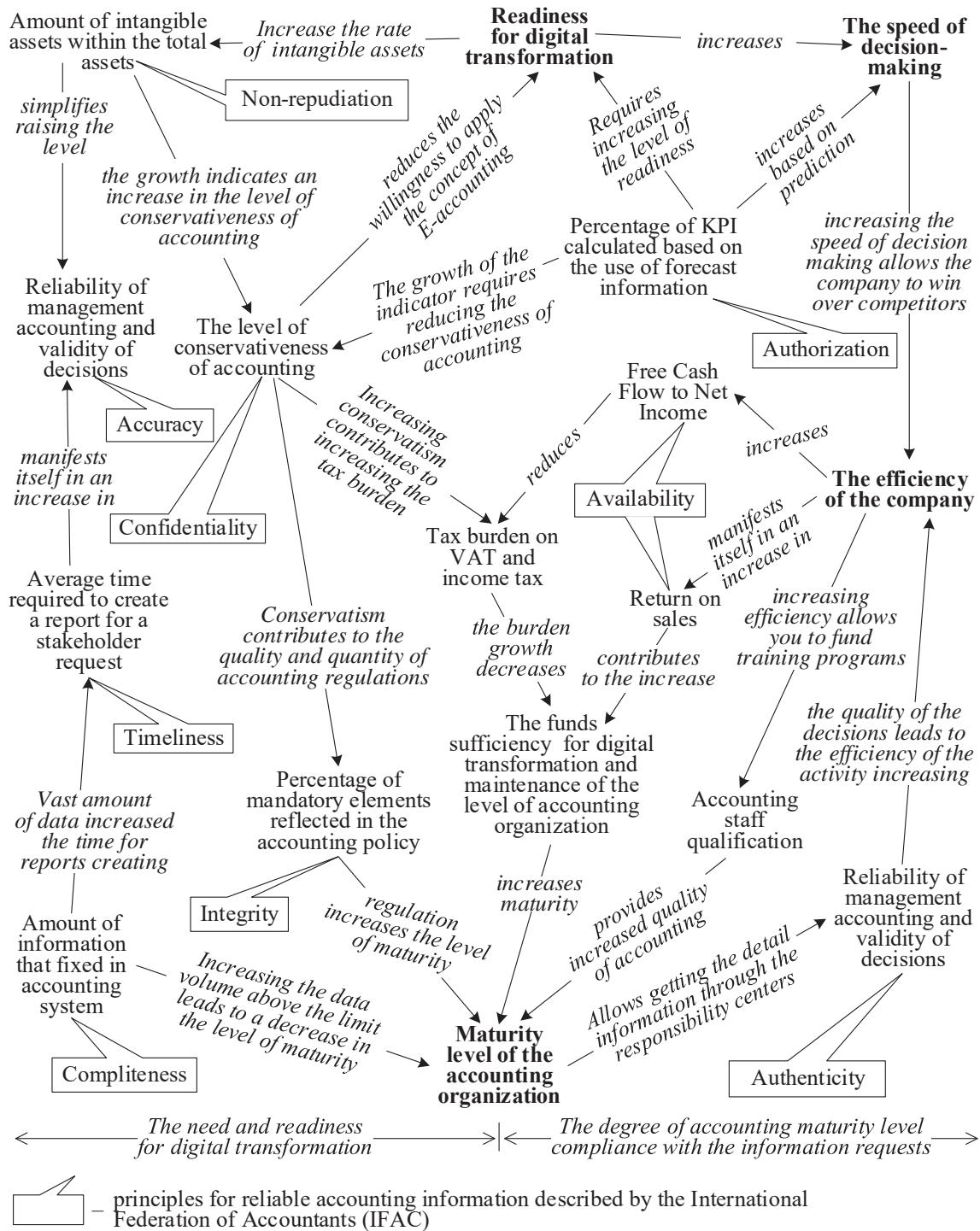


Fig. 1. Representing the correlation between accounting organization maturity and the enterprises' possibility for improvement of the decision-making process

Table 1

Characteristics of linguistic variables for the model parameters

Name of the parameters and levels. (variable designation within the FuzzyTech program)	Terms of variables, values of membership function					
	Starting		Middle			Finishing
	Equal 1	Decrease from 1 to 0	Increase from 0 to 1	Equal 1	Decrease from 1 to 0	Increase from 0 to 1
The need and readiness for digital transformation (RedinessLevel, RL)						
Amount of intangible assets within the total assets (IntangeRate)	0–0,3	0,3–0,7	0,5–1,0	1,0–1,5	1,5–2,0	1,7–2,5
Tax burden on VAT and income tax (TaxBurden), %	0 – 1,5	1,5–3,5	2,0 – 4,0	4,0–6,0	6,0 – 8,0	5,5 – 7,5
Percentage of KPI calculated by the use of forecast information (ForecastedKPI)	0 – 5	5 – 12	5 – 10	10 – 15	15 – 20	15 – 25
Return on sales (Efficiency) , %	0 – 4	4 – 10	5 – 10	10	10 – 17	10 – 15
Free Cash Flow to Net Income (FreeCash), %	0 – 10	10 – 25	10 – 25	25–40	40 – 50	35 – 50
The degree of accounting maturity level compliance with the information requests (Maturity, ML)						
Amount of information that fixed in accounting system (AccoRate), rate	0 – 0,4	0,4–0,6	0,4 – 0,6	0,6–0,8	0,8 – 0,9	0,7 – 0,9
Average time required to create a report for a request (TimeForReport), hours	0 – 10	10–20	10 – 20	20	20–30	20 – 30
Reliability of management accounting and validity of decisions (Reliability), points	0 – 2	2–4	2 – 4	4 – 6	6 – 8	6 – 8
Share of administrative costs per accounting employee (EmployeeCost)	0 – 0,5	0,5–0,7	0,5 – 0,7	0,7–1,2	1,2 – 1,6	1,2 – 2,2
Percentage of mandatory elements in the accounting policy (Policy), %	0 – 40	40–60	40 – 60	60–80	80–90	70 – 80

The membership function, which is given in Table 1, is based on the digits that are intended only to illustrate the author's approach. These memberships' function requires some explanation. The trapezoidal memberships' functions were used in the vast majority of cases. The triangular memberships' functions were used for expert evaluation. Figure 2 represents some examples of how the memberships' function looks like within the neural network software.

The relations between the variables specified in Table 1 are based on the connections established in Figure 1. The memberships' functions, part of which are described oh Figure 2, gives the possibility to get a quantitative assessment for accounting maturity level and for enterprise possibility to perform the digital transformation. Given this, Figure 3 represented the space of fuzzy inference and the set of rules for making the assessment. These rules are set manually according to the influence of indicators from Table 1 on the final variable. It has to be mentioned that these rules are changeable due to the enterprise accounting police. As were described in Figure 1, the enterprise could provide aggressive accounting policy or profess the principle of conservatism in accounting. The given situation could change the image of fuzzy rules presented in Figure 3. One more aspect of neural network approach has to be mentioned. The level of influence of indicators on the final value was also taken into account while creating the rules.

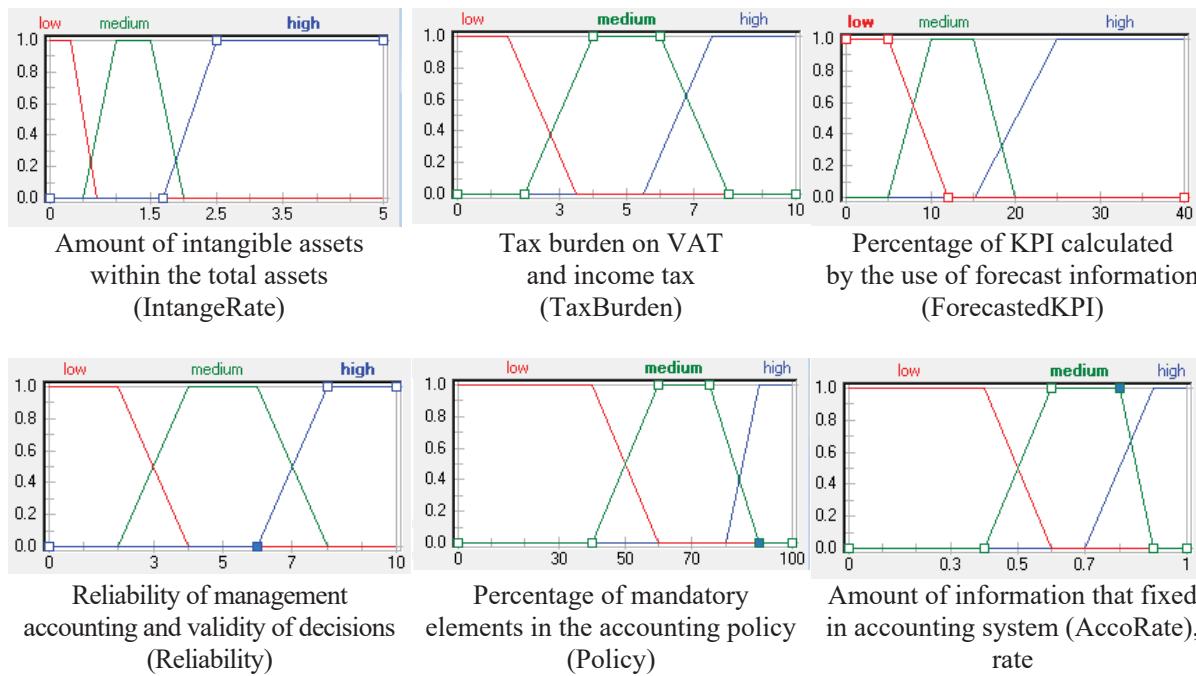


Fig. 2. Representation of variable within the FuzzyTech software (fragment)

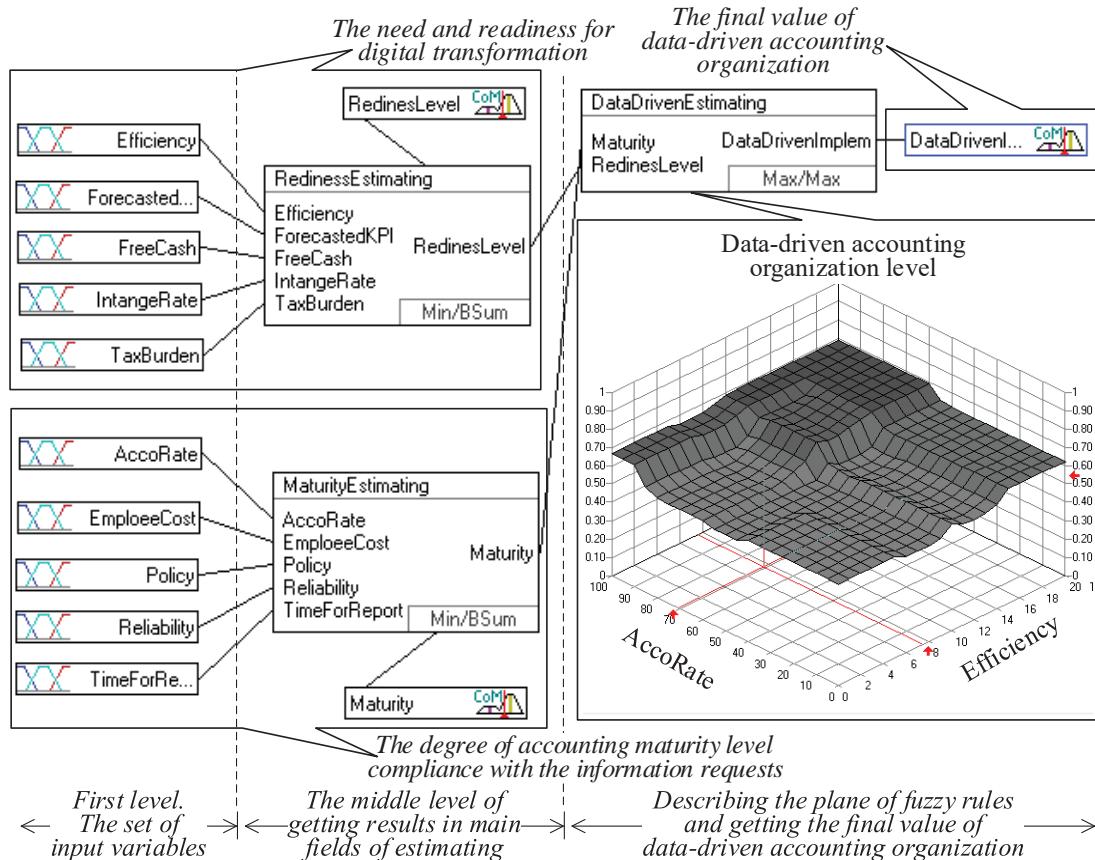


Fig. 3. Representation of FuzzyTech general computer model and surface of dependence between main model variables

The procedure for estimating the level of data-driven accounting organization, as we can see from Figure 3, is based on the existence of three hierarchical levels. Each of these levels makes its own impact on the result. In the same time, getting only the value of the level of data-driven approach development in the company is not enough for the accounting process improvement. Given this, there is one more author's proposal presented in Figure 4 that described the strategic matrix for the interpretation of the result of the offered indicators level estimation.

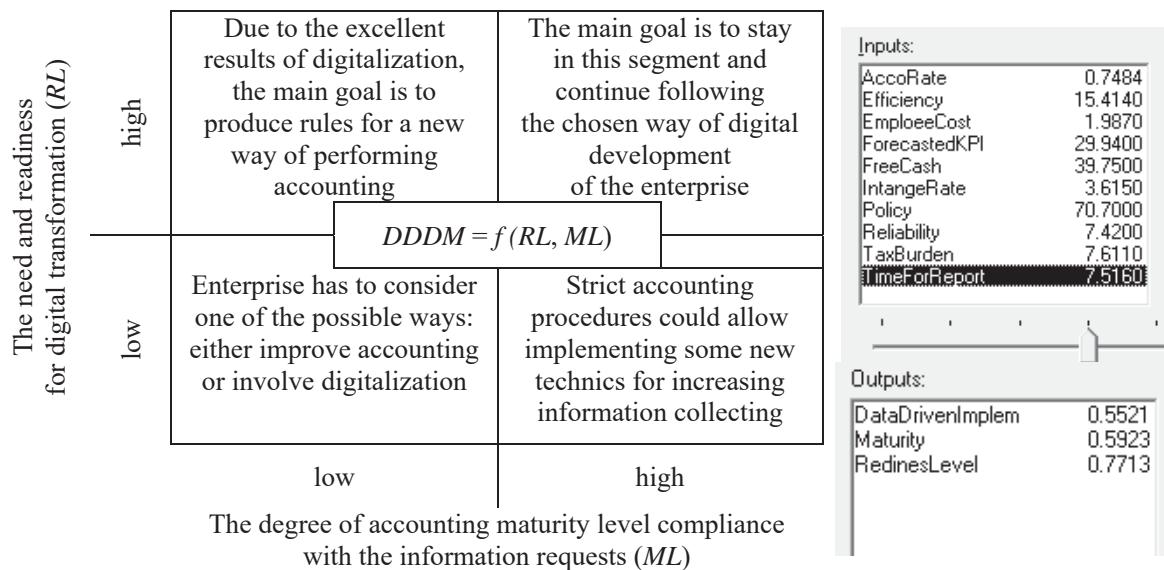


Fig. 4. The strategic matrix for the result of fuzzy conclusion interpretation and getting direction for the improvement in the accounting organization

Figure 4 shows the strategic matrix, which based on the results of fuzzy estimating. The interface of these types of estimates is also presented in Figure 4. Based on the parametric research method offered strategic matrix displays the main direction to enterprise management for developing the data-driven approach for decision-making and accounting improvement through the digital transformation.

Conclusion. This paper has shown the approach to estimating the level of data-driven technics involving in the accounting organization. The authors' hypothesis about the necessity to estimate the readiness level of the accounting system to the digital transformation has been proved by using the fuzzy logic approach. This approach has explained how to estimate the impact of the digital transformation on an enterprise accounting system. In addition, it could improve the way of making strategic and operational decisions. The two sets of indicators for estimation of the enterprise readiness to digital transformation and estimation the maturity level of the accounting organization has been offered. The strategic matrix for the interpretation of the result of the offered indicators level estimation has been presented. This strategic matrix was based on the parametric method of the indicators normalization. The fuzzy inference logic was used for the initial calculation of the offered indicator values. However, as far as the membership's function was used only to illustrate the author's approach, the further author's research will be devoted to searching for statistical dependencies, which can explain the parameters of the fuzzy inference. It is also planned to expand both the composition of indicators and groups of indicators. In addition to these, the offered strategic matrix is planned to become not two-dimensional, but multidimensional.

References:

1. *Zakon pro bukhgalterskyj oblik ta finansovu zvitnist v Ukrayini, 1999* (Law on Accounting and Financial Reporting in Ukraine (Verkhovna Rada of Ukraine)). *Ofitsiynyy sayt Verkhovnoyi Rady Ukrayiny* [The official website of the Verkhovna Rada of Ukraine]. <<https://zakon.rada.gov.ua/laws/show/996-14>> (2020, March, 27). [in Ukrainian].

2. Eromonsele, P.E. (2017). Accounting models: a conceptual review. *International Journal of Marketing & Financial Management*, 5 (6), 29-35. [in English].
3. Romney, B. M., Steinbart, P. J. (2018). *Accounting Information Systems*. USA: Pearson [in English].
4. Turner, L., Weickgenannt, A. B., Copeland, M. K. (2017). *Accounting Information Systems: The Processes and Controls*. USA: John Wiley & Sons [in English].
5. Bodnar, G. H., Hopwood, W. S. (2013). *Accounting Information Systems*. USA: Pearson [in English].
6. Aslanertik, B. A., & Yardimci, B. (2019). A Comprehensive Framework for Accounting 4.0: Implications of Industry 4.0 in Digital Era. *Blockchain Economics and Financial Market Innovation Financial Innovations in the Digital Age* (pp. 549–563). Switzerland: Springer [in English].
7. Lourenço, R. P., Piotrowski, S., Ingrams, A. (2017). Open data driven public accountability. *Transforming Government: People, Process and Policy*, 11 (1), 42-57. [in English].
8. Hora, M. T., Bouwma-Gearhart, J., Park, H. J. (2017). Data driven decision-making in the era of accountability: Fostering faculty data cultures for learning. *The Review of Higher Education*, 40 (3), 391-426. [in English].
9. Mancini, D., Dameri, R. P., Bonollo, E. (2016) *Strengthening Information and Control Systems. The Synergy Between Information Technology and Accounting Models*. New York: Springer [in English].
10. Corsi, K., Castellano, N. G., Mancini, D. (2017). *Reshaping Accounting and Management Control Systems. New Opportunities from Business Information Systems*. Switzerland: Springer [in English].
11. New York: International Federation of Accountants (2002). *E-Business and the Accountant* [in English].
12. Dorokhov, A., Dorokhova, L. (2011). Fuzzy model in Fuzzytech environment for the evaluation of transportation's quality for cargo enterprises in Ukraine. *Transport and Telecommunication*, 12 (1), 25-33. [in English].