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Integration of spatial information resources on the example of utility companies in Częstochowa region

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Abstract

The paper concerns the problems of information system integration based on spatial information resources. The considerations deal with the environment of utility companies. The enterprises conducting business activity are simultaneously dependent on each other. Dependencies result from the location of infrastructure (water, sewage, power, gas and other networks). As an example, the development of new housing estates is dependent on cooperation across companies. The authors prepared the study's model of integration levels based on spatial information resources. They distinguished different aspects of information systems integration, including organization, technology, software, data dictionary and data integration. The model encompasses levels concerning one enterprise and leads to the e-community which contains different organizations from the region. The resulting proposed integration merges information resources from different kinds of information systems. The investigation performed by the Authors shows the level of spatial information integration in chosen utility companies in Czestochowa region. Currently the majority of investigated enterprises is at the basic level with elements of medium level (i.e. 2 - 3 levels in 5 degree scale). The research and spatial information market trends show that the model can be realized in the future.

Keywords: *Spatial information resources, information systems integration, GIS, e-community.*

Introduction

Utility companies such as gasworks, power stations, heating plants, water-sewage companies are a special kind of economic organization. On the one hand, they are focused on achieving the best economic results and on the other hand, they provide public service to the region. The specificity of these companies lies in the fact that in order to provide services they need appropriate infrastructure such as electrical grids, water supply networks, gas pipelines or transceiver stations. All of these create infrastructure systems in the region. Consequently the placement of each utility system to some extent depends on the location of other networks. As a result, each region is covered with a network of utilities supplying services. The smooth functioning of utility infrastructure determines the quality of regional life and very often even safety. The location of these networks and other related infrastructure is governed by the relevant legislation.

Companies use various information systems to perform service tasks. Although these systems are used for numerous purposes, to some extent they describe the same objects and information events. What emerges is a question of whether or not different types of information systems should be integrated and to what degree. More specifically, in the case of utility companies, the question of whether it is worth integrating the information resources of these enterprises on a regional scale in order to provide an undisturbed development opportunity for each entity is discussed.

Utility companies preliminary use Enterprise Resource Planning - Business Intelligence (ERP-BI) (Marakas, 2003) information systems, which are designed to record and analyze the internal events and processes implemented in enterprises. Information systems can also be used as support in the management processes of existing utility infrastructures and as a tool for planning of its development. Development of each infrastructure network should be treated as an investment therefore should be indicated on the proper landplan. For this purpose the use of Geographic Information System (GIS is necessary (Harvey 2008). However, sometimes other types of systems such as Computer Aided Design / Computer Aided Manufacturing (CAD/CAM) (Rao, 2006) may be used. The usage of various types of information systems usually results in the need for integration. The integration of information systems in the enterprise allows for arranging and aligning the data dictionaries used in utility companies and the relationships between the various descriptions of the same objects used in different systems. In this way the knowledge concerning individual objects (e.g. road infrastructure) available within the organization can be unified. This integration can also facilitate the planning of infrastructure development and maintenance processes.

Research Goals

In order to write this paper, research on the topic of the possible needs of the implementation and integration of the mentioned information systems in selected utility companies in Częstochowa was completed. The need for integration at the enterprise level and also the regional level were examined. This paper aims to define the level of computerization and integration of ERP-BI and GIS systems in the surveyed companies and identify the existing trends. The presented model of spatial information resources integration lays the groundwork for consideration and recommendations. The research was conducted based on the observation of technological development used in the scope of discussed types of systems, technological development applied in the scope of discussed types of systems, and a survey completed in support of this research. It was hypothesized that the he results of the research would not only indicate the current state of information systems computerization and integration in the discussed enterprises, but should additionally check the willingness to integrate their own systems with information systems of other utility companies. The outcomes of the survey were compared with the developed model.

Background

The specific of utility companies

Utility companies not only play an essential role in the proper functioning of regions, but also have an influence on its citizens' quality of life. Until recently many of them were a property of the state or local government. Although today most of these companies have been privatized and the competition (in the sectors of particular media providers) in the sector increased, their activity continues to have a strategic meaning for each region. As we know, nowadays it is difficult to imagine life without access to electricity, water, heating or telecommunications.

The management of utility transmission systems (infrastructure) is at the discretion of utility companies. Both the maintenance of the infrastructure as well as potential investments require records of owned and created systems, connections and other constructions. A characteristic of utility infrastructure is the fact that it runs through different geographic

areas, owned by various people. Additionally the location of utility infrastructure is regulated by law, including the mutual interdependence. It requires a spatial form of infrastructure. Basic systems used in enterprises, such as ERP systems, are not suitable for this purpose, therefore the GIS technology is necessary for utility distributors.

GIS allows for the spatial record of possessing infrastructure. GIS systems can be arranged by the record of data concerning the infrastructure and align it with the dictionary of capital assets described in ERP class systems. GIS facilitates, among other things, the location of the failure. It enables visualization, facilitates maintenance, and planning of infrastructure development. In the cooperation with other utility companies, the design of infrastructure development is also facilitated. Using solutions based on vector maps, at the designing stage compatible file formats enables an exchange of possessed maps for the purpose of taking into consideration existing routes of individual media positioning. Possibilities of visualization and animation available within the framework of contemporary GIS can be useful in many domains of discussed organization functionality. Construction of each infrastructure system is generally done independently without consulting other companies in the sector. However, each utility infrastructure location must be discussed and consulted with a public administration authority. Infrastructure development is treated as other investments which, in accordance with the laws, should be registered.

It is worth noting that the development of utility infrastructure can have a very significant impact on regional development. Its absence or inability of improvement can contribute to the decision on whether to create new residential, commercial or industrial zones or not. What is more, the possibility of checking utility infrastructure data is very important in crisis management. Taking all of the above into account, local government offices are naturally predisposed to be leaders of the integration process. On the other hand, their specificity lies primarily in carrying out the administrative tasks. Perhaps this role could be taken over by agencies for local development support appointed by local government offices. These agencies, however, have a smaller impact on utility distributors. In this situation the most favorable factor for the integration may be a sense of shared benefits achievable only through mutual cooperation.

Functions of information systems in utility companies

Companies use information systems for various information functions including the register (evidence), reporting and informing, automated analysis and control, planning, decision support, and increasingly for communications. The functional scope of systems results from both the informational needs of users, as well as from the laws that companies are obliged to obey. In the case of utility distributors in addition to the trade regulations, they are subject to specialized industry laws. The information system needs should be supported by appropriate information solutions. In practice, the implementation of IT projects depends on both the financial resources available to be spent on computerization and the level of technological solutions available from the market.

The common practice of applied information systems allows the distinction of the following types:

- Manufacturing Resource Planning/Enterprise Resource Planning (MRP/ERP) – systems used to register most of the events in the enterprise concerning economics and finance issues as well as business processes (supply, production and sale).

- Business Intelligence (BI) - systems for the analysis of the company's condition, they support higher information functions.
- Customer Relationship Management (CRM) - oriented customers and partners services.
- Computer Aided Design / Computer Aided Manufacturing (CAD/CAM) – systems for design) and manufacture of various components and objects (e.g. connections).
- GIS – enabling spatial location of existing infrastructure.

Companies can use various combinations of these systems. The mixture depends both on the sector specificity and its share in the vertical distribution system. Generally, the MRP/ERP type systems are most important in enterprises. They are used to create basic data which are stored in databases (DB). Modern MRP/ERP systems cover most areas of business activity. They usually impose terminology order and coding systems used across the enterprise and on the basis of collected data they describe the initial events (business events).

It should be noted that today's enterprises pay growing attention to communication processes with the use of communication and information tools. In this way, collections of electronic documents ordered in document databases (DocB) are gathered. These documents can come from external sources or can be made by internal company services. These documents do not always correspond with the company's terminology order and are not suitable for direct record in an MRP/ERP database system. They are also difficult to use in BI systems analysis. It should be emphasized that data (especially external data) should be additionally reviewed in terms of its authenticity. As a result, it must be assumed that companies collect various types of data sets from numerous sources (systems), not always connected to each other and describing their operation from many points of view.

Spatial information resources are data that may be assigned with spatial attributes, such as geographical location of objects described in the information systems (although spaces defined mathematically can be used). These objects can be visualized on maps. The ability of displaying the location of objects on the map along with their description (e.g., through the use of hypertext technology) can significantly facilitate descriptions of the selected aspects of business operations. For utility providing companies a key element is data describing the location of the utility infrastructure. For this purpose GIS systems are particularly useful, however CAD class systems or other specialized engineering systems using geological or surveying data are more useful for new object design. It is important to highlight that every utility providing company must use the basic version of GIS systems which provides basic information about the region (including data about geographic features: rivers, lakes, terrain, road network, and others). In order to design new connections or objects, data about the location of utility infrastructure is needed.

Proposed Model

The model of spatial information resources integration

Realization of spatial information resource integration is a complex process and embraces many aspects. For its realization, development of a certain integration vision and a road map indicating necessary steps is essential. Therefore the proposed model is not only multi-layered but it also determines integration levels. In these considerations five layers were identified (see Table 1 below):

1. Organization
2. Technology
3. Software
4. Data dictionary
5. Data integration

LayerLevel	Organization	Technology	Software	Data dictionary	Data integration
Lack of integration	Single employees	Lack of coherence between information systems	Incompatibility of information systems	Lack of terminology order	Independent event descriptions in various information systems types.
Basic level	Organizational unit	Data exchange between various systems types	Possibility of manual data transfer between systems	Terminology order at the organizational unit level	Data integration between chosen information system modules.
Medium level	Organization level	Information system integration at the enterprise level	Possibility of data transfer between systems used in the enterprise	Terminology order on the enterprise level	Data integration at the enterprise level
Developed level	Enterprises cooperation	Interorganizational spatial data interchange	Possibility of data transfer between systems used in cooperating enterprises	Terminology dictionary exchange between cooperating enterprises	Spatial data exchange between organizations
Destination level	Community	Cloud Computing	Development of common IT projects for spatial information	Unified terminology at the community level	Co-creation and co-visualization of spatial data at the community level

Table 1: The proposed model of spatial information resource integration in utility companies

Model Assumptions

The basis for model construction were factors analysed within the framework of undertaken IT ventures (based itself on Information Systems life cycles and Information Systems' structures). The second major factor was the analysis of accessible Information Technology (IT) tools and development directions of different types of IT systems. Informational needs were also important as indicated by subjects connected with construction and utilization of the medium infrastructure in individual regions.

The division on levels resulted from the distinction of certain characterizations of the state of Polish enterprise's informational needs. Those states were examined in the progress of consulting works realized by the Authors. Another level appeared as a result of following IT projects and refers mainly to the three first levels. The next two levels result from analyses of new possibilities given by contemporary IT tools and systems. The table above shows the characteristics of spatial information resource integration in each layer of the model. By analyzing the information systems integration levels in each utility distributor, their level of resources integration may be determined. The "destination level" indicates the integration

goal. Its characterizations are based on contemporary technological solutions available in the IT market. The authors do not exclude that, in the future, new possibilities may appear which will cause the distinction of new levels or modification of characterizations proposed and introduced in this model.

When defining "destination level", the following assumptions have been made:

- All utility companies in the region are interdependent in terms of location of infrastructure network.
- Each of them must keep individual records of their infrastructure resources using cartographic tools. In this case, the usage of GIS systems becomes necessary.
- These companies should use the same space and spatial data defining methods (then numerous spatial layers describing each type of infrastructure networks can be overlapped).
- Joint use of the same tools can operationally reduce costs of information systems and data access.

Therefore, while outlining a vision of spatial information resources integration in utility companies; it was assumed that it should lead to the creation of a virtual community consisting of representatives of all stakeholders (including the utility distributors, local authorities, agencies for regional development, etc.) which would use the same spatial information gathering and exchange tool (companies can store their secret data independently, however with the use of integrated systems). This tool could be based on Cloud computing technology. Additionally a common terminology dictionary and the symbolization system for spatially visualized data could be developed. In order to reach the "destination level" evolution of potential users, thinking and technology adaptation to customer needs are required. Undoubtedly, some outlay for the launch and adaptation of available tools and systems will be needed.

In the presented model subsequent steps of evolution according to distinguished layers were defined. Thereby a diagnosis of the actual state and identification of development direction is possible. In business practice appropriate stakeholders who would undertake implementation of this task would be needed.

In this paper the description of evolution was applied to each layer. The Organization layer seems to be most crucial for project success. GIS spatial data has a relatively short history in Polish enterprises. It should evolve according to the following steps. Initially the usage of GIS will evolve due to national regulations and the need for companies to have their own records. Next cooperation between selected organizational units for the joint usage of spatial data at the organizational level should occur. The next step is cooperation between chosen entities, involving data exchange (e.g. during the process of simultaneous infrastructure investments). The last step is active cooperation within the virtual community (Parks, 2011) Thanks to these communities an active undertaking of joint infrastructure projects (e.g. construction of new housing or new service or industrial areacreation) will be possible (Jelonek, Stępniak, & Turek, 2013).

The technology layer relates to the creation of technical conditions for the integration of different types of information systems and computer and telecommunications networks. The integration process begins with the purchase of a license for the use of certain types of information systems and then the creation of appropriate information and communication

infrastructures to enable usage of wide area networks. The next step is the integration of individual systems irrespective of the manner of their use, whether they are based on the company's own network or are obtained from the Internet (or other wide area network). For project success integrated systems should provide at least part of their spatial information resources in Cloud Computing technology.

The software layer involves selection of appropriate applications. The choice of software must take into account the compatibility principle. In other words, data exchange between different types of software is necessary. The integration should initially take place at the enterprise level and then at the community level.

The integration of spatial information resources in the concept layer refers to two aspects: ontological order of collected and visualized data, and defined homogenous spaces. In terms of data, the integration is carried out in two stages: at the enterprise and the community level. Firstly, the dictionary should be introduced at the individual enterprise level (system of concepts, symbols and codes that tasks performed on the stage of parameterization of implemented information systems). Then the principles of acquiring information resources from external systems (e.g. the Internet) should be defined and adjusted to owning rules. During virtual community integration, a company's internal dictionaries should be adjusted to the needs of joint communication. The integration of space can be solved by using the same single GIS system for all users so that data can be stored in the same places. In the case of using various GIS systems, mathematical converting of spaces between tools and changing of format of the spatial informational resource file may be necessary.

While integration in the organization layer is crucial for project success, integration in the data layer is the primary purpose. Integration in the data layer consists of creating possibilities of collecting special informational resources. Each company is legally obliged to collect particular data types. A company can do it only for that reason or it can also use their special information resources for the management system improvement or market position growth. Therefore, data stored in GIS systems should be harmonized with data stored in other systems. Data consistency across all systems reflects in terminology compliance, single registration of events (regardless of the system in which it occurs), and explicit spatial visualization. At the enterprise level, companies must purchase a suitable GIS software and all the necessary data. By joining the virtual community the enterprise gains electronic access to the GIS system and to the common data used by other users. By permitting access to their own selected spatial information resources the company gains access to other resources.

The Conducted Research

In order to empirically verify the model and assumptions, a pilot study of selected enterprises in the region of Częstochowa (Silesia, Poland) was carried out. The study focused on the questions of whether these entities were integrated (or need to integrate), have spatial informational resources, and which type of solutions from this area they used.

In the Częstochowa region as well as in many other regions of the country, there are numerous utility providing companies, including:

- The Water Supply and Sewerage Joint Stock Company of the Częstochowa District;
- Power and Heat company Fortum SA;

- Tauron Polska Energia SA;
- PGNiG - Polish Oil & Gas Company;
- Orange Polska;
- Sewage Treatment Plant Warta SA.

These companies can be easily distinguished because they have their own infrastructure and transmission networks of a physical nature. Without a doubt, there are also other media supplying entities in the city, however their business purpose can vary considerably. These may include city computer network CzestMan, cable television networks, and other companies offering information and communication services. Due to the convergence, their infrastructures repeatedly intertwine and have a virtual character. Due to this factor, these institutions were not included in the study. A similar situation occurs in the case of a specific medium which are the roads. Within the city they are subject to the General Board of National Roads and Motorways (GDDKiA), and local government Municipal Board of Roads and Transport (MZDiT).

In order to meet the study objectives, four companies with clearly outlined distribution network and infrastructure was carried out. These were: water supply, heating plant, power company and gasworks. Observations of companies, the study of their functioning principles and the considerations from "The Concept of Building Regional Spatial Business Community" indicated that these companies should not only work together, but should also create regional business communities. The quintessence of these communities involved an operation in the defined geographical area, mutual collaboration, cooperation and exchange of certain informational resources located in ERP systems, GIS or "the cloud".

Pilot studies (still to be continued) in the indicated companies were carried out in the first half of 2013. In addition to observations of their functioning principles and case study research, a survey questionnaire was prepared. It consisted of eleven questions divided into three major groups. The first group (questions 1 - 2) concerned the use of ERP/GIS by studied companies. The second group (questions 3 - 7) was included to gain information about the nature of organization informational resources and the rules for their usage. Finally, the third group of questions (8 - 11) concerned the integration of information systems used and the prospects for their development in the enterprise. The questions order in the questionnaire resulted from the model of spatial informational resources integration in utility companies. The geographical spread of the infrastructure (connections, ducts, nodes, etc.) is the essence of these organization’s functions. GIS systems allow for efficient analysis of their actual status, diagnosis and management. On the other hand the ERP systems include information concerning the resources of the entire organization, transactions, customer service, etc. Thanks to mutual integration of GIS and ERP systems the full analysis of the organization and its infrastructure is possible. Therefore, it is an essential element of comprehensive management.

Research Results and Conclusions

Research questionnaires were completed during interviews with persons from four companies entitled to provide this type of information:

- PGNIG – Upper Silesian Branch in Częstochowa;
- Fortum Częstochowa;
- The Water Supply and Sewerage Joint Stock Company of the Częstochowa District;

- Tauron Distribution in Częstochowa.

Complete information was not given in all situations. Respondents justified themselves citing trade secrets. Among others, the information about ERP and GIS product trade names was not provided. However, collected data can be a basis for comparison of systems and informational resource usage levels within the model.

The most complete results were obtained from PGNiG. The firm declared to use a whole range of MRP/ERP and/or BI systems. The basic solution used by PGNiG distribution in Częstochowa region is SAP ERP. Other systems are tools dedicated for gasworks and they included GAZELA, MEGAZ, WEBGAZ and PINKASO. As declared, these systems are used to register the location of the network and connections as well as for planning purposes. Indirectly, these systems support the records of gas consumption and demand.

Upper Silesian Branch of PGNiG also uses GIS systems. These are solutions dedicated to the gas distribution. They were designed and implemented for PGNiG activities. These systems are used for infrastructure register, fixed asset records and market analysis. Unfortunately, these systems lack full integration and so a double registry occurs. Dictionaries of terms have not been standardized either. Data transfer between ERP and GIS systems appear in the investment department and infrastructure maintenance.

The study results also proved that full integration between ERP and GIS is desirable. The possibility of automatic data retrieving from one system to the other would significantly facilitate work and management of infrastructure. At the same time, it would help the optimization of business processes in the gas distribution sector.

The second of the analyzed entities is a company that distributes the heat energy in the city - Fortum Czestochowa. As in the case of the gasworks, the primary IT solution is an ERP system. During the interview the respondent did not agree to reveal the software name. It can be assumed that it is TETA Constellation, because the system manufacturer admits to implementing this software. The system supports the company in the implementation of core business processes and customer service. Fortum also uses a GIS solution, called Termis. This system is used to register the location of the network and connections, as well as for planning purposes. Additionally, it supports the repair of the heating network. The similarities to the analysis of PGNiG are noticeable. ERP and GIS systems are non-integrated solutions. The transfer of information resources occurs exclusively in the area of infrastructure registration and maintenance and in the investment and distribution departments. On the initiative of the distribution department the terms and dictionaries have been unified in order to support the resource transfer. At the moment, Fortum has no plans for new ERP and GIS integration investments.

The next of the analyzed entities was a water supply and sewage company. The ERP system used in this company is a product of Microsoft Dynamics AX implemented by ASSECO Poland. The Water Supply and Sewerage Joint Stock Company of the Częstochowa District also uses its own GIS software. Similar to the other cases, it is used for the location of network and connections owned. Waterworks base on GIS systems also for the purposes of planning and system development. Aspect of the infrastructure register is also indicated as a key area in which integration of ERP and GIS is desired. The IT solutions used in the company do not require separate records in ERP and GIS databases.

Other systems data access and reading is possible in all functional areas of business. However full access to the systems, allowing data enhancement and modification, is possible only in the department responsible for the infrastructure maintenance. Data access and exchange of resources is possible through the development of a common dictionary. The integration of ERP and GIS in the functional area is done through a system of hyperlinks that allows data retrieval from one system into another. However, systems integration is incomplete and it is done through the exchange of files at specified intervals.

The last of the surveyed entities is the energy company Tauron Distribution. The branch in Częstochowa has implemented an ERP type system. The study did not disclose the name of the system. The ERP system supports the company in the implementation of key business processes. GIS systems are mainly used for network management and inventory. Tauron Polish Energy Group has been working on full integration of ERP and GIS technologies since 2011. Common terminology and dictionaries that allow automatic data access in accordance with the law are being developed.

The synthesized approach of the characteristics and scope of ERP and GIS systems is presented in Table 2.

Company	Systems features	Level
Gasworks	- ERP + support systems - GIS (network and connection register of localization and planning goals) - ERP and GIS Integration - NO - Joint terminology and dictionaries – NO - ERP and GIS integration need – YES - Planned investments in ERP and GIS integration – YES	Basic level
Heating plant	- ERP - GIS (network and connection register of localization and planning goals) - ERP and GIS Integration - NO - Joint terminology and dictionaries – YES - ERP and GIS integration need – YES - Planned investments in ERP and GIS integration – NO	Basic level (Medium level elements)
Water supply	- ERP + CAD/CAM - GIS (network and connection register of localization and planning goals) - ERP and GIS Integration - INCOMPLETE - Joint terminology and dictionaries – YES - ERP and GIS integration need – YES - Planned investments in ERP and GIS integration – NO	Basic level (Medium level elements)
Energy company	- ERP - GIS (network and connection register of localization and planning goals) - ERP and GIS Integration - YES - Joint terminology and dictionaries – YES - ERP and GIS integration need – YES - Planned investments in ERP and GIS integration – YES	Medium level

Table 2: Characteristics and scope of ERP and GIS systems

The information included in the table above indicates that every surveyed utility company in the Częstochowa region has implemented ERP and GIS systems. ERP systems are used in the implementation of key business processes. GIS systems are fundamentally used in the

management and recording of geographically spread transmission networks. The integration of ERP and GIS is a desirable state in all surveyed enterprises. In most cases, the transfer and sharing of informational resources are carried out semi-automatically. This is possible due to the attempts of terminology and dictionaries standardizations.

The attempt of comparing the study results with the proposed model shows that the utility companies in the Częstochowa region classify to "basic level" or "medium level". It means that in all cases, the data exchange between ERP and GIS within the organization is provided. However, companies are not interested in building lasting relationships or cooperating in the field of information resources with other companies. On the basis of observations, it can be noted that this results from the functional scope of the surveyed companies, where single organizational units are closely tied with their activity range.

Conclusion

The results of the conducted studies indicate an increasing degree of spatial information usage in distributing companies. The usability of GIS systems makes them indispensable in the functioning of these enterprises. However, these systems are still new solutions therefore they must reach maturity stage in order for the central management of the company to realize that a complex usage of GIS technology in the process of integration with other systems brings many benefits.

Some utility providing companies operate in a specific market segment where the competition is limited. Hence the persistence in functional systems and relatively low susceptibility to new investments in IT is noticeable. These companies have clearly defined market spaces and do not have to seek new markets. The model itself can be used in business. There are many factors speaking in its favor, including:

- The emergence of business solutions offering “GIS in Cloud”;
- The undisturbed increase of competition in the utility sector (already notable in telecommunication and energy sectors);
- Undertaking new mutual economic ventures;
- Increase of communication needs between subjects;
- Technical advantages of GIS (e.g. visualization and animation tools, the possibility of spatial analyses conducted, and the possibility of data import and export);
- The expected increasing role of government (both national and local is important, especially in development planning and in crisis management).

The pilot programs can already be introduced. It seems that in the future similar solutions will be regulated by law. Nowadays there is a need for successful practical solutions that would be approved by all interested companies. In the Częstochowa region, this concept is simply unknown, however, by observing the GIS technology implementation in individual enterprises, it can be noted that the development process proceeds in accordance with the described levels of the model. Additional problems result from the fact that most utility companies functioning in the Częstochowa area have head offices outside the region. Local initiatives have difficult possibilities of realization, while local branches are strictly dependent on head offices. That is why realization of the proposed model will demand overcoming many organizational, psychological, and of course financial barriers.

The present elaboration was a diagnosis of the current state. In progress research was presented with a proposed model which generally was treated as a new theoretical idea. The team who conducted the research will conduct further research on more fully specifying the model and elaborating the study of its feasibility.

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