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ENTERPRISE ACTIVITIES MODELING BY BPMN NOTATION

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Depending on the process behavior, available know-how and organizational goals, different techniques and tools can be used for business process modeling. We concentrate on e-commerce, and try to find the best marketing strategy for the sales process improvement. In the paper we present the multilayer approach to define enterprise scenarios. This allows us to collect the suitable knowledge necessary for enterprise analysis and improvement. Moreover, we use BPMN notation to formalize this approach and show its capability for the concrete example of an e-shop.

Keywords: process modeling, enterprise activities, BPMN notation and analysis, development strategy improvement

1. Enterprise as key element of development strategy implementation

To make progress in national development, suitable development strategy should be defined, prepared and consequently realized. Each such strategy consists of many different programs showing main development goals and directions (see Fig.1). One such program is called Program Operacyjny Polska Cyfrowa (POPC), which consists of three subprograms:

- Internet development,
- e-services design,
- digital skills improvement.

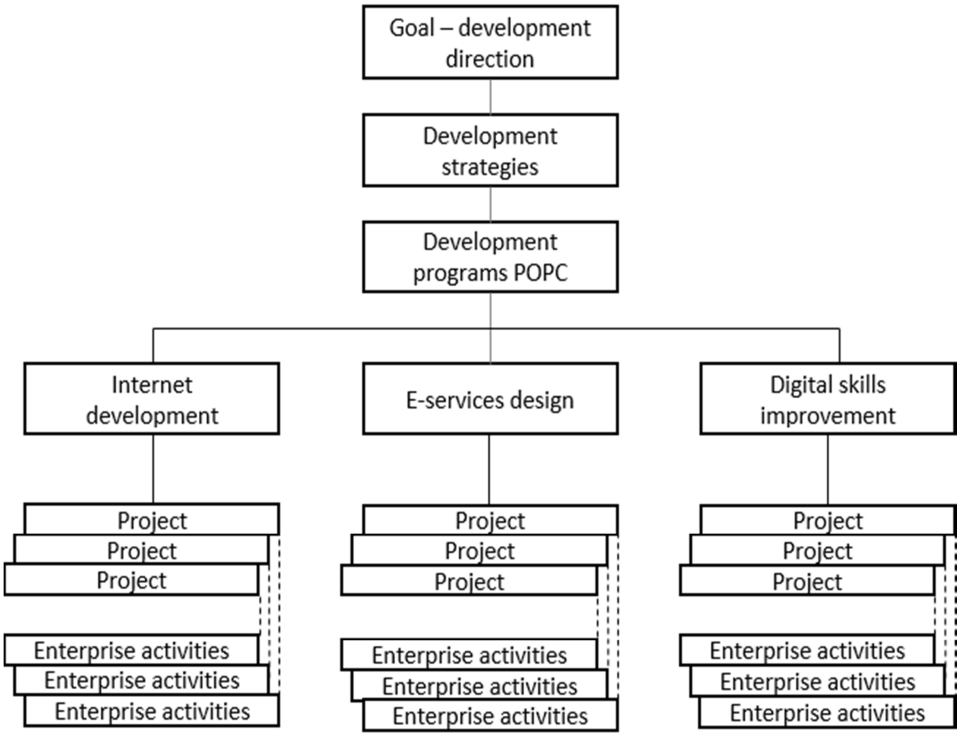

Figure 1. The role of enterprises in the development strategy

To implement the program and suitable subprograms, government organizations prepare special call proposals for project propositions. All propositions are detailed, prepared in a standard way, and are evaluated by reviewers; the best ones are accepted for realization. Such competitions allows the selection of the most important propositions, and increase chances for their reliable implementation. Particular project contains one or more well-defined activities called enterprise activities. Each such activity takes into account three aspects (see Fig. 2):

1. Predictable tasks/activities for the enterprise realization.
2. Organization, or a human team, for its realization.
3. Intra- and inter-legal, technical and organizational conditions.

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Figure 2. Three aspects of an enterprise realization

To achieve innovative solutions, information technology (IT) should be largely used to support implementation of each enterprise. Due to this, many activities design projects can be transformed into e-activities. In consequence, a chosen enterprise related to such activities is converted into electronic enterprise. The representative example of such changes is the transformation of a traditional shop into an e-shop. The POPC stimulate these kinds of transformations. The digitalization degree (*dd*) can be expressed by the following formula:

$$dd = \frac{\text{the number of electronic enterprise activities (e - services)}}{\text{the number of all enterprise activities (services)}} \tag{1}$$

In many cases different activities of the considered enterprise can be implemented either as services or e-services. If the number of e-services increases, the *dd* value also increases. This only a necessary condition to improve the whole enterprise. Besides, it is important to achieve the main goals of the considered enterprise. It means that all services must be well chosen to enterprise activities. It determines the sufficient conditions for enterprise improvements. To illustrate it, we consider an improvement to e-shop activities.

2. Knowledge discovery for enterprise understanding

In general, a business enterprise [6] consists of many human activities supported by different IT software. To get knowledge about these processes we should monitor human behaviour, and some computer actions. Fig. 3 shows five layers of elements of different approaches to create suitable enterprise scenarios. Firstly, we should monitor the majority of activities (communication, calculations and data acquisition) to discover knowledge about the analysed enterprise.

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Secondly, based on this, we define and design (if they are not available) some services (including e-services) to design enterprise scenarios.

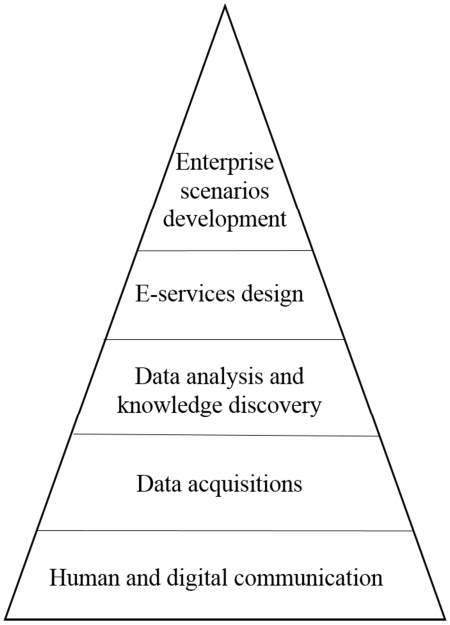

Figure 3. Layered organization to create enterprise scenario

In Smart Organizations [4] such procedures are much easier to implement. One of the sources of data is e-mail and SMS supporting communication among members of enterprise teams. Another is devices installed in the area of team activities. Currently, a favourable solution is IoT (Internet of Things) technology. It allows you to determine many content parameters referring to the time, place of localisation, and other conditions impacting on organization behaviour. Extra monitoring systems of special procedures analysing software behaviour can gather data from some intra-organisation and inter-environment. The collected data are the base to discover some rules referring to team activities. Additionally, we can determine what kind of functionality is needed, and what level of quality is required. Based on this knowledge, the proposition of different services can be determined, such a set of services allows you to build scenarios of enterprise activities. In Fig. 4 an example of such a scenario is given, where we can distinguish human and computer activities.

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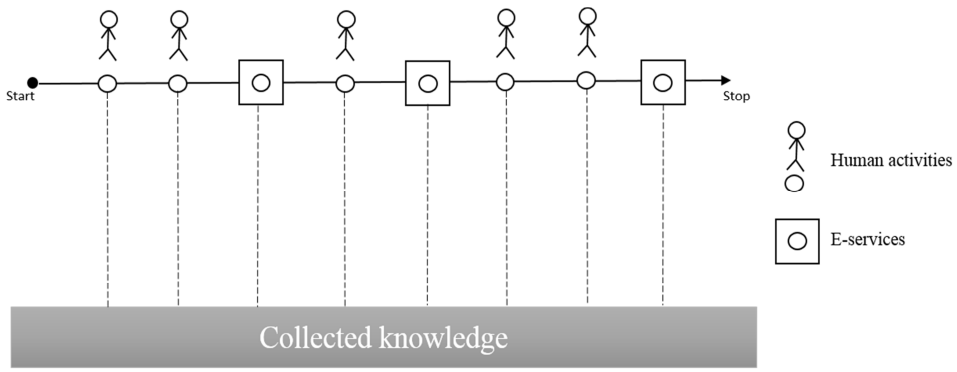

Figure 4. Idea of an enterprise scenario

In the case of an e-shop [2], the accumulated knowledge enables the improvement of product sales, and determines its strengths and weaknesses. Such an approach allows recognition of the history of sales of the selected product, current customer preferences, and consider the important (from client point of view) attributes of the product. These characteristics impact on product price, but also allow to improve the positioning of the product on the website, or to prepare a promotion product on the popular portals, and also propose new proposition purchase, which combines the simultaneous sale of two or more products. Analysis of these different variants of proposition of selling improvements are not simple, because they need exact knowledge about customers and the market. This example underlines once again how it is important to gather different types of data, even for such a not too complex enterprise. Obviously, it is possible to use other more classical approaches, which usually require the work, for solution of this problem, of a number of experts. The IT support significantly reduces the number of engaged human resources in such an improvement process.

3. Design of enterprise scenario

The considered e-shop, where its main functions are shown in Fig.5. We can distinguish four main activities:

1. Recommendation of the suitable shop for a client.
2. Product promotion.
3. E-payment for the product.
4. Logistics of the product.

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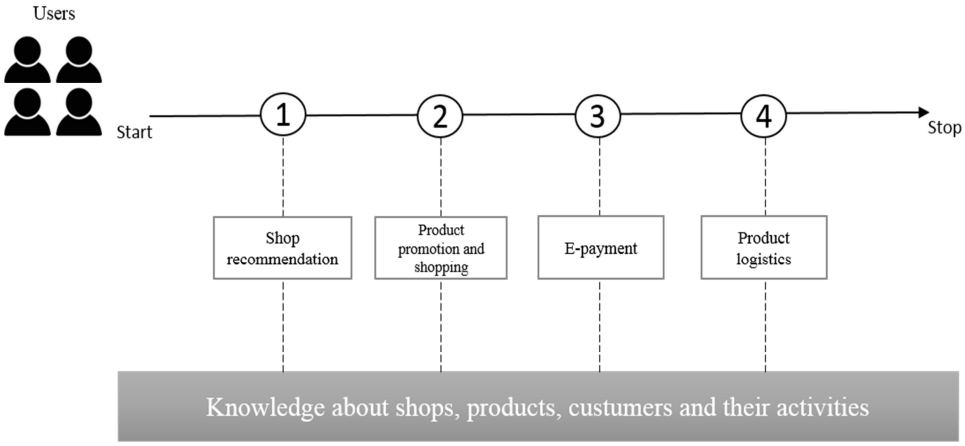

Figure 5. Scenario of e-trade realization

Different types of IT tools and platforms are able to collect extensive information about products and customers. Such scenarios, as shop recommendations, may be implemented as an internet service, but the promotion of products requires more human activities. In turn, the charge for the product is a typical e-banking service, but of the pointed-out products, logistics needs again relevant human activities. Our main goal is to improve the selling process, and express it by a suitable improvement scenario.

The scenario we define using BPMN (Business Process Model and Notation). The BPMN approach [1] allows one to present enterprise activities in graphical form. The main elements in such a proposed model are called lanes, which define the services name by which they act (e.g. the tasks in the project). The lanes can also represent the IT services. The model contains various types of symbols where circles present an initial, intermediate, or final event. Activities are defined by rectangles, and gates by rhomboids. The arrows in turn indicate the flow of data (sequence flow). A diagram of the model representing product sales improvements is shown in Fig. 6, it has been realized by using the IBM Process Designer tool. The tool is available at the Centre of Excellence (CD) NIWA [3] operating in the computing cloud at the Academic Computer Centre in Gdansk (CI TASK). E-services supporting the entire process were marked in a grey color.

List of activities presented in the model (Fig. 6) describes Table 1.

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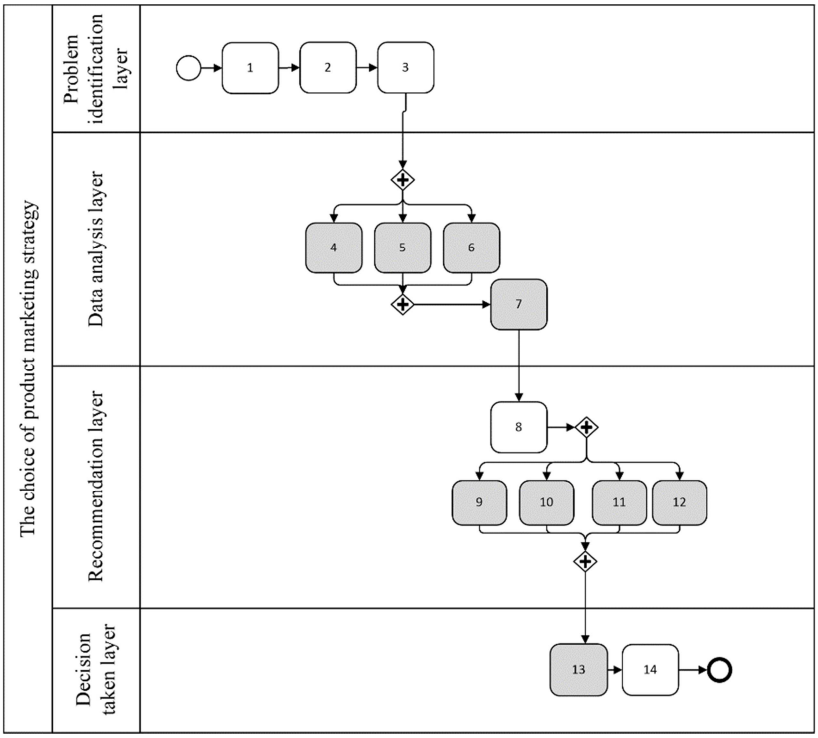

Figure 6. An example of enterprise scenario written in BPMN

Table 1. Product analysis steps

No.	Activities
1.	Discover the existing problem in the e-shop e.g. excess of stock
2.	Make inventory for specific products having some problems
3.	Make marketing analysis for this product e.g. for mobile phone product No. 00X
4.	Identify relevant attributes of product No. 00X
5.	Recognize customer preference choosing the product No. 00X
6.	Keep history of selling a product No. 00X
7.	Provide the results of a comparative analysis of alternative products
8.	Prepare of marketing strategy for the product No. 00X
9.	Reduce price of product No. 00X
10.	Improve the positioning of the product on the e-shop website, product No. 00X
11.	Advertise product No. 00X on the popular entertainment portal
12.	Make promotion, referring to the purchase of the product No. 00X, extra accessories to the product
13.	Present obtained results
14.	Select the best strategy by the shop manager

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The proposed approach can be used to analyse the behaviour of the improvement enterprise for different product and existing market conditions. In the case of an e-shop it is possible to consider several previously discussed approaches. Assuming that the available knowledge follows from the following information: users interests, reference to purchases of the competition, the popularity of the products concerned, effectiveness of the marketing (ranking position on a page describing the product) and appropriate sale recommendations of groups of products. Considering the above possible strategies will improve levels of product sales.

4. Analysis of BPMN improvement enterprise

The presented scenario (Fig. 6) starts with the e-shop employee, who signals the problem of products excessing storage. He thus wants to get wider information about the current status of the products in the storage. In this case, mobile phones are taken into account due to the knowledge base, e-shop information processing system is able to send information about particular phone models, and their current inventory levels. The employee receives the desired information an e-service, and on this information base selects the mobile phone models, from further analysis. The chosen characteristics of the product are compared to alternative products existing in the market. The analysis considers three categories of characteristics:

1. Relevant product attributes - price, warranty, possible service, position of the product on the e-shop website, kind of advertising or promotion.
2. Customer preferences – impact of product marketing on user decision to visit that shop. Frequency of e-shop visits, the most frequently chosen products (product sets).
3. Sales history - monthly sales performance of the given product.

The system automatically presents the results of a comparative study of the particular category of the products. Based on this, the e-shop manager will be able to prepare new sales strategies increasing the popularity of the product among customers, and increase the rate of sales. In the presented model (Fig. 6), the manager decided to prepare four different types of sales strategies: price reduction, improving the positioning of the product on the shop website, advertising it an entertainment portal, and increased promotion of purchasing. For each of these strategies the model is analysed to evaluate the profitability of these strategies. The expected increase in both the number of customers visiting the e-shop, and the estimated sales rate are predicted. The BPMN tools [5] allows you to make simulation scenarios, and point-out the most efficient strategy.

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Table 2. Results of the analyzed strategy

The number of possible strategy	Product price	Estimated the mean number of product selling	Estimated the mean product monthly sale volume	Current product sale volume	Increase of sales rate	Current the mean number of clients visits on the product website	The mean number of clients visits on the product website	Increase of the number of clients visits on product website
1	750 *pln*	45	33 750 *pln*	25 600 *pln*	31%	603	1130	87%
2	800 *pln*	51	40 800 *pln*	25 600 *pln*	59%	603	1262	109%
3	800 *pln*	40	32 000 *pln*	25 600 *pln*	25%	603	985	63%
4	800 *pln*	37	29 600 *pln*	25 600 *pln*	16%	603	920	52%

The result of analysis are shown in Table 2. The strategy number 2 in this case is the most promising. It means that improving the position of the product on the e-shop website will bring the greatest benefits. In consequence, the popularity of the product among clients can increases, and monthly sale rate will increase about 60 %.

5. Conclusions

We present universal approaches to modelling different scenarios for the enterprise activities. It was highlighted that it is acceptable only in case of existing and adequate knowledge regarding to the market state, e-shop activities and client behavior. Gathering this type of knowledge, it is more likely that traditional projects will be transformed into some e-projects. The construction of enterprise scenarios requires the creation of appropriate IT services. At the present stage of system development it is important to build knowledge bases, which is a big challenge not only for functional reasons, but also because of the legislation (confidentiality issue). The proper construction of the knowledge base, and its correct contents, impact on the quality design of appropriate scenarios. Moreover, the further analysis of such scenario is possible, and proper advice on the best marketing strategy can be done. This approach is most real in the so-called Smart Organizations, where collection of required knowledge is easy to obtain. Then, using a BPMN analyzer we are able to trace different possible marketing strategies, and analyze the more suitable market conditions for improving the sales rate of some products. However, for practical use, further improvement of the proposed method is required. Additionally, new kinds of e-services supporting such analysis should be developed and interpreted with the BPMN tool.

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