Products of the Industry 4.0 competence centers

D A Zakoldaev¹, A V Gurjanov², A V Shukalov¹, I O Zharinov¹

¹ Faculty of Information Security and Computer Technologies, Saint Petersburg National Research University of Information Technologies, Mechanics and Optics, 49, Kronverksky Av., Saint Petersburg, 197101, Russia
² Department of Aviation Instrumentation Systems and Training Systems, Saint Petersburg State University of Aerospace Instrumentation, 67, Bolshaya Morskaia str., Saint Petersburg, 190000, Russia

E-mail: mpbva@mail.ru

Abstract. Branch competence centers are organization and jurisdiction forms of company activity to unite digital, smart and virtual factories of the Industry 4.0 according to its specialty. Branch competence centers are for huge infrastructure projects solution where the result is not only the item itself (high-tech product) but also professional cadres, new types of technologies, new forms of the production data representation and other. There is the Industry 4.0 products classification and also specializations of the branch competence centers which are meant to be implemented into the industry by the first hand. Actual for the Industry 4.0 competence centers in digital projection are digital production competence centers, item exploitation accompanying competence centers and standardizing and certification competence centers of products and technologies. There are schemes of the digital companies interaction and the most probable branch competence centers in the item designing industry results are defined.

1. Introduction

Science and technical progress in the projection methods development and production with the progressive informative technologies showed up [1, 2] the vector of the industry development in the mankind different activity. New generation of companies known as the Industry 4.0 factories oriented for the automatic production where the production primary units are cyber and physical systems [3, 4].

Cyber and physical systems are a new type of automatic technological equipment functioning in the physical devices level and company cloud environment components level. Cyber and physical system into a single production division is done with robotized transport system and necessary company storage infrastructure [5, 6].

Cyber and physical exploitation in production requires from specialist professional knowledge and skills specific for some manual and engineering and technical occupations of the Industry 4.0 [7, 8]. To prepare the specialists of new generations industrial and educative companies must unite into a branch competitive centers where the main objectives are to create new products — the Industry 4.0 products [9].

The Industry 4.0 products are new forms of electronic technical documentation; items, which use high-tech components created in conditions of automatic production; norm and technical and organization and order documentation define the process of item creation and the following product digital certification and other [10, 11].
Here an actual task is to create competence branch centers oriented to prepare different types of the Industry 4.0 products keeping in mind centers personnel and specialization with the participation of project and production or exploitation companies [12].

2. Types of branch competence centers

Company interaction scheme of the Industry 4.0 within branch competence centers is given in figure 1.

![Figure 1. The Industry 4.0 organization interaction scheme within the branch competence center.](image)

From the Industry 4.0 industrial company specialty and their interactive educative companies branch competence centers can be divided into:

- the Industry 4.0 competence center of digital production to unite educative company and smart factory;
- the Industry 4.0 competence center of digital projection to unite educative company and digital factory;
3. Digital production competence center products
Digital production competence centers are the main driver of the industrial economy sector development. This center organizes innovative production of high-tech products, state policy improvement to prepare the high qualified specialists, application and advanced informative technologies development into production sphere and other.

Digital production competence center main types of products are:

- innovative product is a high tech item or a new item or machine designing technology;
- intellectual product is a result of specialist intellectual activity (invention patents, useful models patents, CPU programs, data bases, industrial samples, know-how and other.);
- educative product which is educative documentation of educative programs and technologies oriented to prepare cyber and physical production divisions exploitation specialists;
- professional product which is a highly qualified cadre oriented to work in an educative organization and smart factories of the Industry 4.0.

4. Digital projection competence center products
Digital projection competence center is specialized in digital modelling tasks and designer project activity virtualization in different industry branches. The most perspective activity spheres today where the digital projection technologies could be applied are item designing and machine designing.

The main types of digital projection competence center products are:

- science product which are methods, models, algorithms and other that is necessary to create and research project solutions in the digital projection and production spheres of high-tech products including the modelling and virtualization tasks of project and production processes and results;
- technological product which is electronic technical documentation (digital replica, digital shadow, digital twin) which is used in smart factory to manufacture the items and to automatize project and production activity of a digital company. Item digital replica, digital shadow and digital twin are electronic forms of the Industry 4.0 product digital copy with all characteristics of the physical device. Such approach to describe an item may help to analyze in details in the modelling environments and virtualization all the construction features of the item being projected;
- educative product which is sets of educative documentation and technologies which is necessary to prepare the specialists of high-tech products digital projection;
- professional product which is a highly qualified cadre having prepared and oriented for practice educative programs in digital production of high-tech items.

5. Standardization and certification competence center products
Standardization and certification competence center of high technology products and digital informative technologies is a profile structure of jurisdiction regulation for the quality of items being manufactured. The center primary objective is to prepare norm documents to describe methods and evaluation criteria of the Industry 4.0 product quality being prepared in the conditions of the world industry digitalizing.

The main types of the standardization and certification competence center products are:
jurisdiction product which is norms and rules of digital economy oriented to create educative standards, professional standards, industrial standards of new generation;

- educative product which is sets of educative documentation, educative programs and technologies which are necessary to prepare specialists in metrology, quality technological control of production processes, quality norm control of new generation electronic technical documentation and other;

- professional product which is a highly qualified cadre to accompany of the Industry 4.0 digital company project and production activity.

6. Exploitation accompanying competence center products

Exploitation accompanying competence center is for development and implementation in practice of new logistics methods of high tech products application to accompany the item itself and its consumer in the product life cycle.

Exploitation accompanying competence center main types of products are:

- technological product which is electronic technical repair documentation with which the items will be restored if they failed in exploitation;

- innovative product which is functioning item repaired after the exploitation;

- educative product which is sets of educative documentation for educative programs and technologies oriented to prepare exploitation and repair specialists of item and machine designing components;

- professional product which is a highly qualified cadre to repair and maintain a high tech product.

7. Conclusion

Development state program (digitalizing) of the industrial economy sectors of leading countries must solve the task of production complex industrialization. Which means to create new type of high-tech products with high added value is impossible without preliminary and sometimes parallel solving of several collateral tasks which are from organization, methods, technologies and other types of project and production activity provision in the paradigm of the Industry 4.0.

Production industrialization complex character can be seen clearly when the key factors are found (development drivers) to define the behavior strategy of the main say rocket and industry and some parallel industry branches. Scientific tasks for a designer of the main industry branch create secondary technical solutions in radio electronics (create new components), item designing (create new items), material study (development of nanotechnologies) and other.

The main industry branches to define quality science and technological leap to the fourth industrial revolution (the Industry 4.0) are:

- rocket and space branch;
- aviation branch;
- railway branch;
- maritime branch;
- automobile branch and others,

which already today require the creation of special competence center based on advanced and new industrial companies and educative companies.

Automatizing implementation into industrial sector industrialization show the competitive advantages of high tech items manufactured with cyber and physical systems. Cyber and physical production oriented to manufacture the huge bunches of items (mass production) where the Industry 4.0 product cost reduces significantly. In this case, the industry developed countries will provide their
products instead of expensive analogues of the developing countries manufactured with manual work or the previous generation automatizing means. Industrial companies competence engagement for consumer markets in their product realization the Industry 3.0 companies will be re-formed or shut down and their personnel must be sent for re-studying the new occupation of the Industry 4.0. The Industry 4.0 specialists preparation must be conducted by the branch competence centers in specialties.

References

[1] Zhuang C, Liu J, Xiong H 2018 The International Journal of Advanced Manufacturing Technology 96 1149-63
[2] Odwazny F, Szymanska O, Cyplik P 2018 Scientific journal of logistics 14(2) 257-267
[3] Lee J, Noh S D, Kim H-J and Kang Y-Sh 2018 Sensors 18 1428-44
[4] Schuhmacher J, Hummel V 2016 Procedia CIRP 54 19-24
[5] Nitschke C S, Williams S P 2018 Procedia computer science 138 580-586
[6] Gebhardt J, Grimm A, Neugebauer L M 2015 Journal of technical education 3(2) 117-133
[7] Negri E, Fumagalli L, Macchi M 2017 Procedia Manufacturing 11 939-948
[8] Gurjanov A V, Zakoldaev D A, Shukalov A V and Zharinov I O 2018 Journal of Physics: Conference Series 1015 052034
[9] Gurjanov A V, Zakoldaev D A, Shukalov A V and Zharinov I O 2018 IOP Conference Series: Materials Science and Engineering 450 032046
[10] Terkaj W, Urgo M 2015 Procedia CIRP 28 137-142
[11] Deniaud S, Descamps P, Hilaire V, Lamotte O and Rodriguez S 2015 Procedia computer science 56 520-525
[12] Leitao P, Colombo A W, Karnouskos S 2016 Computers in industry 81 11-25