Analysis of Design-Technology Workflows in the Conditions of Large Enterprise

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Abstract. Authors propose the analysis of design-technology workflows at large design manufacturing enterprise, the-level structure of workflows according to IBM Rational Unified Process methodology is developed. The problem to coordinate (approve) the design-technology documentation is studied, the author's model of a Petri net modeling standard workflows under approval of design and technological documentation is developed.

Keywords: Workflows · Business process · Enterprise

1 Introduction

Activity of any enterprise can be considered as set of the processes directed to achievement of any collective purpose, whether it be design, production, work with clients and so forth. During these processes, basic data will be transformed to the end result which quality depends on a set of factors. Let's list some of them:

- existence of the modern means of production allowing to gain the maximum income from activity of the enterprise at simultaneous minimization of expenses;
- use of the professional software, and also optimum compliance of its opportunities to solvable production tasks;
- organization and quality of management of productions and resources of the enterprise (financial, technical, human);
- quantity and qualification of employees.

Pay to the first and last points a close attention, including them the factors which are not subject to doubt, pompously the second point today the majority already agrees. The importance of the third factor (the organization and quality of management of productions), perhaps, yet is not so obvious.

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One of conditions of productive work of the enterprise is effective interaction of all divisions and structures making it. The information flows capturing the production essence move on a chain. Tasks are transferred from the performer to the performer. Owing to a set of the reasons (organizational, technical, subjective) the speed and reliability of data transmission are not always satisfactory. Information can be distorted, delayed, not be transferred at all. All this not in the best way affects the speed of achievement of the end result and its quality.

Will help to remove these problems (at least partly) the technology designed to arrange activity of the enterprise, having presented it in the form of the sequence of accurate procedures - business processes, control of which is exercised automatically, according to the predetermined rules. Such technology in modern systems of document flow is called workflow.

For the last 20 years the set of program systems for management of workflows is developed. Most of them is oriented to electronic document management (for example, 1C, DocVision). And only some organizations develop the software for project management (for example, MS Project or Pilot-Ace of the company ASCON, ELMA). These systems have a number of problems when developing workflow which will be considered below in more detail.

Now in software solutions of most of the advanced vendors of data management systems there is a workflow module: Siemens PDM, Lotsia PDM. The ASCON company has such development and: The PILOT of workflow is one of system modules of management of engineering data and life cycle of the product LOTSMAN: PLM. It is intended for modeling of worker processes and management automation by job flows.

To show opportunities the PILOT of workflow, we will consider stages of creation and implementation of the business process capturing the essence of mining process of a set of design documentation. The PILOT of workflow is the key to effective work correctly performed tuning of system which should take place in close cooperation of the qualified system administrators and specialists possessing the complete information about productions and information flows of the enterprise.

Article has the following structure. In Sect. 2, the list of standard problems with workflows is submitted briefly. Section 3 supports-level structure of the organization of business processes. In Sect. 4, the standard business process model to coordinate the design-technology documentation is presented. Outputs and the further directions of researches are presented in the conclusion.

2 The List of Standard Problems in Workflows

1. Dynamic change of business processes includes:
   - adding new blocks of business process (tasks and procedures). It is realized in almost all existing management systems.
   - removal of excess blocks of business process (tasks and procedures). It is realized only in few existing management systems. This function is implemented by creation of the new version of the procedure (function) of business process on which new workflows are started, and old continue to be performed in the old version

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of the procedure (function) of business process. For a solution of this problem, it is necessary to carry out the analysis of the started workflows regarding a possibility of translation them on the new version of the procedure (function) of business process. Complete tasks, as a rule, do not change.

- adding new context variables for tasks and procedures. In the existing management systems workflows, adding new variables is possible only on condition of creation of the new version of the procedure (function) of business process, with all that it implies, described above.
- removal of context variables for tasks and procedures. Variables are defined at the level of start of workflow therefore removal of variables is caused by some difficulties, but are not critical. If information entered earlier is not necessary at the moment, then and removal it should not cause any difficulties.
- adding and removal of the predetermined (constant) variables which act on the level of all business process is almost absolutely impossible. In this case it is offered to create the new version of the business process, with restart of all static (constantly started) tasks.
- not the basic changes made to logic of business processes within certain variables, usually do not cause complex problems.

2. The analysis of integrity of business process on existence of hangups, cyclings and an extremity.
3. Implementation of workflow management systems on the basis of the developed business process. If for business process wiring design, there is a weight program providing, such as MS Project and so forth, then implementation of management systems workflows is carried out most of large developers PDM and ERP of systems is not dependent from each other. Also, developers of systems on document flow (1C, DocVision) and management systems of projects get to this category of developers (Pilot-Ace of the company ASCON).
4. Role concept. Appointment to the post, assignment of performers.

3 Standard-Level Structure of Workflows at Large Design Manufacturing Enterprise

In methodology of IBM Rational Unified Process, the object-oriented approach in which the coordinated workflows are selected is used: The 6th main design process (business modeling, requirements, design, implementation, testing, deployment) and 3 processes of support (configuration & change management, project management, environment). In Fig. 1 the scheme of problems of a flow “Design-technology preparation of production” is provided in Rational Unified Process technology which is one of examples of normative workflows.

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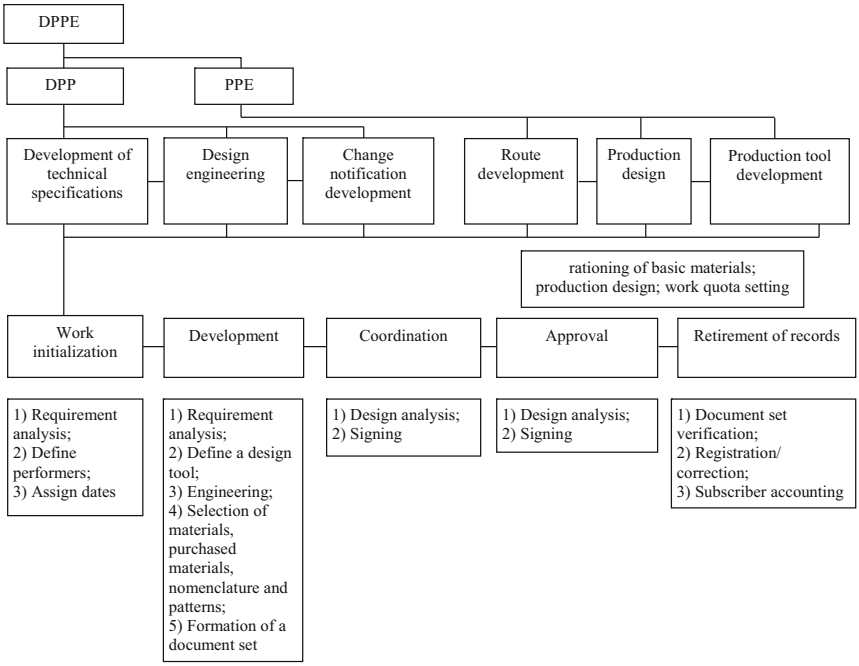

Fig. 1. Design-technology preparation of production in methodology of IBM Rational Unified Process

In the DPPE, DPP, PPE, Development of technical specification, Design engineering, Change notification development, Route development, Production design, Production tool development are shown standard tasks. For example, Development of technical specifications:

1. Work initialization;
2. Development;
3. Coordination;
4. Approval;
5. Retirement of records.

In turn 1. Work initialization contains the following list of works:

(a) Requirement analysis;
(b) Definition of performers;
(c) Assign dates.

4 The Standard Business Process Model to Coordinate the Design-Technology Documentation

The stage to coordinate the design-technology documentation contains two levels: upper (Fig. 2) and lower (Fig. 3).

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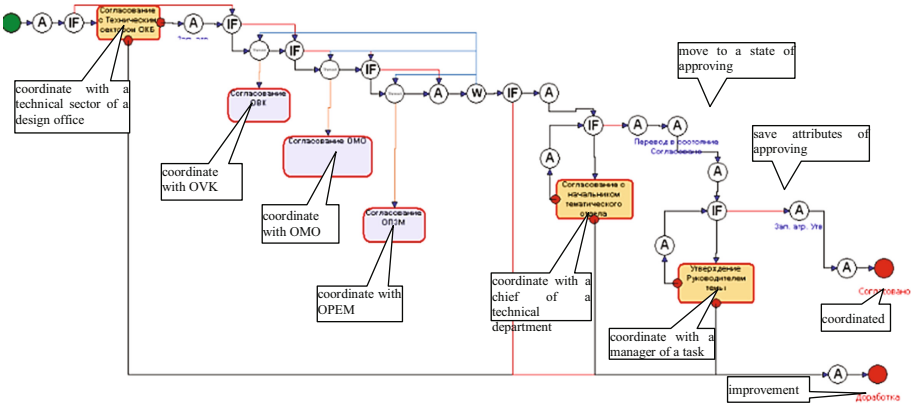

Fig. 2. Top level of the coordination

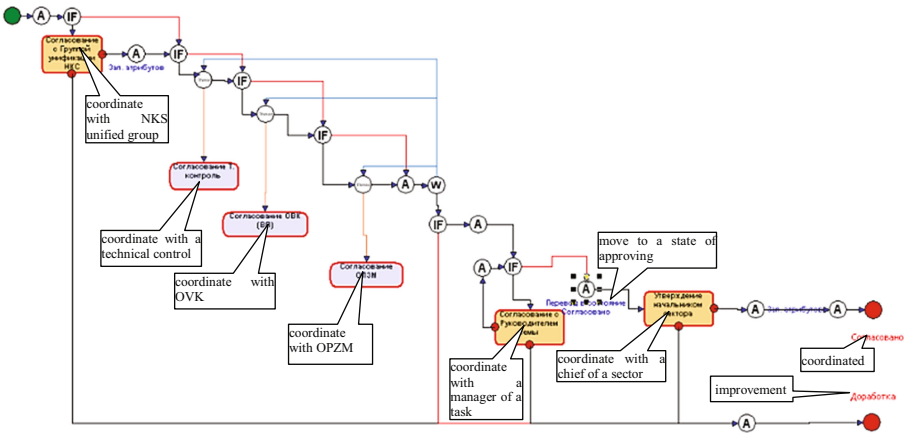

Fig. 3. Bottom level of the coordination

The top level represents the laboratory coordination in respect of a correctness of the scheme (verification of electric circuits, nomenclatures, etc.). The bottom level represents the coordination of construct (technology of radio mounting, etc.). The specified workflows are presented in the specialized language allowing to organize conditional and side-by-side execution of works. The topological correctness (especially in respect of deleted "And", "OR" branching and their merges) is offered to be carried out by means of the author's device of RV grammars [1–5, 11–13]. Authors develop the dynamic model (based on a top and bottom level of the coordination) on the basis of a Petri net (Fig. 4) allowing to carry out the analysis "in general", and its detailing to solve a problem of integrity of business process.

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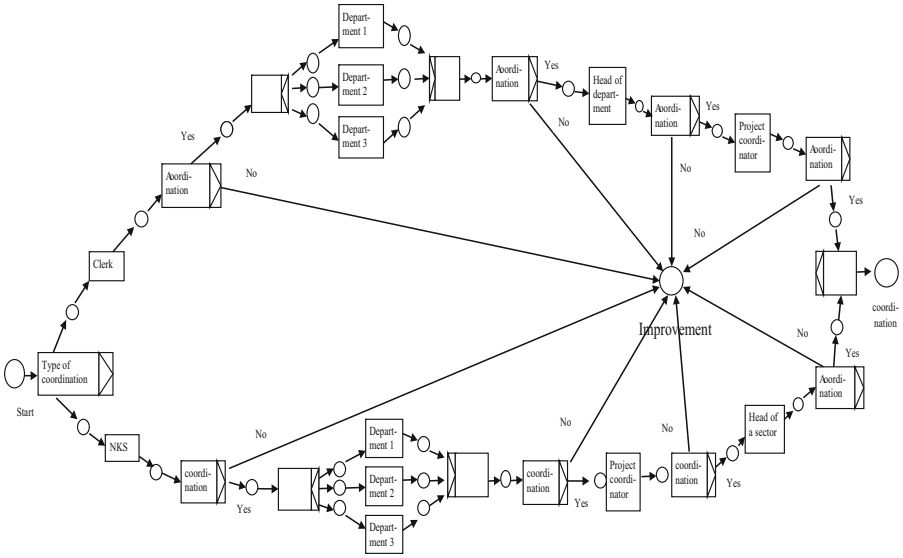

Fig. 4. Dynamic model of a stage of the coordination on the basis of a Petri net

In Fig. 4, the transition "Department" is a unit of the enterprise as a technical sector and etc., and the transition "Coordination" is a consultation with the head of a sector, a chief and etc. Token movement in such net means a workflow.

5 Conclusion and Future Work

In this article, we analyzed business processes of design-technology preparation of production of large design manufacturing enterprise. Developed the author's scheme of standard workflows, and also developed a workflow of design process to coordinate the design-technology documentation. The topological analysis of the scheme of a workflow is offered to be carried out by means of author's automatic RV-grammars. The model of design process of approval on the basis of Petri nets is developed. In future works of authors, the analysis of a business process model to coordinate the design-technology documentation in respect of vivacity, accessibility will be carried out.

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