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APPLICATION OF GIS TECHNOLOGIES IN MANAGING PRODUCT DEVELOPMENT

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ABSTRACT
The development of new products requires application of sophisticated technologies. Current global business management presupposes the selection of adequate partners capable of providing technological support to new products. The technology which provides business solutions based on the analysis of the spatial data is titled GIS, i.e. geographic information systems. As an element relevant to rendering decisions in managing product development GIS is geared towards integrating geographically different participants involved in product development e.g. institutions, companies, faculties, etc. The paper presents business structure of product development by the application of GIS technologies, which includes new product ideas, work on construction and technological materials, building prototype, the realization of null-series and implementation of alterations.
Key words: managing product development, GIS, UML

1. INTRODUCTION
Product development involves the following issues: selection of ideas for a new product,elaboration of construction documentation of a product based on a new product development plan, elaboration of technological documentation of a product based on the new product development plan, building prototype, and realization of the null-series, if foreseen, based on technical and technological documentation for prototype and the null-series, implementation of alterations into technical and technological documentation.Product development is based on a New Product Development Plan, and it includes recommendations arising from the production and information obtained from the supply. In addition, it observes licences and standards, and internal standards. Figure 1 presents a business diagram of product development activities.

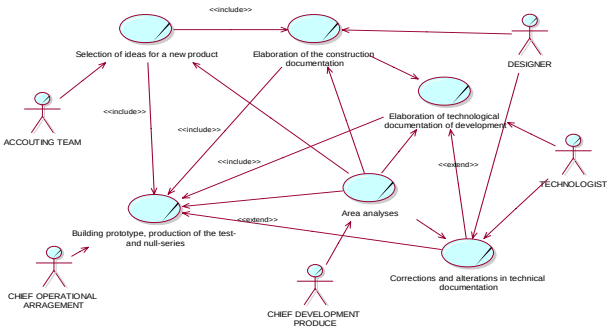

Figure 1 Diagram of business cases in product development

2. SELECTION OF IDEAS FOR A NEW PRODUCT

Product improvement or product development begins with generation of ideas in terms of the manner a product should be improved, or how to use current scientific and technological knowledge so as to contribute to the development or advancement of a product already in a production programme of an enterprise. It is market demands, customers' complaints and applied new product ideas that impose the selection of ideas for a new product. The selection of ideas is applied within the procedure for the development of a new product considered as the base for the formation of the development proposal which comprises the following:Gathering applications, Selection and assessment of an idea and Analysis of possibilities for the introduction of a new product. *Gathering applications* is according to the following information resources:Application of an idea, as induced by a customer demand, Customers' complaints, Information on domestic and foreign markets, etc.Servicability and completeness of the 'idea application' and potential attachments are checked. The formed application is entered into the 'Registar of the new product ideas'. An initial analysis of the applied ideas in terms of its compliance with strategic objectives of an enterprise as well as the estimation of quota shares and prices is performed. *Selection and assessment of the idea* – An assessment team is set up with the following assignments: Defining resources for generating new ideas, Organizing preconditions for permanent generation of ideas, Defining assessment methodology, Defining criteria for acceptability of ideas, Unbiased assessment of all gathered ideas, and Elaboration of a plan for awarding new ideas. *Analysis of possibilities for the introduction of a new product* – The analysis of possibilities for the introduction of a new product includes

3. THE ELABORATION OF THE CONSTRUCTION DOCUMENTATION

The elaboration of the construction documentation links the following issues: elaboration of the preliminary design, product design, product design and construction and tools and equipment design.

Elaboration of the preliminary design is a complex procedure that includes the following steps: methodological approach to designing, developing mathematical models (models of characteristics, processes, products, analysis of a mode behaviour), sensitivity analysis – parameters that influence a product efficacy, analysis of compatibility among subsystems, parts and constructions, optimization – the best possible approach to designing, future orientation – prospective solutions, testing project design, simplification of conceptually designed product – elimination of requirements that do not influence the efficacy but increase complexity and costs. *Product design* represents an artistic interpretation of technical requirements for a product which searches for the solutions to the esthetic aspects of a product (harmony, shape, colour, etc.) that are pleasing to customers. The input for the product design include: technical requirements for a product, construction analysis (necessary for shape design and product functionality). The output is the model of the designed product manufactured from the adequate material and size. *Product design and construction* - The major activity performed here is designing and elaboration of construction documentation which is compiled through the following phases of development (producing prototype documentation for both null-series and the series).

Tools and equipment design is performed according to the requirements for the manufacture of tools which, besides the construction drawings, comprises technological proceedure for the product tool. For the purpose of developing of a new product, PLOTTING of tools and equipment required for the realization of the development of the trial (which do not exist in a real form) is performed.

4. ELABORATION OF TECHNOLOGICAL DOCUMENTATION OF DEVELOPMENT

The elaboration of technological documentation is the next step to be performed by the department of development. All the necessary operations, materials, tools and other parameters are defined and described by the technology. The elaboration of technological documentation links the following activities: Elaboration of technological procedure of development, Determining tools and equipment and Completing tools and accessories. *Elaboration of technological procedure of development* – The first step is defining heading of the technological procedure related to a detail (part) of the technological procedure. As a single detail requires a number of different variants of a technological procedure, it is necessary to precisely define the variant of a technological procedure. *Determining tools and equipment* – Tools and equipment need to conform to the appropriate operation of the technological procedure. Since prototype and a test series are needed, tools and equipment should be

constructed from available components. In case of the null-series, tools and equipment utilized in the assembly-line production are used. *Completing tools and accessories* for prototype and the null-series is done in the toolroom, and it is based on construction drawings and accesories. This is followed by the construction of the null-series tools and equipment whereupon the head of the toolroom submits a request for the test. Based on the test report, functionally working tools are then forwarded to the toolroom storehouse via a transfer document. Defective tools are returned to the toolroom for repair.

5. BUILDING PROTOTYPE, PRODUCTION OF THE TEST- AND NULL-SERIES

One of the key phases of development of a new product is building a new product prototype as well as the realization of the null-series of the product, if forseen by the development plan. This phase is subsequent to those of design and construction, and elaboration of technological production procedure, the latter being the final phase in a new product development. Similarly, the phase is considered as a test of readiness for the assembly-line production. Building prototype, production of the test- and null-series bring the following issues into connection: Labor order maintenance, Building prototype, Production of the test series and Production of the null-series. *Labor order maintenance* – In order to monitor costs of release of a new product, according to the pro forma invoice, a request for opening labor order is needed to be submitted to the officials. The request should also include the attached pro forma invoice. *Building prototype* - The step that follows finalization of tools is building a new product prototype, which is based on the construction documentation labelled 'for the prototype' which is temporarily maintained either in a separate section of the Technical preparation archives or in the Service that designed it. *Production of the test series* – The finalization of prototype is followed by the correcting the prototype documentation whereupon the construction and technological documentation for the test series is completed. The contents of the documentation is identical to that of prototype nonetheless the latest is to be considered as a permanent-basis documentation. *Production of the null-series* is based on technical and technological documentation labelled 'null-series'. As it can be seen, the null-series is not only the test of success of the work realized by the design and construction services, but also the test of success of the new technology. The final document is the report on results of the realization of the null-series.

6. CORRECTIONS AND ALTERATIONS IN TECHNICAL DOCUMENTATION

When speaking of 'corrections' and 'alterations' in technical documentation of the basic activity considered as part of the total organization system of an enterprise, we have to be acquainted with basic postulates of the enterprise, since the solutions to the problem of corrections and alterations, as well as the meaning of the very terms 'corrections' and 'alterations', are directly governed by that knowledge. In our production environment, the development function is most commonly related to the one operation sector, whereas the operational and accompanying functions (technical preparation and production) are carried out within the production drives.The terms 'corrections and alterations' of the technical documentation of the basic activity include corections and alterations of technical documentation related to the basic activity of the enterprise.Corrections arise from mistakes, and changes are the outcome of new construction and technological solutions aimed at achieving improvements.

7. THE APPLICATION OF GIS TECHNOLOGIES AND MANAGING NEW PRODUCT DEVELOPMENT

GIS technology is to be applied within all the phases of development management, from the selection of new ideas for a new product and the elaboration of construction documentation, past the elaboration of technological documenation of a product and building prototype, to the realization of the null-series and implementation of alterations within technical and technological documentation. As for the **selection of ideas for a new product**, GIS technology should provide top management with a more comprehensive survey on patents and innovations related to the development of the product in question. This survey should be grounded on the analysis covering various geographical sites, and can be classified as it follows: Analysis of ideas gathered on a regional basis and potential implementation, Analysis of published papers in respective field by region, Analysis of legal opportunities (e.g. Digital signature) by region, Analysis of stimulating measures provided by the state, Analysis of geographical connections among institutes, faculties and enterprises. Within the field of **elaboration of**

construction documentation, GIS technology should analyse engangement of designers by region, and should include Analysis of the number of qualified engineers in a region required for the development of new products, Analysis of investments into an enterprise within the product development field. Within the field of **elaboration of technnical documentation**, GIS technology should analyse engagement and connections among institutes, faculties and capabilities of production drives. Similarly, it should include the analysis of geographical conditions under which a new product will be utilized (air fluctuations, climate, quality of roads, etc.). As regards **building prototype and the realization of the null-series**, GIS technology should provide a product development firm with an analysis giving particular reference to the number of the realized new products and duration of the realization, as well as the equipment of engaged firms. The analysis of accredited laboratories (by region) and their possibilities for their introduction into the process of a new product development. The implementation of **alterations on technical and technological documentation** necessitates conducting an analysis of alterations that need to be made within the scope of future application of the product, which are associated with different regional factors (air fluctuations, quality of roads, air humidity, salinity, etc.)

8. CONCLUSION

As the decision making element, GIS precisely defines activities and provides monitoring of the very process of performing tasks and outcomes thereof accordingly.The conducted analysis of the the activities has to provide answers to questions related to the defining of all business activities as well as to the rationalization of the administration operations. The analysis should give a comprehensive description of all activities of product development thereby showing respect to all partners included in the business. This analysis is to be considered as a base for defining and standardizing the organizational structure associated with the product development, as it specifies the activities assigned to employees. In addition, the analysis is the base of the implementation of standard requirements ISO 9000: 2001

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