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Cezary Stępniak
Czestochowa University of Technology
e-mail: cezary.stepniak@wz.pcz.pl
ORCID: 0000-0003-4833-6411

UTILITY OF SPATIAL DESCRIPTION FOR EVALUATION OF PROSUMPTION EFFECTS ON EXAMPLES OF IT COMPANIES

UŻYTECZNOŚĆ DESKRYPCJI PRZESTRZENNEJ DO OCENY EFEKTÓW PROSUMPCJI NA PRZYKŁADZIE FIRM INFORMATYCZNYCH

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Summary: This article proposes concepts for a tool to support the management of prosumer activity. Using spatial descriptions, it allows for multi-criteria visualization of the effects of prosumer activity. Spatial description is a way of mapping reality using the broadly understood concept of space. In this case, space can be seen not only in geographic dimensions, but also as heuristic or mathematical space. The study presents the principles of construction, operation and objectives of using the proposed tool. The practical application of the tool to assess the prosumption effects of an IT company dealing with the implementation of ERP / BI class information systems has been shown. The applicability of the proposed tool has been verified on the basis of two criteria: feasibility and usability.. The article shows what can be visualized and in what way, and what benefits it can bring. The indication of how the concept of space can be used in dynamic management.

Keywords: prosumption effects, spatial description, map of prosumption effects, ERP application effects.

Streszczenie: Proponowane narzędzie do opisu efektów prosumpcji bazuje na wykorzystaniu deskrypcji przestrzennej, która z kolei opiera się na metodologii GIS wykorzystywanej do opisu różnego typu przestrzeni, nie tylko geograficznej, ale także heurystycznych. W artykule podjęto tematykę prosumpcji na przykładzie wdrażania systemów informatycznych. Samo wdrożenie bardzo często poprzedzane jest badaniami firmy klienta, aby możliwie najlepiej dopasować implementowany system. Na potrzeby artykułu zaproponowano firmie informatycznej współpracę w opisie efektów wdrożeń ich systemów. Zgromadzone w ten sposób dane empiryczne posłużyły do zaprezentowania sposobu, w jaki można przygotować proponowane narzędzie. W artykule przeanalizowano i wskazano możliwości budowy tego narzę-

dzia. Wykorzystano do tego celu dwa kryteria: wykonalności i użyteczności, dzięki którym uzasadniono możliwości ich zastosowania.

Keywords: efekty prosumpcji, deskrypcja przestrzenna, mapy efektów prosumpcji, efekty wdrożenia systemów ERP.

1. Introduction

Increasing competition or the increasingly sophisticated taste of clients means that various methods of acquiring and maintaining a client are undertaken. One of the available methods is prosumption. The possibility of jointly constructing products or providing specific services tailored specifically to the client's needs should be conducive to the creation of their loyalty and provide a source of information about the potential needs of other clients. In this way, presumption can affect the creativity of business. In practice, presumption should not be limited only to customer service. All the possibilities for studying the effects of prosumption should be used. For this purpose, it is not only important to construct products or plan services, but it is also necessary to clearly define the assumed effects of the activities in question, so that after some time it can be assessed whether the assumed goals have been achieved and to what extent.

The use of presumptions may be incidental, but it seems rational to use it as a kind of marketing action, which is designed to attract many customers at the same time. Using the pressure to serve many customers may, on one hand, allow to increase the range of its own offer, eg. through ongoing use from the results of cooperation with other entities. On the other hand, the question of assessing the effectiveness of results obtained through presumptions, appears in the background. If there are relatively many prosumer activities, it may be difficult to assess each case quickly enough. In addition, the question of assessment criteria remains. It should be determined whether the assessment will be carried out each time according to the same criteria or for each case specific ones should be developed.

In these considerations, the use of spatial descriptions for assessing the effects of activities in the area of presumption was proposed. Spatial description is a way of visualizing the chosen environment with the use of tools based on a cartographic methodology extended with the technological capabilities used in the Geographic Information System (GIS) [Stępniak 2011].

The aim of the study is to present the concept of a tool that uses spatial descriptions to assess the effects of prosumption. Verification of the tool was made on the basis of data from an IT company implementing its product (an ERP class IT system among its clients). It can be assumed that most of the implementations made by the aforementioned company are of a prosumer nature due to the fact that before the application of the said software, research is carried out to determine the user's needs.

Only on this basis is the system parameterization and its start-up. The company, bearing in mind the desire to best match the needs of customers, as well as seeking inspiration and knowledge to develop the product offered, is interested in assessing the effects of the use of the offered systems (see [Ziemba, Eisenbarth 2017]). The point is that many determinants of effectiveness were defined during the research. It is difficult to present them in a collective form especially since the problem is not to achieve the highest aggregate rating possible, but to solve specific problems. In addition to proposing a tool concept, the author's contribution was also the development of research questionnaires to study the effects of ERP implementation. These questionnaires were distributed among the clients' companies. Ten completed questionnaires returned. Basing on them, it was possible to develop maps of the effects of implementing the ERP systems.

2. Theoretical bases

The phenomenon of presumption appeared in the literature almost forty years ago. Since that time it has been undergoing a certain evolution, which was presented for instance in [Mitręga 2013]. Generally, it can be assumed that nowadays it is a system that connects a supplier of products or services whose preparation and delivery is accompanied by cooperation with the client aimed at adapting them to the requirements of the consumer. During the last forty years, many elements of the market have been transformed, among others, the level of globalization and turbulence of the market have increased, organizations have become more and more open, and the role of Information and Communication Technology (ICT) has significantly grown.

The prosumption can be seen from different points of view. One can distinguish, among other things, its types [Mitręga 2015], examine the organization of its functioning, relations with other issues such as personalization or recommendation [Flis 2015] or determine the effects of its application. These effects can be presented from a quantitative (eg. economic performance) or qualitative (define the level of satisfaction of the needs assumed prior to presumption). Efficiency can be investigated both from the perspective of a client and a supplier. Studies of the effects of presumptions can be useful for both and for other party. It can even be presumed that joint research can reinforce potential customer loyalty and, on the other hand, enable the diagnosis of the existing defects or other weaknesses [Szul 2013]. On the IT market, this can lead to community creation in order to improve IT tools (eg. HTML5 [Gutierrez 2018]).

In these considerations, the problem of presumption is taken from the point of view of the possibility of visualizing its qualitative effects. In other words, the goal is to answer the question of whether the effort put together has brought the expected result. The article addresses the problem of looking mainly from the perspective of the supplier of presumptions, although the client may use the results obtained, which in turn may lead to attempts to improve the subject of presumption or support his/

her entrepreneurship [Boyaval, Herbert 2018]. The point is that there may be a lot of qualitative indicators describing the effects of presumption, but the success of the whole undertaking will not be determined by the fulfillment of most requirements or any set of selected effects, especially when the researched customer or service is already in the consumption or use phase. In this case, an assessment is important for a supplier in order to improve the assumptions of their product or service, possibly improve the quality of the product already sold or a service as a service. Qualitative indicators can be used repeatedly to assess the effects of presumptions because they relate to the subject of delivery. Therefore, it is possible to compare the results of various measures of presumption related to a similar product or service. This is possible especially when an entity sells similar products or services, and their personalization under presumption is mainly reduced to the change in the value of selected features of sales items. In practice, despite the volatility of the value of the features of the products or services provided, the same quality indicators can be used.

The proposed solution aims at creating a tool based on GIS technology. Similar solutions can be found in other areas of life [Obade, Moore 2018]. It will lean on visualization of spatial indicators of qualitative effects of presumption. Using partly the idea of mind maps, maps of indicators will be built on the basis of which indicator spaces will be created. Visualization will consist in displaying qualitative indicators on the map and reflecting the evaluation results obtained. The essence of the concept lies in the fact that individual indicators will have a strictly defined place on the visualized maps, and their presentation will be carried out according to the rules of cartographic symbolization (on the subject of cartographic semiotics, see [Żyszkowska 2012]).

The development of the concept of the proposed tool has been subject to several assumptions. These include, among others:

First of all: a supplier provides a repeatedly modifiable product or service. Secondly: the product or service, or their final useful parameters, are mutually agreed between the supplier and the recipient. Thirdly: both sides are interested in the results of the evaluation. Fourth: criteria for assessing the effects of presumption have been developed. Fifth: there are many different features that can be used repeatedly within the distinguished criteria. Sixth: clients will enable the audit of the effects of implementing presumption according to the agreed criteria or do it themselves. Seventh: the rating according to the criteria can be expressed, for example, according to Likert scale, but it should also be supplemented by a commentary.

It is true that the assumptions put forward mean that in practice the development of an evaluation questionnaire can be time-consuming. It would be even more time-consuming to analyze the collected factual material. However, the evaluation of the results of prosumer activities fits into the perception of the given organization and its products or services in the environment and may be significant. For this purpose, spatial descriptive tools are used to allow a faster analysis of the results obtained, and in addition, the results obtained from a given sale may be compared with other similar data.

3. Applied research methodology

As already mentioned, the aim of the work presented in the article was to develop a tool concept that using a spatial description would allow for a multi-criteria assessment of the effects of individual prosumer activities. However, the development of the tool concept itself was considered insufficient. Therefore, it was decided to make a practical verification of the concept developed. The verification of the developed concept of the tool was decided in terms of its feasibility and usefulness.

The feasibility criterion referred to two types of issues: technical and organizational. On the other hand, the usability criterion was to be verified by analyzing the empirical results obtained in cooperation with one of the IT companies.

Work on the development of the tool can be divided into three phases:

- conceptual,
- research,
- analysis of results (visualization).

In the conceptual phase, the concept of the tool itself was developed. To this end, the literature and current GIS tools available on the market have been analyzed. The identification was mainly focused on the possibilities of defining various types of space and cartographic symbolization.

In the research phase, an entity providing services, that can be treated as being carried out on the basis of presumption, was chosen. The choice is one of IT companies that deals with the development, distribution and implementation of information systems of the Enterprise Resources Planning / Business Intelligence (ERP/BI) class. Although the application of the ERP / BI class system is treated as a common standard, in practice, the implementation or even thorough improvement of the applied system requires an appropriate pre-implementation analysis, and often also necessitates the addition of extra functions. Information about ERP efficiency can be found in [Parthasarathy, Sharma 2016]. Therefore, the implementation or thorough improvement of the system requires close cooperation among future users (the company that implements the system) and the software provider, regardless of whether the systems are implemented on internal client servers or in Cloud Computing technology [Dziembek 2018]. It can therefore be assumed that work on the implementation of information systems can be of presumption nature.

In cooperation with the aforementioned company, a research questionnaire was developed, the aim of which was to gather opinions of real users on the implemented system (in other words, about the effects of presumption). The questionnaire prepared by the team was verified by representatives of the company implementing the systems. It was about supplementing the objectives of detailed implementations and matching the data collected for the company's marketing needs. Then the prepared questionnaire was distributed by IT company implementation services among selected company's clients. As a result, factographic material was collected regarding the implementation or modification of systems made in ten enterprises.

Basing on the obtained factographic material, the principles of its visualization and interpretation of the obtained maps were developed. On this basis, it is possible to build individual (regarding individual entities) and collective (concerning many entities) maps describing the effects of prosumer activities.

4. The idea of spatial description

The idea of spatial description is based on the broadly understood concept of space. In this case, it is not only about the geographical dimension of space, but it can also be understood as a kind of abstract construction (types of space see [Pachura 2016]). However, regardless of the type of space, it can be visualized using cartographic methodology, and especially using its extension based on GIS technology. For the purposes of the tool concept, the following elements of the cartographic methodology were used:

- the ability to define space,
- scaling and transformations among space projections,
- principles of cartographic symbolization.

In addition, while using the GIS technology extension, map dynamics can be used. This means on-line maps can be created. When connected to the appropriate maps, they can be updated on an ongoing basis and interactive maps can also be used, not only for visualization, but also for manual applying objects to the maps. In addition, the advantage of GIS technology is also the possibility of using hyperlinks for objects visualized on the map, thanks to which, when reading the map, a broader description of the visualized object may be obtained.

For the purposes of the article, first of all, attention was paid to heuristic and mathematical spaces. It was considered that indicators describing the effectiveness of presumptions could be arranged in space assigning them a constant location thanks to the so-called spatial attributes. As a result, if any prosumer undertaking is the subject to visualization through specific performance indicators, they are always in the same place in the given space.

5. Implementation of the research procedure

In the conceptual phase, the work was carried out in two directions. On one hand, spaces for visualization had to be defined. On the other hand, a research questionnaire had to be developed. Both tasks were interdependent. On one hand, it was necessary to develop the idea of space in which determinants of the effectiveness of presumptions would be entered. However, its detailed elaboration required creating a list of indicators and determining their mutual interdependence.

It was assumed that a heuristic space with simple XY axes would be used for visualization. The mentioned axes will be superimposed on the original scheme, which will be arranged from indicators and will constitute a kind of cartographic

grid. However, a set of performance indicators was required to draw the original schema. The set of performance indicators is specific to a specific type of prosumer activity. In the case of the example being developed, the implementation of ERP class systems was accepted as a kind of prosumer activity. This means that unless there are any significant qualitative changes to the software or the system implementation procedure is not significantly changed, then the same set of indicators can be used for each separate implementation of the system. In addition, it is possible to compare the effects of different deployments.

On the basis of the original experience in the implementation of the ERP class systems, quality indicators have been developed. The developed effect indicators referred to the arrangements between the ERP provider and companies that wanted to implement these systems. Assuming that as part of prosumption, the customer actively participates in the preparation of the product that is intended for him/her, the client submits his/her specification of needs and expectations, and then, at the implementation stage, they should actively participate in the parameterization of the system, which is characteristic only for them. The proposed indicators have been verified by the implementation and marketing services of an IT company. As a result, a three-level system of indicators was obtained. The first level consisted of 11 items that referred to 11 modules of the implemented system. Each module was evaluated independently. It should be remembered that although ERP systems use shared databases, individual modules are usually supported by other users.

Each module had three indicators at the second level. They included general, user and detailed factors. In each module, three similar general indicators were determined. At the same time among the other two groups of factors, the number of indicators varied. In the third level are detailed questions about the effects of implementing a given system and the ways they are perceived by users. In total, there were just over two hundred questions.

The hierarchy of the indicator system facilitated the possibility of their classification. This, in turn, allowed them to be easily located on the original scheme. Thanks to the above-mentioned scheme, the space was defined. For the purpose of this example, a closed space in the shape of a square was built. The space is divided into twelve parts. Six straight lines intersect the centre of the space creating a shape similar to the watch face. Eleven sections of the space represent individual IT system modules that have been assigned to them. Then, two circles are written into the modeled space: the inner and centre ones. Both circles have their centres in the middle of the space. This way, each part of the space is assigned to a specific ERP system domain module that has been divided into three parts. The part which is closest to the centre of the space is assigned to general factors, the central factors of the user, and the external factors to the specific ones. This way, thirty six polygons are created, three of which are neutral (they can be assigned to a new module in the future), while the remaining thirty three relate to one of the implemented modules and a given group of factors.

The basic model of the environment of the space is presented in Figure 1.

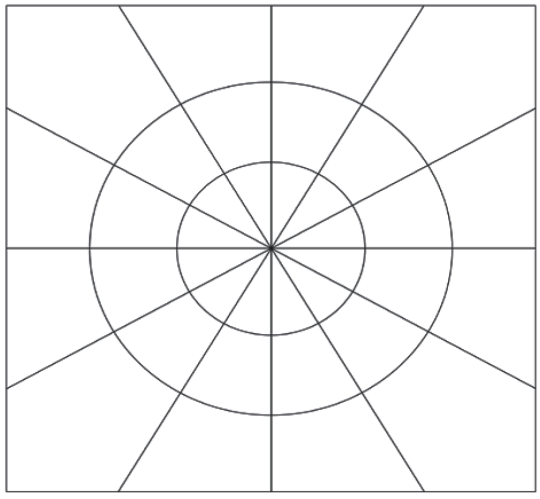

Fig. 1. The environment of the space of effects indicators

Source: own elaboration.

The third level of indicators represented specific questions that users were asked. In this case, these were point objects. Their locations were made by hand, making sure that they were in the correct range, adequately to the represented module and the type of factor. It was also tried to maintain a similar arrangement of indicators in training areas representing general factors. Applying individual indicators in the form of a point to the original scheme clearly defined their location. Based on XY values there is explicit localization of the objects on the map, i.e. (x = 0, y = 0) coordinates are the centre of the designated space. These coordinates were then assigned to each pointer, permanently becoming its spatial attributes. Owing to that if other prosumer activities were assessed according to the same questionnaire, then the applied efficiency indicators would always be in the same place on the map. Potential new indicators can be added by entering them in the original scheme. In the proposed case, only two-dimensional space is needed for visualization. Therefore, there is not much need to transform space. Otherwise, it would be possible to build n-dimensional spaces in which GIS tools for transforming space and converting among different types of maps can be used. The scales for visualization purposes can also be reduced or increased. Regardless of the purpose of the visualization being developed, individual objects will be printed on the maps based on spatial attribute values.

The third element of spatial description is the use of cartographic symbolization. It consists in applying thematic layers to the cartographic grid. In the developed

example there are two thematic layers. The first one means ERP modules and assessment factors, i.e. the first and the second level in the hierarchy of indicators are presented in the form of polygons. The second thematic layer visualizes specific indicators. They should be presented in the form of a name and a symbol. The name is the description of an indicator, while the symbol shows its location and strength of importance among other indicators. In the example in question, the strength of meaning signifies the value that the indicator obtained during the tests. In practice, this means that the symbol of the indicator will be in the map grid according to its position in the original scheme, and its appearance will depend on the value of the feature according to which the indicator will be visualized.

The result of the conceptual phase was a developed research questionnaire that was a set of indicators that were subjected to the research and the rules for their evaluation, and the space for the test results was defined.

In this phase, research was conducted to examine the effects of prosumption on the clients of an IT company where the IT system was implemented or improved in accordance with the effects specifications. The results of the research were to be used by both, an IT company (including acquiring knowledge about clients' needs) as well as clients themselves who could become more aware users of the implemented systems. For both sides verification whether the assumed implementation goals were achieved in fact is important.

For the research, the above mentioned questionnaire containing all the distinguished efficiency indicators was used. As a part of the individual questions, it was necessary to provide an assessment of the implementation effect in the form of an integer on a scale from –2 to 2 with its justification. Individual rating values stand for:

- –2 − there was a deterioration within the given indicator and the assumed goals were not achieved,
- –1 − there was a deterioration despite the fact that formal goals were achieved,
- 0 − no change occurred (neither deterioration nor improvement),
- 1 − there was improvement despite the fact that the intended implementation goals were not achieved,
- 2 − there was improvement and implementation goals were achieved.

The data was collected by the representatives of an IT company, working mainly in implementation and marketing departments, in cooperation with the users. For spatial analysis, both quantitative (or evaluation) and qualitative (comments) data can be used. The quantitative data can be illustrated directly on the basis of the importance assigned to the indicator. However, qualitative data (comment or justification of the indicator value) can be attached on a hyperlink basis to the indicator symbol on a map.

As a result of the research, a description of the effects of ERP system implementations in ten enterprises was collected. The deployments referred to the same software, but some implementations did not cover all modules or functions availa-

ble. The authors' team obtained quantitative data treated as a trade secret of an IT company and its clients. As mentioned, the proposed ERP system consisted of eleven modules. Their symbolization is shown in Table 1.

Table 1. Symbolization of ERP system modules

No	Symbol	The name of the module
1	P	Production − execution of orders
2	D	Sales − order fulfillment
3	V	Service − after-sales services
4	R	Recycling − utilization
5	M	Marketing − acquiring orders
6	S	Purchasing − acquiring resources
7	W	Warehouse management
8	E	Economic analysis
9	O	Organization of the company
10	H	Human resources and registration of working time
11	F	Finances and accountancy

Source: own study.

Symbolization of modules is important when symbolizing specific indicators. As it is known, the indicators are assigned to specific modules, hence the first letter in their symbolization refers to the module.

Another element of the symbolism of a given indicator is the determination of its role as a factor. The following signs have been adopted:

- G – general factor,
- U – user factor,
- P – particular factor.

The third step was to assign symbolization to individual indicators. Due to the size of the factographic material collected in this study, data on one module is presented in the Economic analysis. Symbolization of the indicators is presented in Table 2.

Symbolization was made for all indicators related to each module. Symbolization was necessary due to the legibility of maps. Long names of indicators would significantly reduce the readability of maps, therefore relatively short symbols were used. Then the allocation of individual indicators in space was made. The allocation of indicators for module E − Economic analyses, is presented in Figure 2.

Empirical data were needed to visualize the maps. These were obtained in the form of eleven tables for individual types of ERP modules. In this article, due to the volume of the text, one table is inserted concerning the results obtained from the evaluation of implementation in the module "Economic analysis" (see Table 3).

Table 2. Symbolization of indicators regarding the effectiveness of the Economic analysis module implementation

No.	Type of a factor	Symbol	Name of the indicator
1	G	EG-1	Compliance with business requirements (pre-implementation analysis)
2	G	EG-2	Compatibility with the strategy
3	G	EG-3	Functional fit for business processes in the client's company
4	U	EU-1	Overall system user satisfaction
5	U	EU-2	Easiness of usage
6	U	EU-3	Functional adjustment (does the system handle all the tasks necessary for the user?)
7	U	EU-4	Friendliness of user interface
8	U	EU-5	User support in solving problems
9	U	EU-6	The scope of user's autonomy (the need to use system administrator's intervention)
10	U	EU-7	Visual evaluation of printed documents
11	P	EP-1	Increasing the scope of reporting
12	P	EP-2	Acceleration of decision-making processes
13	P	EP-3	Analysis of the effectiveness of individual organizational units and employees
14	P	EP-4	Customer analysis
15	P	EP-5	Analysis of the effectiveness of owned and available fixed assets

Source: own study.

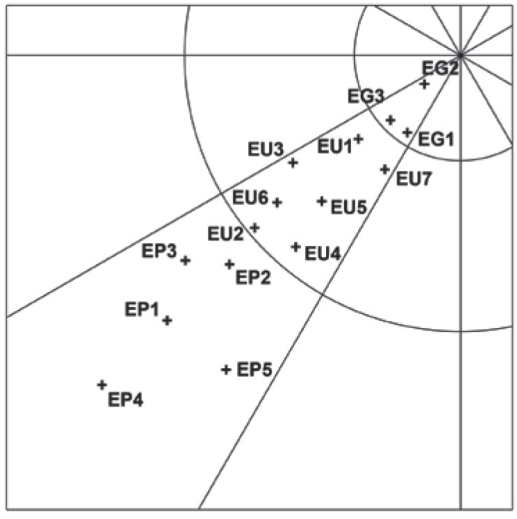

Fig. 2. The location of indicators on the map on the example of the Economic analysis module

Source: own study.

Table 3. Results of the assessment of prosumption effects for the module "Economic analysis"

Symbol	Clients									
	1	2	3	4	5	6	7	8	9	10
EG-1	2	1	2	2	0	2	2	0	2	1
EG-2	2	1	1	2	0	2	2	0	2	1
EG-3	2	1	2	2	0	2	2	0	2	1
EU-1	2	1	2	2	1	2	2	1	2	1
EU-2	2	1	2	2	0	2	2	0	2	1
EU-3	2	1	2	2	1	2	2	1	2	1
EU-4	2	1	1	1	1	1	1	1	1	1
EU-5	2	1	2	2	0	2	2	0	2	1
EU-6	1	1	2	1	–2	1	2	–2	1	1
EU-7	2	1	2	1	1	1	2	1	1	1
EP-1	2	2	2	2	2	2	2	2	2	2
EP-2	2	1	2	2	0	2	2	0	2	1
EP-3	2	1	1	2	1	2	1	1	2	1
EP-4	1	1	2	2	0	2	2	0	1	1
EP-5	2	2	2	2	2	2	2	2	1	2

Source: own study based on research results.

In these considerations, for visualization the results of prosumption obtained in co-operation with customer No. 5 regarding the module of "economic analysis" were chosen. The created map is presented in Figure 3.

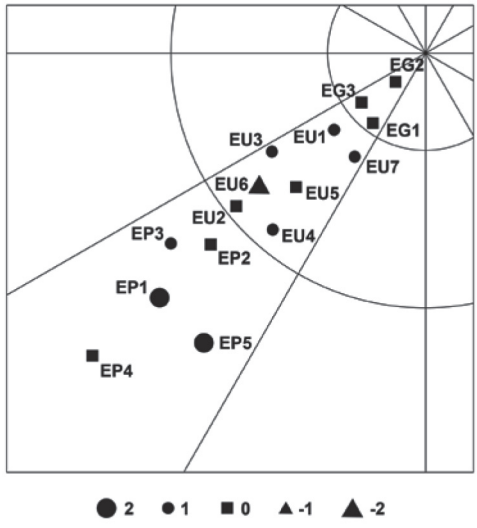

Fig. 3. A map of prosumption effects for the customer No. 5 under the Economic analysis module

Source: own study based on research results.

The map presented in Figure 3 has the character of an example. Placing a prosumption map for the entire project in this study would significantly reduce the readability of the map. In practice, an electronic map is created, which can be appropriately enlarged or reduced by matching the scope of visualized data to the research needs.

Due to the size of the article, only two types of visualization are presented in it. In practice, it can be done much more according to different criteria. Examples of other criteria are:

- it is possible to visualize polygons (describing features according to modules), where it can be pointed out that given features have been implemented adequately to the adopted assumptions,
- a dominant or other statistical parameters can be calculated from the effects within a given feature and the given polygon can be presented in a suitable way.
- another type of visualization is a colorful visualization of symbols, which facilitates searching for all indicators that have accepted unsatisfactory values.
- as mentioned, using the hyperlink tools, problems can be read directly from the map (without having to refer to the proper documentation).

The obtained prosumption results can also be visualized in bulk. This means that the individual symbols represent the results of not single prosumer activities but the entire analyzed activity. Then, individual symbols can take the form of histodiagrams describing the effects of all implementations according to individual indicators. Another possibility is to calculate the arithmetic mean or dominant of the evaluation that the indicator obtains in all the analyzed activities.

An additional advantage of the use of spatial descriptions is the ability to create maps on a regular basis, if the evaluation results are entered into databases on the basis of which the visualization is made.

6. Possibilities of using spatial description

These considerations present the possibilities of using a spatial description for the descriptions of the effects of prosumer undertakings. Of course, the proposed tool can also be used to evaluate other types of enterprises in many different branches of the economy.

In the research assumptions of the article it was stated that the presented tool would be verified by two criteria of feasibility and usefulness and feasibility criterion would be verified from the organizational and technological point of view.

The organizational criterion is to indicate whether there are organizational conditions for using the mentioned tool. In previous considerations, it was indicated in what applications the discussed tool could be used. From an organizational point of view, the use of a tool requires: the environment and prosumer processes that occur in it, and which are to be described by them. During the prosumption processes, many variables may occur, according to which their effects will be studied. In

addition, prosumer processes may be repeated, which may lead to the occurrence of personalized products or services, but they will be assessed according to the same performance indicators. Another requirement is the willingness of the entity to use prosumer to more or less systematically examine the effects of its operations. In practice, this may lead to the transformation of individual sales acts into periodic cooperation (eg. in the form of warranty service), which in turn should support the improvement of the value of the analyzed indicators. From an organizational point of view, organizational conditions include the existence of an individual in a company that uses prosumption, which oversees cooperation in the framework of prosumption and assesses the achieved results on an ongoing basis. The test results have to be collected and analyzed. Basing on them, it will be possible to improve the hitherto effects of prosumption, and perhaps to gather the needs reported by clients (i.e. qualitative data), which in turn should favor creative and pro-innovative attitudes.

Bearing in mind the example of the IT company presented in the article, the evaluation in the long term is not indifferent to it, because its sale actually means licensing the use of a particular type of software. Under this type of contract, the software supplier usually commits to its ongoing modification resulting, for example, from changes taking place in state law. Changes in information needs can also affect the willingness of long-term cooperation expressed by ERP/BI class users. Therefore, the aforementioned company is interested in collecting data on the prosumption effects obtained. The applicability of these tools is not due to the specificity of the industry. There are some examples of other prosumer activities (eg. car industry), where from the organizational point of view the offered tools can be used.

From a technological point of view, the basic question is to determine whether the discussed tool is feasible. For the preparation of this article, the visualization was prepared in a manual manner, i.e. no GIS tools were used. In practice, it is technologically feasible. The following elements are required to perform the appropriate tool that will work automatically:

- mathematical module of any GIS software,
- spatial databases connected on-line to the aforementioned software,
- visualization module.

Manufacturers of ERP/BI systems are aware of the fact that space is an important element of modern management processes. Therefore, there are or will be created interfaces thanks to which GIS software producers will be able to use databases generated by ERP/BI systems and vice versa, ERP/BI class systems are increasingly using spatial databases. These possibilities show [Yaptenco et al. 2005]. Therefore, it can be concluded that there is a possibility of communicating both types of software. The problem may be the issue of the need to use a mathematical module, as until now communication at the data level has been sufficient. A mathematical module is needed to define space and its transformation, as well as to locate objects on the map. It is feasible from a technical point of view. GIS software producers can share this type of module for mathematical space transformations with cartographic

symbolization tools. In classic databases (both relational and object-oriented) there is the possibility of adding supplementary attributes. In this case, it would be spatial attributes that would define the location of objects on the map. This way, databases (for example the used tables with data on prosumption effects) from classic ones could be transformed into spatial ones. They have spatial databases, and an on-line visualization module is still required. Generally, it is used by most programs that enable working on a vector model when processing spatial data.

Therefore, it can be assumed that on the example presented in this study, an IT company can purchase appropriate GIS software or more likely start cooperation with a company that deals with GIS software and thus gets an adequate access to it. Data obtained from the research and stored in a regular table can be transformed into spatial data by manually applying individual indicators to an interactive map opened in the original schematic mode. By combining the indicator system from the original diagram with the data stored in the table containing the indicator values, it can be visualized on-line. It is worth paying attention to the fact that the visualization may take place due to different criteria depending on the current needs of the user. The dynamics of GIS software and the timeline can also be used. Then it is visible how the values of individual indicators for many prosumer activities changed at the same time. Bearing in mind the above arrangements, it can be assumed that the feasibility criterion of a given tool both from the organizational and technological point of view is possible to meet.

The criterion of usefulness was met by presenting the idea of the proposed tool. It is worth mentioning that the presented section of the research results referred to the real prosumer activities carried out by a company operating on the international market. The number of implementations made by the aforementioned company is over 10,000. The specificity of the product (ERP/BI class IT system) means that the supplier has to be in constant contact with their clients and wants them to be satisfied with the level of services provided. Therefore, these maps can be an important tool for them in managing their prosumer activities.

7. Conclusions

The proposed idea of the tool is part of the current system of transformations taking place on the IT services market. It is mainly about the growing dynamics of changes, the growing role of the process approach in management and the growing role of qualitative data.

At the moment there are many different tools available to visualize various types of issues (see, among others [Mendeleev 2018]). Generally, however, these are tools for a certain group of applications, not always covering the whole issue. The proposed tool has been used for a certain section in management, namely to visualize the effects of prosumption. However, by changing the visualized environment, the tool could be used at all stages of managing the prosumer activity.

Basing on these considerations, it can be assumed that the proposed tool is both feasible and can be useful. Thus, a question arises, why it is not widely used. It seems that the current market conditions stand in the way. The GIS and ERP/BI software developed completely different paths and have completely different market characteristics.

ERP/BI software was focused mainly on supporting business operations and acted on the basis of a description of events and processes taking place in organizations, mainly based on quantitative data. Qualitative data were usually collected in other types of systems, such as CRM. ERP/BI class systems are largely national or regional.

Meanwhile, the GIS software is focused mainly on the visualization of geographical phenomena although its producers more and more often notice the possibilities of its use to describe economic phenomena (see, for example, Spatial Decision Support System systems – SDSS − eg. [Viavattene et al. 2008]). GIS class systems are usually international as well. It seems, therefore, that there are problems in closer integration between the two types of information systems.

Summing up, it seems that an indication of the applicability of this tool to appropriate software producers may, in future, affect the practical application of the proposed tool. It also seems that clients from companies providing services or manufacturing products based on prosumption principles should be among the most interested.

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