

Developing Practical Recommendations for Increasing the Level of Digital Business Transformation Index

Iryna Strutynska¹, Lesia Dmytrotsa¹, Halyna Kozbur¹, Liliya Melnyk¹, Hlado Olha¹

¹Ternopil Ivan Puluj National Technical University, Ternopil, Ukraine
{ringtons999, dmytrotsa.lesya, kozbur.galina, liliana.mel0512, gladyo.olga}@gmail.com

Abstract. *Research goals and objectives:* to develop practical recommendations for increasing the level of digital business transformation index based on clustering of small and medium enterprises.

Subject of research: development and use of practical recommendations (digital roadmaps of digital transformation) for entrepreneurs.

Research methods used: survey of entrepreneurs, analytical methods for determining the Index, statistical methods of data processing, expert analysis of respondents' answers, cluster analysis of business structures, business analytics.

Results of the research. The list of multilevel recommendations for increasing the Digital Transformation Index were formed as well as the calculation method of the Index were described. Also was displayed gradation of recommendations; the results of clustering of business structures by the level of digital maturity were demonstrated; specific recommendations for raising the HIT for the enterprises of each of the clusters were formed. Such a methodology should take into account the current state of affairs in Ukraine, reflect an in-depth analysis of the level of digital transformation of business structures, while being flexible in order to respond promptly to new phenomena and the emergence of new digital technologies.

Keywords: Digital Transformation, Clustering, Index of Digital Transformation of Business Structures, Digital Transformation Roadmaps.

1 Introduction

At present, the transition of the industrial economy and the information society to the concepts and requirements of the "digital" economy is actively taking place. Such radical transformations require a new approach to understanding the nature and consequences of these processes, as well as the ability to adapt digital technologies to the contemporary demands of society and business. The rapid adaptation and transformation of business structures in the digital sense is one of the key tasks for raising the competitiveness of the domestic economy as a whole and integrating it with the leading global economic system.

The process of digital transformation of a business structure involves the transformation of its business strategy, models, operations, goals, marketing approaches, etc.

in the direction of increasing use of digital technologies [1]. Beside these management and strategic changes digital transformation also includes usage of industrial automated systems which help in manufacturing such as automatic robots, manipulators, augmented reality etc. Also, cybersecurity should be mentioned as a one of most important aspects in the implementation of the principles of digital transformation.

However, in Ukraine, such processes are slow. The problem is the lack of entrepreneurs with the necessary knowledge regarding the use of innovative digital technologies [2]. There are also no platforms, services or applications to explain the importance and potential of using digital tools in business transformation.

Insufficient awareness of entrepreneurship about the ability to integrate technology into their own business processes causes retardation of development of companies and difficulties in the entry of domestic business into the international arena. That is why along with statistical studies of the use of information and communication technologies in business and shaping the positions of companies in the process of digital development of the country, it is an important task to create roadmaps for digital transformation and to provide recommendations on opportunities to use digital tools and increase digital literacy of both entrepreneurs and the population in general.

The purpose of this work is to provide a list of common multi-level recommendations for the indicators defined by the Digital Structural Transformation Index of Business Structures proposed in [3].

The problem of the development of digital economy and transformational processes taking place in society under the influence of digitization has received a lot of attention among both foreign authors [4-8] and Ukrainian researchers [1-3, 9-12], etc.

Despite numerous scientific studies on the development of information and communication technologies and the digital economy, we believe that the issues of the impact of digital technologies on business transformation are under-researched.

2 Features of the digital business transformation index (HIT)

2.1 Concept of Digital Business Transformation Index

The creation and use of the Digital Business Transformation Index was proposed as one of the methods for assessing the level of digital development of small and medium-sized enterprises (SMEs). If applied as a national methodology, it will be possible to evaluate the digital maturity of business structures and provide recommendations for improving it. This method allows to take into account sufficient indicators of impact on the development of business and the information society as a whole.

Regular calculation of the Index for a specific business structure can be used as a tool for monitoring and evaluating the performance of a business using digital tools. This will help identify the problem areas in the development of SMEs and will at the same time form a transformation vector with the aim of integrating domestic business into the global digital economic system.

The baseline statistics used to develop the methodology for determining the Digital Transformation Index were collected through a questionnaire that included 4 groups of indicators: informative, digital indicators, use of digital tools, and digital human literacy [3]. For the direct calculation of the Index, the last three indicators are used, namely:

- indicators of the enterprise digital infrastructure, which describe the level of its provision with the necessary equipment (personal computers, laptops, smart phones) and broadband Internet;
- the use of digital tools is a key indicator that represents the qualitative characteristics of the effectiveness of technology in business. This indicator includes components such as use of social media management (SMM), site functioning and search engine optimization (SEO), work with specialized systems for business process automation, etc.;
- digital literacy (competence) of human capital, which is defined as the ability of an employee to perform complex tasks and requirements, involving both professional and personal skills [15].

It should be noted that digital competence has been recognized by the European Union as one of the 8 key competences for a fulfilling life and included in the updated Digital Competence framework created by the EU [16; 17]. Due to the three main components used to determine the level of digital transformation of business structures - Human Resources, Digital Instruments and digital Technologies, the generalized three-component Digital Transformation Index has been known as “HIT”.

The first, an informative indicator that gives an overview of the company, its business scope and the ability to use certain tools according to its specificity and needs, was not used to calculate the Index.

2.2 Mathematical basis for HIT index calculation

Using summary structural indicators of digital transformation, the authors proposed in [3] a formula for determining the generalized Digital Transformation Index of a business structure (1):

$$HIT = Summ_H \cdot \omega_H + Summ_I \cdot \omega_I + Summ_T \cdot \omega_T, \quad (1)$$

where «HIT» – Digital Business Transformation Index;

$Summ_H$ – summary of the digital literacy of the human capital of the organization;

$Summ_I$ – summary of the status of the use of digital tools in the business processes of the organization;

$Summ_T$ – summary of digital technology usage in a business organization;

ω_H – weight factor indicator H;

ω_I – weight factor indicator I;

ω_T – weight factor indicator T [3],

$$\omega_H + \omega_I + \omega_T = 1 \quad (2)$$

Separate indexes of the Index are determined by (3):

$$Summ_X = \sum_{i=1}^m n_i^{(X)} k_i^{(X)}, \quad (3)$$

where m – number of components of the indicator X ,
 $n_i^{(X)}$ – meaning of I component indicator, $n_i^{(X)} \in [0;1]$,
 $k_i^{(X)}$ – weight factor indicator, $n_i^{(X)}, k_i^{(X)} \in [0;1]$.

The contribution should contain no more than four levels of headings. The following Table 1 gives a summary of all heading levels.

Table 1. Table captions should be placed above the tables.

Metric range	Level
$Summ_X \in [0, 0.2]$	very low
$Summ_X \in [0.21, 0.4]$	low
$Summ_X \in [0.41, 0.6]$	average
$Summ_X \in [0.61, 0.8]$	high
$Summ_X \in [0.81, 1]$	very high

Obviously, with the introduction of these restrictions for an arbitrary j business structure will be implemented

$$HIT \in [0,1]. \quad (4)$$

Using formula (3), the values of the three main consolidated indicators were obtained, which are important components not only for calculating the numerical value of the Business Transformation Index, but also for providing recommendations to companies to improve the Index.

2.3 Creating a list of multi-level recommendations

As mentioned above, the recommendations are a kind of a “roadmap” for the digital development of small and medium-sized businesses, as they allow to specify own digital transformation vector for an individual company or group of companies. At the same time, the availability of recommendations makes it possible to monitor the effectiveness of the implementation of digital technologies in business processes in view of the annual change of the Index and its constituent indicators. Taking into account the results of the research [11], [12], the authors developed recommendations for different levels of each of the three main indicators listed in Table 2.

Table 2. List of multilevel recommendations for increasing the HIT index.

Indicator	Number	Value	Recommendations for different levels
H	1A	0...0.2	Introducing employees to basic digital tools: user-level social networks, messengers, office applications
	1B	0.21...0.4	More advanced level of working with social networking: creating business pages, systematically filling out these pages. Using targeted sites, viewing articles, video tutorials, online beginner courses. Practicing digital skills, training employees. Introducing a separate Digital Specialist position (if required).
	1C	0.41...0.6	Training company employees (at beginner courses) in the desired field: marketing, SMM, SEO, design, Human Resource Management (HR), Customer Relationship Management systems (CRM), advertising and more. Analyzing trends in your industry, monitoring competitors in Ukraine and abroad, learning ideas, experiences, analyzing their mistakes.
	1D	0.61...0.8	Consultations with professionals in specific fields of digital technology: marketers, targeters, copywriters, designers, pay per click specialists (PPC), CRM specialists and other systems. Outsourcing of specialists is possible, experience of employees of the company, attending conferences.
	1E	0.81...1	Attending company specialists for professional conferences or events, participating in targeted webinars or online courses, improving skills, in-depth analysis of trends and their production.
I	2A	0...0.2	Use of basic digital tools: social networks, messengers, online documents; creation of an enterprise site, digitalization of communication with clients (communication via e-mail, messengers, form on the site, etc.).
	2B	0.21...0.4	Improvement of digital competences of personnel, transition to business use of social networks, partial digitization of business processes, positioning of a company in a social network, automation of communication with clients (chatbots, QR codes).
	2C	0.41...0.6	Performing SEO-optimization of your own site, starting to use advertising campaigns on social networks, creating content plans for systematic work, use of CRM-systems and financial management systems, increase of digital competencies of the personnel, partial introduction of data collection analytics.
	2D	0.61...0.8	Professional use of social networks and their advertising offices, involvement of specialists. Use of online analytics data for decision making and Business Process Management systems (BPM) to model and automate business processes. Introducing digital systems for staff training. Creating a strategy for promoting a company on social networks and adhering to it. Use of corporate messengers (if necessary).
	2E	0.81...1	Use of statistical analysis and projection technologies (Data Mining, Big Data, Predictions), working with analytical applications for Supply Chain Management (SCM) and Product Data Management (PDM) and Enterprise Resource Planning systems (ERP). Working with 3D - printing, product location tracking, geoinformation systems (if needed)
T	3A	0...0.5	Providing the minimum necessary amount of computer and mobile equipment in the enterprise, concluding agreements with ISPs and service centers, solving existing problems.
	3B	0.5...1	Maintaining a satisfactory state of the equipment and technology, and gradually upgrading or increasing its the number, if necessary.

It is worth noting that the recommendations cover both improving the company's technical support and enhancing the professional level of employees and expanding the integration of digital tools into the company's operations. In addition, the recommendations given for "very low", "low" and partially "average" levels of indicators often do not require additional financial costs for software purchase or staff training. At the same time, tasks that are defined at a "very high" level of performance often involve the use of specialized technical and information tools, which may not be relevant for a large part of business areas.

3 Research results

3.1 The results of the clustering of respondents

In order to develop a common methodology for providing guidance to SMEs, business entities were clustered according to their level of use of digital technologies and tools in their activities [3]. Clustering was performed according to the results of the survey, described at [11]. Participants were representatives of SMEs of various industries in Ternopil region including private schools, dentistry, cafes, manufacturers of industrial goods, IT-businesses etc. Also, it should be noted that clusters were formed without taking into account division by industry and were based only on calculated efficiency of three indicators described above.

As a result, 5 stable clusters were identified with the following characteristics:

- Cluster I: companies that have no experience in usage of digital technologies;
- Cluster II: companies with the limited use of only one tool, social networks, namely;
- Cluster III: companies using more sophisticated digital tools;
- Cluster IV: companies that use some digital tools of their own (SEO, social networks, advertising);
- Cluster V: companies that use almost all advanced digital technologies, including Data Science techniques.

Equation (4) summed up values for each indicator for all respondents. For example, the values for Cluster 4 participants are shown in Table 3.

Table 3. The value of the Digital Transformation Index for the respondents.

Cluster	$Summ_I$	$Summ_T$	$Summ_H$
IV	0,341	0,767	0,4
	0,338	0,684	0,6
	0,261	1	0,8
	0,453	1	0,6
	0,488	1	0,8

The ordered triple $(Summ_I, Summ_T, Summ_H)$ of the numerical values of the indicators for each individual enterprise can be represented by a point in the three-dimensional coordinate system, where x-axis denotes the level of use of digital tools ($Summ_I$), y-axis – availability of digital business infrastructure ($Summ_T$), z-axis – digital literacy of human capital ($Summ_H$). Since the values of all indicators belong to segment $[0;1]$, all points will be placed in a cube with edge $a=1$ (see Fig. 1).

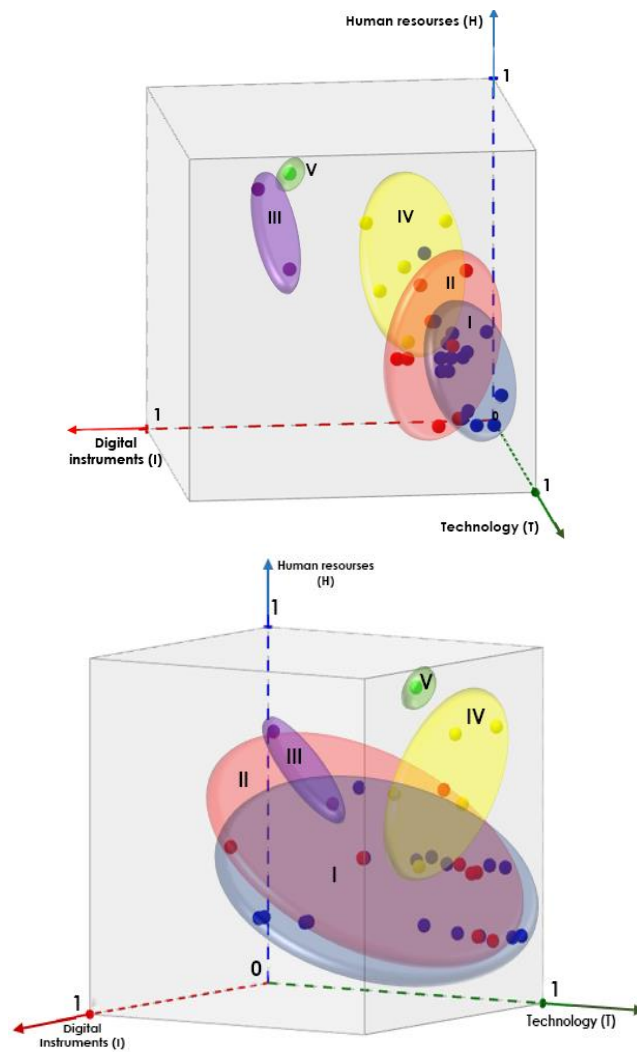


Fig. 1. Visualization of respondents' clustering results (two projections).

Fig. 1 illustrates the results of the division of SMEs into clusters. The spatial rectangular coordinate system shows two projections of the cube of all possible locations of

points. The clusters formed are shown as ellipsoids of different colors, the points inside the ellipsoids indicate separate business structures. The closer the point to the origin (O point) is, the weaker is the business structure in digital terms.

As we can see from Fig. 1, clusters V and III have the largest values in the coordinates H (human capital) and I (digital instruments), which is why they are quite different from the others. With respect to the T (technological support) coordinate, a wide spread of points can be observed for clusters I and II (values in the interval), but by the X coordinate they are rather tightly grouped in the region of the origin of the axis. Cluster IV is close to zero with respect to the x-axis, but in terms of human capital development it is higher than clusters I and II, and the points are distributed fairly tightly with respect to y-axis.

3.2 Providing cluster recommendations

Taking into account the peculiarities and distinctive features of the individual “clusters” of business structures resulting from clustering, the authors developed specific recommendations from Table 2 for each individual group of enterprises. The intervals of indicators and the reference numbers for each cluster are shown in Table 4.

Table 4. Providing recommendations by cluster of respondents.

# cluster	Number of participants	H	I	T	Recommendation numbers
I	16	0.2...0.6	0.05...0.26	0.07 ... 1	1B/1C, 2A, 3A/3B
II	10	0.2... 0.6	0.174 ... 0.4	0 ... 0.9	1B/1C, 2B, 3A/3B
III	2	0.6... 0.8	0.669... 0.74	0.5 ... 0.67	1D, 2D/2E, 3B
IV	5	0.4... 0.8	0.261... 0.49	0.684 ... 1	1C/1D, 2B/2C, 3B
V	1	1	0.712	1	1E, 2D/2E, 3B

It should be noted that only general management, marketing and strategic recommendations are considered in the research whereas industry solutions may vary between companies which have different work areas. Such solutions may be offered and implemented only by industry experts in specific area, so this is a separate topic for work and research.

The general recommendations for each of the clusters can be worded as follows:

1. The following measures are recommended to the first cluster:

- practicing basic digital skills of all enterprise employees and developing the professional skills of employees who work directly with digital technology through offline and online courses;
- using basic digital tools: social networks, messengers, online documents, design platforms;
- providing workers with the required amount of digital technology.

2. The measures recommended to the second cluster are:

- to practice basic digital skills of all employees of the enterprise, and the development of professional skills of employees who directly work with digital technologies through offline and online courses;
- after increasing the volume of work on social networks and platforms, to distinguish the position of SMM-manager / internet marketer / digital specialist, etc.;
- to transition to more complex use of social networks, regular content creation, automation of communication with clients through chatbots, QR codes, etc.;
- to provide the required amount of equipment and keeping it up to date.

3. Businesses that are referred to the third cluster are recommended:

- conducting an external audit of the quality of the use of digital tools, if necessary, consult with professionals in the chosen field;
- following trends in the industry, attending conferences, taking on the experience of competitors and trendsetters;
- creating a strategy for positioning the company in the Internet space, using analytics data for decision-making and specialized systems to fully automate business processes;
- using statistical analytics and forecasting technologies, industrial robots, sensors, etc.;
- keeping hardware and software up to date.

4. The representatives of the fourth cluster are recommended:

- training responsible for the use of digital technology by company employees on offline or online courses in the required topics, creating a post of SMM-manager / internet marketer, etc.
- analysis of industry trends, lessons learned from competitors or brands in related businesses, consulting with professionals about the challenges and opportunities of using a digital tool;
- positioning the company on social networks, creating regular content and publishing it according to the content plan, start using advertising campaigns on social networks;
- automation of communication with clients by means of chatbots, QR-codes, etc., SEO optimization of the site;
- use of CRM systems, financial management systems, connection of analytical tools and start of data collection;
- keeping hardware and software up to date.

5. The following measures are recommended to the fifth cluster:

- continued professional development of company specialists, attending highly specialized conferences, events, courses and webinars;
- deep analysis of trends of own and related industries, rapid response to topics of peak popularity, analysis of competitors' mistakes;

- create and adhere to a strategy to promote and build brand or company loyalty, refine strategy, actively use a large number of digital tools and analytics data;
- when using Data Science, statistical analysis, forecasting, geo information systems and other sophisticated technological tools;
- keeping hardware and software up to date.

An analysis of the list of specific recommendations developed to increase the level of complex digital maturity of business structure clusters has shown that most of the proposals are aimed at increasing the digital literacy of company employees and increasing the share of digital tools used. It should be noted that low digital literacy (H) results in low technology usage and business process digitalization (I). This is due to the fact that staff who do not have sufficient knowledge of the use of computer technology at the user level, cannot effectively use even the simplest tools: social networks, online documents, etc. and independently solve creative business tasks. An example is the first cluster in which the indicated level of digital literacy of staff ranges from 0.2 to 0.6 (low-to-average level of subjective assessment of the manager), but the level of use of digital technologies is at the lowest. At the same time, in the third cluster, digital literacy was rated in the range of 0.6... 0.8 (high level), and therefore the use of digital tools is in the same range.

In contrast, the level of computer hardware provision has little effect on the success of modern technology, since most companies have enough equipment to use most digital tools.

One way to solve the problem of low digital literacy of staff is to educate all employees in terms of the basics of digital tools, assign positions for professionals who will be responsible for the use of technology in enterprises, and develop their professional skills.

4 Conclusion and future works

The result of this study is to develop a list of common, multi-level recommendations to small and medium-sized businesses in order to increase three indicators of digital maturity: the use of digital technology in company operations, the integration of digital tools into business processes, and the level of digital competence of employees. Based on previous research on clustering of interviewed entrepreneurs of Ternopil region and formulation of the concept of digital transformation of business structure, each of the groups of respondents was advised to improve the value of the components of the Index to the next level.

Providing guidance on improving digital business metrics will allow small and medium-sized businesses in Ukraine to choose the right vector for developing groups of companies with similar metrics. Dissemination and acceleration of digital transformation of business structures will positively influence the digitization of society in general and the integration of domestic companies with the advanced global digital economy.

Future research plans to outline a list of personal recommendations for each respondent, depending on their current status of use of digital tools and needs for busi-

ness activities. These guidelines will create individual development vectors for companies to increase competitiveness in both the domestic and global business space, as well as monitor and strengthen their weaknesses and remove barriers to further development.

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