

PRODUCTION-EDUCATIONAL ANALOGY AS A TOOL OF SYSTEMS DESIGNING OF PROFESSIONAL STAFF TRAINING FOR AN INDUSTRY

M.A. Ivlev

Nizhniy Novgorod R.E. Alekseev State Technical University

Abstract: Aspects of the professional training of personnels – the aspects important for the customers of specialists – hi-tech industrial enterprises are considered in the article. The analogy of industrial and educational innovations and technological processes is offered. The types of over educational innovations corresponding to the classic industrial innovations are brought. It is shown on practical examples, that transfer of different types of industrial production into the sphere of trade education is the effective instrument of the systems planning of personnels training for industry.

Keywords: educational innovations, types of industrial manufacture, project management.

Aspects of vocational training

The development of innovative activity (*IA*) of educational establishments, construction of innovation models, promoting to development and distribution of innovations in system of vocational training (*VT*), is an actual task [1]. For its decision it is expedient to construct logic connection *VT* with a nature and kinds *IA* in industrial manufacture, that is necessary for perfection of educational process and raising the quality of the educational programs. The training of specialists in technical high school is carry out for satisfaction of needs in the staff of an industry. The development of the last takes place as cycles according to change of the technological orders in public manufacture occurring to "long", "average" and "short" cycles. Each cycle, since its origin, includes stages of growth, saturation, domination and, at last, recession (fig. 1) [2].



Fig. 1

Task of the managers and specialists of the industrial enterprises is the duly transformation of manufacture on the new technological order, as the delay on a former level of development causes inevitable fall of competitiveness. Innovative activity, called to ensure this transformation, is based on scientific and design works in the course of which the search, optimization and display the technical decisions for new goods in the constructional-technological documentation are carry out, that demands, in turn, the professional staff [5,6].

The technical university has to consider phases of development of modern industries of economy, when university plans to train developers, designers, technologists of industrial products and systems and shall predict development of innovative processes in equipment and technologies,

relying on results of applied researches. Thus, perfection of *IA* at technical university must begin in scientific sector and be based on search and development of innovations products, innovations technologies, upgrade of products in the industries corresponding to a preparation profile. These innovations of a subject domain should in time be reflected in the educational programs periodically processed and replaced according to stages of life cycle (*LC*) of the goods and industrial technologies. Hence, educational programs at technical university as well as the industrial technologies should have cyclic nature, and logically enter concept of their life cycle, which phase should correspond to *LC* phases of the goods. Influence (the interrelation) mentioned above elements (categories) of innovation model is shown in figure 2 [6]. Such represent *adaptive aspect* of organization of educational process of technical high school.

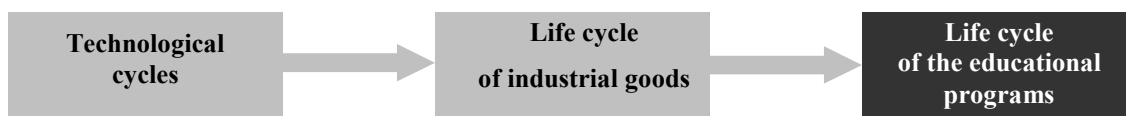


Fig. 2

The degree of conformity of *LC* phases of the educational programs to *LC* phases of the goods and technologies of public manufacture should depend on a level of industrial innovations (pioneer, outstripping, innovative or improvement). For the first change of a product (technology) should result in change of the educational program, for the last - only changes in its elements (working programs of disciplines). For example, intensive development of such industries, as telecommunications, development and the introduction of computer technologies naturally has resulted in occurrence of new specialities. The evolutionary changes in designing of the electronic equipment - to the change of the contents of disciplines. By analogy to *IA* kinds in industry the innovations at technical university are represented by the following kinds:

- to product-innovation there corresponds new quality of the graduate;
- to technology-innovations - progressive methods and means of training of the staff;
- to modernizations of a product - two connected kinds of activity:

* perfection of the professional training of the graduates on a basis of the constantly updated educational programs,

* improvement of professional skill, professional retraining or receiving of additional qualification of the staff of the enterprises.

In that case the *innovative aspect* of the educational programs is shown.

Innovative activities both in the industry, and in education are characterized by uniqueness, time limitation, a high probability of modification at any stages of works, availability of strict requirements to quality and terms of accomplishment, need of coordination of works of many contractors. Taking into account the specified features of *IA* it falls under the category "projects". Therefore, for planning, the organization, carrying out and implementation of innovations at

technical university the use of project management methodology which is stated and developed in works [4,7] is advisable. Now this methodology is supported by systems of automation that allows to increase productivity and quality of management of educational innovations [3].

Productivity of *VT* is offered to be increased on the basis of a combination of technologies of industrial production of various types, their transformation in subject domain and applications of system approach. It is reasonable to develop the industrial technologies corresponding to different types of production, their economic opportunities and benefits of their integration on the *VT* area based on the analogy of industrial and educational innovations entered above. As is known, depending on quantity N of technological operations which are carried out on one workplace, distinguish "spectrum" of types of industrial manufacture. Its borders are types of the mass manufacture ($N=1$) and the single-piece production ($N > 40$). We will consider their possibilities on implementation of innovative activities.

Features of mass manufacture (MM). Using the specialized equipment and personnel with narrow-purpose competence, *MM* provides the profit pro rata to amount of release of the unified products. Its quality is created at a design stage by restriction of listed products and their components on the basis of selection of the best samples which have proved in practice. Such production technology is characteristic of the developed entities – the large corporations issuing the products fulfilled for a long time. For them the low profit margin, technological production, an intensive use of the equipment, material resources and personnel, a low risk degree are characteristic. Strategy of development of the entity is based, first of all, on price competition: *MM*, reducing unit costs, allows to get at the low cost and acceptable quality of goods profit in the mass steady markets. The second component of strategy consists in the fixed insignificant enhancements directed to continuous cost reduction (production efficiency increase). The economic benefit of the entity depends on "small" innovations and duration of release of the standardized goods more and more, and less – on product quality - set of its consumer properties (set) at a stage of certain marketing researches. Highly specialized production becomes prospect of development of such entity. The entity, working in stable external environment, has an opportunity to accumulate material and non-material resources, in particular, financial resources.

Payment for it is a loss of flexibility of response to change of requests of the market, the multi-level hierarchical system of subordination and the responsibility and the growing share of fixed costs in structure of cost of goods. Development and preparation of production of a new type of products, without telling about new activity, become unsoluble problems and are postponed for indefinite time.

Growth of a share and feature of the single-piece production (SPP). The modern entities with the *SPP* technology for the purpose of decrease in risk of failures shall implement new procedures

of development of goods on a basis effective methods of the analysis of innovations in the industry and a segment of the market, to be guided by highly skilled human resources. The creative and intellectual potential, encyclopedic knowledge and abilities of their successful practical application, aspiration and a capability to continuous enhancement, search of new perspective technological and organizational decisions become necessary qualities of the last, first of all. The listed qualities significantly differ from the main advantages of the personnel working in the conditions of *MM*: the sense of duty and discipline, aspiration to work according to the instruction and to exclude mistakes. This circumstance leads to essential change of the mechanism of the relations of the worker and employer, emergence along with the "corporate family" model of its modern alternative option - "a set for one specialist of several works in the different organizations".

Everything told means that the *SPP* technology requires, in comparison with the approaches which have developed in the conditions of mass manufacture, the new methods of management which are turning on mechanisms of planning, the motivation of personnel, the enhancement of mechanisms of internal and external interactions, the forming of adequate organizational structure.

Integration of *MM* and *SPP* technologies

The culture of innovative management of the organization developing at the expense of own means (including educational structures) has to combine the considered technologies of industrial production. The main feature of such system is availability in the same organization and at the same time contradictory (by sight from outside) methods of management and various standards of an assessment of several types of activity. This difference causes application of new - integrative culture of management. Its signs are a combination of adaptive and hierarchical organizational structures in one entity, the use of styles traditional (based on a tough framework of job descriptions, a constant control of activities) and the democratic (based on a wide authority delegation, on encouragement of aspiration to new technologies, work methods, searches of the best decisions even with risk of mistakes) leadership styles. We will give its examples from practice of educational institution. Analog of *MM* in higher education institution is the program of "traditional" higher education. Of course, as the rule of reference of types of educational activities to categories *SPP* or *MM* is the distinction not of sizes of coefficient of fixing of technological transactions of N , and the features of production technologies stated above, and also accounting of analogy of industrial and educational innovations. First of all it is necessary to estimate the required and reached degree of efficiency of reaction of educational system to change of requirements of the entities and citizens, a possibility of flexible "setup" of parameters of the educational programs on dynamic requests of economy subjects. It is necessary to identify key factors of providing competitiveness, a competence requirement of teachers, to educational programs content and forms, technologies of their implementation. It must be kept in mind that unambiguous separation of types

of educational activities for criteria of *SPP* and *MM* cannot be executed. To the same program of training the different kinds of types of industrial manufacture can be put in conformity.

On the basis of the formulated criteria we will give classification and examples of "production types" created and realized in activities of interfaculty project structural division - the special faculty of the Nizhniy Novgorod state technical university of R. E. Alekseev. One of the tasks of special faculty was formulated as the "designing" and a pilot study of new forms and methods of staff preparation and development for the high-technology enterprises of the Nizhniy Novgorod region.

The *SPP* technology is realized in programs of advanced training of the specialists spent at the initiative of customers (the "unique", not repeating programs) by amount, as a rule, from 72 to 120 hours. Such training programs are realized within the solution of a complex task of development of the specific entity, for example, in case of implementation of the project of upgrade (replacement) of technology and (or) the equipment.

Target training of specialists (duration of 3 - 6 years) and the repeating programs of advanced training and occupational retraining (100-1200 hours) correspond to the combining elements of the single-piece production and mass production. Forms and content of the listed types of educational activities are characterized by appeal to a number of the entities and categories of individual customers that provides successful replication of educational programs. Their development is carried out on the basis of selection and development of the best programs of the first group. At the same time in the course of replication of the hybrid programs the type of production of educational services changes in the direction from single to mass production.

In relation to traditional educational programs of higher education institution the types of off-budget activities of the special faculty considered above should be carried to examples of technologies of single-piece and small-lot production.

Conclusion

The practice of special faculty in conditions of a rigid competition has shown, what exactly the flexible application of *MM* and *SPP* technologies in activity of self-paid back structural division of university provides as its long-term financial stability, and high competitiveness in the market of educational services [3]. In a combination and mutual addition the mentioned above educational programs are classified as the differentiated goods [4,6], determining a necessary variety of educational services and opportunity of adaptation of their manufacturers to varied inquiries of the customers. Implementation of the offered production and technological model of adaptive system of professional education requires the corresponding organizational structure. As such structure the interfaculty division of technical university functioning according to a project and technological organization type of activities was approved [6,7].

Sources

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