

THE R&D PERSONNEL – A KEY COMPETITIVE FACTOR FOR THE INNOVATIVE ENTERPRISES IN BULGARIA

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Abstract. *Purpose* – the article explores the R&D personnel as a competitive factor of the innovative enterprises in Bulgaria.

Research methodology – a wide literature review and survey are conducted on R&D personnel and its performance together with a comparative analysis of secondary data resources.

Findings – the article presents the essence, the peculiarities, the innovation results, the R&D competencies in the context of the innovative enterprises in Bulgaria. A generalized classification of the innovation goals and results is developed. The approach and the model clearly describe the R&D personnel as a factor, influencing the innovation activity and focus on its improvement.

Research limitations – lack of relevant research studies on the topic in Bulgaria.

Practical implications – the results help managers to make decisions on how to raise the enterprise's innovation activity. The model can be implemented in the enterprise's innovation system to distinguish the R&D personnel's needs for improving their innovation competencies, motivation or performance measurement, and management.

Originality/Value – a model for decreasing the discrepancies between the R&D personnel and the organisational innovation requirements. Framing constructs for developing an approach for identifying the needs for more competitive R&D personnel and overcoming the innovation gaps in search of high innovation activity.

Keywords: R&D personnel, innovative enterprises, innovation factor, R&D competencies, innovation results.

JEL Classification: O3, M5.

Conference topic: Digitalization of Business Process: Trends, Challenges, Solutions.

Introduction

The innovative enterprises have a significant role in the growth and the development of the knowledge-based economy and they are a priority area for the future of the EU member states (European Commission, n.d.). The innovation activity of these enterprises is the level and the ability to renovate by creating, using and transferring new knowledge. It correlates with the optimal functioning of the basic enterprise functions – R&D and human resources. The innovative enterprises require highly skilled and qualified personnel that is directly involved in creating high-added value innovations. The innovative enterprises are an effective tool for the development of the modern economy. They are constantly updating all elements of the production and marketing processes to ensure high competitiveness of their products and services. The innovative businesses are able to respond more agile to the changes in the customers' needs and requirements as well as to the new proposals and perspectives of the emerging technologies and R&D activities (ARC Fund, 2004, 2014–2018). The increased innovation activity of the Bulgarian enterprises will help the state to achieve one of the objectives of the Innovation Strategy for Smart Specialization (2014–2020), which is Bulgaria to move from the group of the modest to the group of the moderate innovators (The Global Competitiveness Report, 2017–2018).

The R&D personnel is a key factor for the economic success of the innovative enterprise and at the same time, it is one of the most complex and difficult for managing resources. It is engaged actively in developing bottom-up innovations, building an enterprise innovation system, creating innovation capabilities and delivering high added value innovations. One of the priority management tasks in innovative enterprises is the effective and efficient leading of the R&D personnel in order to achieve enterprise innovation goals and strategies (Antonec, Nechaeva, Xomkin, &

Svedova, 2013). Management has to ensure organizational conditions and opportunities, to motivate and empower employees for innovation and to fill the gap between individual and organizational goals, competencies and performance requirements. The managers of the innovative enterprise should make constant efforts to improve the performance and integration of all their employees by developing the necessary competencies and clarifying the understanding of innovation (Abdel-Kader & Lin, 2009; ARC Fund, 2018).

The objective of the paper is to clarify the essence, characteristics, innovation results and competencies of the R&D personnel in the context of the innovative enterprises in Bulgaria. The methodology consists of a comparative analysis of the scientific literature on the research problem, analysis, and summary of the results from secondary sources, a survey on the personnel's competencies in Bulgarian enterprises. The role of the R&D personnel in innovative enterprises in Bulgaria has not been studied in depth in terms of the innovation competencies, which are leading to increased innovation activity, neither the degree of impact of different types of factors on the qualification of the R&D personnel. The innovation results and their distribution among individuals, teams and the enterprise as a whole has not been explored. The scientific literature and management theory do not address the peculiarities and advantages of R&D personnel management and its impact on enhancing the innovation activity in innovative enterprises.

1. Essence and conditions of the innovative enterprises in Bulgaria

The innovative nature of an enterprise in today's economy is its ability to create, transfer, integrate, protect and use knowledge (Chiesa & Frattini, 2009; Teece, 2000). Based on the newly created and/or adapted knowledge and know-how in the enterprises, innovations take place in the form of new products, services, and processes (OECD, 2005; ARC Fund, 2014–2017). An innovative enterprise is an enterprise in which innovation is carried out, the goods and the services are results of the innovation activity, including external innovations, which are applied by technological transfer (Chesbrough, Vanhaverbeke, & West, 2011). Innovative enterprise is an organization, which creates, develops and disseminates systematically, purposefully and intentionally innovations. The innovative enterprise has an increased innovation activity; employees are predominantly highly qualified specialists with specific professional qualifications and work experience. The different stages of the innovation process have different outcomes and they need personnel with different qualifications and competencies in order to create innovation.

The innovative enterprises can be characterized by 1) initiative to adopt creative concepts and stimulate innovation; 2) well-guided cooperation for sharing knowledge and information; 3) discover and realize ideas regardless of where they come from within the enterprise; 4) flexibility in terms of processes and use of human resources; 5) strategic leadership – working with managers who offer strategic views, supported by measures to promote innovative ideas; 6) easy to cope with the negative impact of the external environmental factors and mobilize more effectively their domestic potential to counteract them; 7) managers and collaborators have an entrepreneurial orientation and are ready to take a measured risk (ARC Fund, 2014–2018).

The innovative enterprises in Bulgaria form only a small part of the added value of the Bulgarian industry (Taneva, 2015). According to the EU Innovation Scoreboard rating (2018), Bulgaria is in the penultimate position and it is in the group of so-called “modest innovators” along with Romania with results significantly lower than the EU average. Our country is at the lowest levels of the indicators for innovation potential and national competitiveness in the EU (The Global Competitiveness Report, 2017–2018). Bulgaria remains in the last places and is very lagging behind all other EU member states on GDP and labor productivity per employee. Bulgaria has a great need to increase its position in a global context in terms of technological development and innovation potential, limiting the insufficient and inefficient interaction between the core units of the national innovation system (ARC Fund, 2018).

A large part of the Bulgarian businesses does not develop innovation activities. Most of the Bulgarian innovative enterprises offer innovations with a low level of performance without a significant impact on the market and on the economy as a whole (ARC Fund, 2014–2017). The assessment of the innovation activity of the Bulgarian economy in terms of the average European achievements is unsatisfactory (see Table 1).

Figure 1 shows the share of the Bulgarian innovative enterprises according to their size. The large enterprises are the most innovative although in the literature there is a discussion on this research topic.

The aggregate assessment of the innovation activity in Bulgaria is too low but still could be an engine for increasing the national competitiveness. The contribution of R&D to innovation in enterprises is very modest.

The results of the innovative activities, such as renewal of products offered to the market, new or improved technological processes introduced to the enterprises, the frequency of applications for registration of patents in the country and abroad, are unsatisfactory. Managing innovative activities is a complex process. It requires the application of a broad set of specific knowledge, skills, approaches, and tools to support the enterprise's innovativeness.

Most enterprises in Bulgaria do not have their own R&D department and do not develop their innovative capacity and potential. For those who have it, the R&D expenditures are still insufficient. Bulgarian companies competing in European and international markets are significantly more innovative than the enterprises that have chosen to work on the national or on the local markets. Relatively most innovative enterprises are in the sectors “Information technologies”, “Engineering and consultancy activities”, “Financial intermediation”. By 2020, about 1/4 of all

employees are expected to work in innovative and creative businesses in Bulgaria, accounting for around 40% of GDP (National Development Programme 2020). This requires certain professional qualifications and skills that are related to the manufacturing of products with high added value. Such businesses will have an interest in allocating more resources to build these industries and the younger generation will prefer this area of work to actualize their talents and skills. This requires the provision of an environment in which to access new technologies, expertise, venture capital, counseling schemes and innovative governance structures (Harvard Biznes Revyu, 2011). The development of human resources in them is vital for the creation and development of innovations.

Table 1. Innovative enterprises as a share of all enterprises (source: NSI, 2016)

Industries (NACE rev. 2) Size class (by number of employees)	2016		
	Innovative enterprises ³⁾	Enterprises with technological innovation ⁴⁾	Enterprises with non-technological innovation ⁵⁾
Total	27.2	19.8	17.3
Industry ¹⁾	31.6	24.9	17.9
Services ²⁾	22.1	14.1	16.7
10–49 employees	20.5	15.2	12.7
50–249 employees	44.3	32.9	28.0
250 or more employees	81.9	50.6	62.0

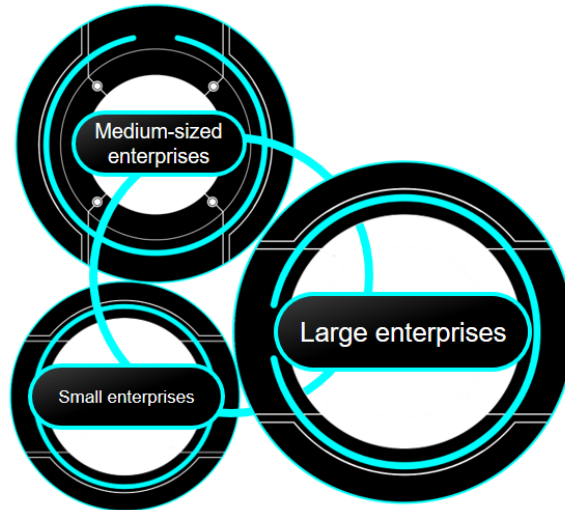


Figure 1. The share of the innovative enterprises in Bulgaria, based on the company size (source: the authors)

At the European level, the issue of innovative enterprises is a priority, but Bulgaria is ranked last and is looking for an opportunity and tools to influence innovation activity. This may be a technological change or a change in the internal environment factors, one of the keys, which is the R&D personnel. The R&D capabilities and competencies are crucial for the innovation competitiveness of the enterprise. Each enterprise must create innovation through R&D activities and the paper shows the importance of the human factor, directly engaged with the innovation process.

2. The R&D personnel in innovative enterprises

The innovation potential of the innovative enterprises is a combination of the different types of resources (material, financial, intellectual, scientific, technical, etc.) needed to carry out innovation (Taneva, 2015). A special place among them has the personnel, who are directly engaged in innovation activities. The R&D personnel is a key factor in the creation, development, and diffusion of innovation in the enterprise (Gorfinkelja & Čerņševa, 2008). According to OECD (2005, 2015), NSI (2012-2018) and ARC Fund (2014-2018), the entity that organizes, maintains, stimulates and develops innovations in the enterprise is the R&D personnel – the researchers and the technical personnel. They are directly responsible for the creation, implementation, and dissemination of new knowledge and innovation in the enterprise (Taneva & Dimov, 2014). The R&D personnel consists of the most educated and professionally developed competencies within the overall employment of the enterprise. These are researchers, technologists, designers, programmers etc. In most cases, the R&D personnel is typical for the medium and large enterprises in which there is an R&D organizational division or unit. According to the National Classification of Occupations and Positions (NCOP,

2011), the R&D specialists refer to the categories – analysts, technical specialists, and other applied specialists.

Depending on economic activity, most researchers work in the field of Professional Activities and Research, followed by Manufacturing and ICT (NSI, 2016). The researchers, employed in research and educational institutions in Bulgaria, are 57.48% of all researchers. For many of the Bulgarian businesses, there is no real data, reported by the NSA, which significantly changes the profile of the employees in the enterprises. In Bulgaria, in the area of research-intensive high-tech enterprises, there is a reverse steady trend of employment growth.

Other categories of the personnel in innovative enterprises can be found by dividing the people into different specialists by their main professions as well as into internal and external specialists, who are temporarily involved in the enterprise’s research and development activities.

Not all innovative enterprises carry out R&D activities and they do not have a category of researchers among the personnel’s categories. The professionals, who generate ideas for innovation, develop and implement them, are called innovators. The authors of the report present an adapted model from Dimov (2017) of the personnel’s categories in an innovative enterprise, their shares and competencies (see Figure 2). People with specific qualification and expertise are generators and analysts of ideas for innovation in the innovative enterprise. The following functional categories of the personnel are identified in the innovative enterprises: 1) managers; 2) administrative personnel; 3) researchers; 4) technical personnel; 5) supporting staff.

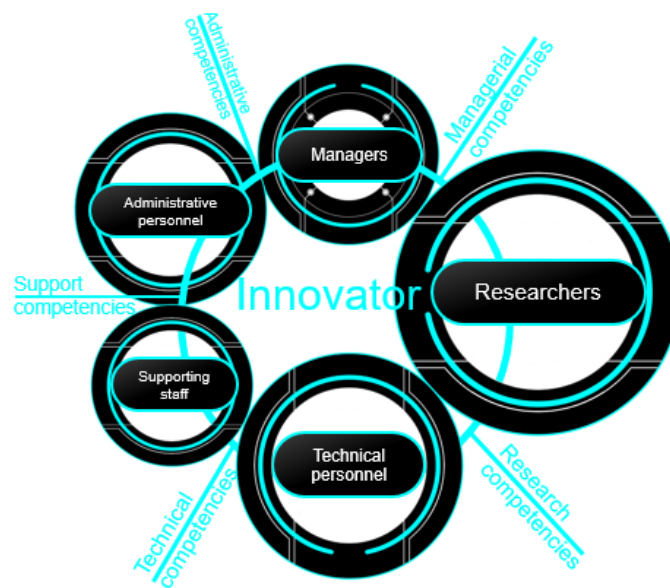


Figure 2. Personnel’s categories in an innovative enterprise and their competencies (source: developed from Dimov, 2017)

The innovators are not researchers by profession or job description, but they have the knowledge and the competence to create and recognize new ideas and implement them into new products and services. Each innovator contributes and participates in the generation of innovations, regardless of the job occupation and position. This statement is in line with the understanding of an open innovation paradigm developed by Chesbrough, Vanhaverbeke, & West (2008). Depending on the category of the personnel, the innovator must possess the competencies that characterize it – scientific, technical, administrative or managerial competencies.

The characteristics of the R&D personnel can be analyzed by the quantity and the quality of their work and the competencies, acquired by the collaborators. The personnel’s characteristics are education, work experience, knowledge and competency requirements. The main advantage of the innovative enterprises is their highly qualified personnel with a professional structure and competency profile consistent with the nature of the innovation activity.

The significant share of researchers, engineers, and managers shape the professional structure of innovative enterprises. There are two internationally recognized criteria, used by OECD (2015) and the National Competence Assessment System (n.d.) to assess the R&D personnel: 1) formal education and 2) occupation. The qualification of the personnel in the innovative enterprises is higher than in the traditional enterprises, where the production personnel predominates and its qualification can vary widely. This predetermines the various potential human resources’ capacities and the need for particular care in terms of their development and job performance management for innovation. These criteria are facts that cannot reflect the real level of employee performance in innovation activity. They can be proof for already developed professional and labor competencies and a prerequisite for a higher innovation potential of the R&D personnel. Formal education gives the worker a certain level of competence – knowledge, and skills, and the position occupied must ensure a level of professional experience. This criterion is mainly used for recruitment and selection, and less frequently for performance evaluation and assessment of the innovation activity. In addition to formal education, the R&D personnel also needs lifelong learning to develop and enrich their intellectual

assets. Knowledge is an asset that is not depreciated and lifelong learning is a necessary investment for competitiveness in the modern world. Researchers with doctoral degrees have a special place among the R&D personnel of the innovative enterprises (National Strategy of Scientific Research, ARC Fund, 2018). Higher educational and scientific degrees indicate an affinity for research work and an interest in professional realization in science, technology, and innovation.

One of the main problems with innovation in Bulgarian enterprises is the lack of enough specialists with relevant education, qualification and professional experience (Innovation Strategy for Smart Specialization 2020, National Development Programme: Bulgaria 2020, National Strategy of Scientific Research, ARC Fund, 2016–17). The EU expects the need for researchers and highly qualified and technical personnel to increase in the next years, especially in the high-tech sectors of the economy. Qualification and training of the personnel need to be improved by increasing the quality of education, ensuring that sufficient professionals with scientific, mathematical and engineering educational background are available to the market. The learning programmes should be focused on technology, innovation, creativity, and entrepreneurship. There is a gap between the demand and supply of highly qualified specialists, engaged in innovation in Bulgaria. There are fewer researchers in all major categories, compared to the average of the EU.

Regardless of the position, the innovators must have the necessary competencies and qualities to create innovations at each hierarchical level.

3. Competencies of the R&D personnel

Innovations require knowledge, ideas, cognitive abilities, and creativity. Interdisciplinary teams and professionals with different qualification and expertise operate in innovative enterprises. The innovative work involves creating and sharing knowledge, working in project teams and building productive working relationships and collaboration, both inside and outside the enterprise.

The R&D employees' competencies are a set of knowledge, skills, abilities, and attitudes that are necessary for successful innovation performance. There are different classifications of the competencies of the R&D personnel. Based on a vast research of various scientific, normative and practical information sources (OECD, 2015; NASA Systems Engineering Leadership Development Program Behavioral Competency Model; National Competence Assessment System, n.d.; Petkova, n.d.; Skills and competencies needed in the research field objectives 2020; Measuring R&D Personnel, 2009; Tripathy, Ray & Sahu, 2011), the most commonly used competency requirements for the R&D personnel are: 1) formal education; 2) occupation and 3) professional experience. These requirements define the professional competence and suitability of the personnel that is key to innovation development in innovative enterprises. By another survey, the key competencies of the researchers can be grouped into three strands: 1) scientific competencies; 2) project and team management skills and 3) interpersonal skills. The scientific competencies relate to specific scientific knowledge, the ability to acquire, analyze and adapt to a new context or problem, working in an interdisciplinary environment and using complex IT tools. Based on the personnel's category model on Fig. 1 and the competency profile of the innovative enterprise (Dimov, 2017) the innovators' competencies can be grouped as follows: 1) general; 2) functional; 3) specific; 4) technical; 5) administrative; 6) leadership; 7) personal. The competency groups are summarized for all categories of the R&D personnel – the innovators. Some of the competencies are not mandatory for innovators in the enterprise, such as Leadership competencies.

Table 2 shows the amount of basic, specific and managerial competencies identified for eight of the most innovative economic sectors in Bulgaria according to a conducted survey in compliance with the Innovation Strategy, ARC Fund, and National Competence Assessment System.

Table 2. Types of competencies in leading innovative sectors of the Bulgarian economy, nr. (source: the authors)

Industry Sector	Innovative enterprises, nr	General competencies nr	Specific competencies nr	Managerial competencies, nr
Machine manufacturing	20	17	67	8
ICT	19	28	33	19
Electric vehicles	10	16	67	9
Mechatronics	13	3	17	4
Chemical Industry	15	21	75	16
Electronics	11	20	53	12
Electrical Engineering	13	3	19	4
Metallurgy	10	22	85	12

As bearers of enterprise competencies, the innovators employ a specific set of competencies (see Figure 3) that develop and acquire new work experience. An important feature of the innovator is the personality that distinguishes him/her from all other specialists at the same position, who perform the same tasks and duties. From this classification, it is clear that the researchers must have both professional competence and a high level of personal competencies. Their personal characteristics remain an important sign for their inclusion in the innovation team and the maintenance of productive performance and social relations in the enterprise.

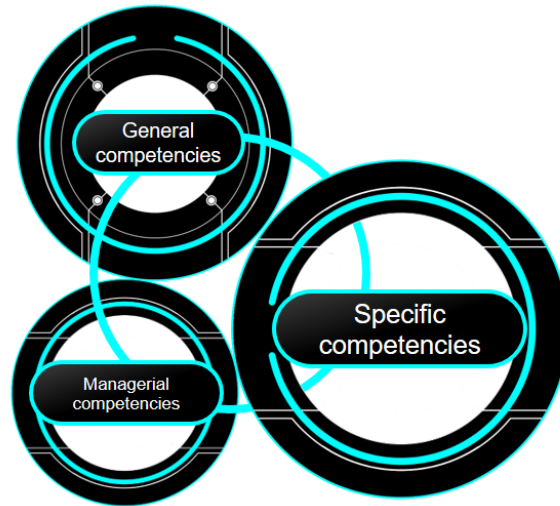


Figure 3. Competencies of the personnel in innovative enterprises in Bulgaria (source: the authors)

According to the results of the innovation activity, the authors divided the innovation competencies into the following two groups: 1.1) Competencies leading to product innovation; 1.2) Competencies leading to process innovation; 1.3) Competencies leading to organizational innovation; 1.4) Competencies leading to marketing innovation. The second classification is: 2.1) Competencies needed for individual innovation results, 2.2) Competencies needed for collective innovation results and 2.3) Competencies needed for organizational innovation results. Identifying and structuring the competencies of the R&D personnel into different classifications will help managers to plan and organize the innovation processes and the R&D personnel more precisely and effectively. This will affect HR functions and activities, such as job design and job description, recruitment and selection, training and development, talent management, performance, and career management. By increasing the competencies of the R&D personnel, the added value that people create for the enterprise will increase. In order to generate more innovations in the enterprise, it is necessary to attract and develop highly qualified R&D personnel who has specific knowledge and skills, with higher motivation, higher productivity and more.

4. Innovation results in innovative enterprises

In the scientific literature, there are different criteria and indicators for evaluating and measuring the R&D personnel's performance, which depend on the specificity of the innovative enterprise and its production: (Petkova, n.d.; Taneva & Dimov, 2014; Crawford & Cabanis-Brewin, 2005; Curtis & Ellis, 1997; Verburg, Ortt & Dicke, 2006; Khatibi, Keramati & Montazeri, 2017; Aksnes, Sivertsen, Van Leeuwen & Wendt, 2017). Driva, Power, and Menon (2000) distinguish between the indicators developed by academics and those applied in practice. Academic measures are mainly related to time and costs, which are mostly quantitative measures. The practical criteria are user-oriented in the design and development of innovation projects. The authors of the report developed a table with the most commonly used innovation results, which can be classified as individual, collective and organizational (Table 3).

Akcakaya (2001) divides the results of innovation activity into quantitative and qualitative ones, the first being related to product and technology development and sales, and qualitative indicators cover intangible results, conditions, and methods. Most authors offer primarily performance-related or organizational performance indicators to clarify the impact of human resources on organizational priorities. These criteria are directed at the R&D specialists, but they are too general.

Many of the indicators in Table 3 are characteristics of innovative enterprises with an R&D department. Some of the indicators do not have such a weight for the successful performance of the personnel in the enterprises as they would have if collaborators worked in scientific and academic organizations and institutions, such as the number of scientific publications, citations, etc. The indicators related to the protection of the intellectual property – the number of patents and others - can be immediately taken into account, as opposed to the financial results that can be achieved over a longer period of time. On the other hand, if something is patented, its originality is recognized, but it is still not

known whether the novelty will be perceived by customers or not. The indicators for the innovation impact are also very important, but they are more difficult to quantify.

Table 3. Individual, collective and organizational innovation results (source: Dimov, 2017 – unpublished dissertation)

Individual results	Collective results	Organizational results
Number of participation in R&D projects	Number of participation in R&D projects	Number of participation in R&D projects
Number of new/improved products, processes, marketing methods, methods of production and organization, workplace, approaches to social services	Number of new/improved products, processes, marketing methods, methods of production organization, workplace, approaches to social services	Number of new/improved products, processes, marketing methods, methods of production organization, workplace, approaches to social services
Number of innovative ideas	Number of innovative ideas	Number of innovative ideas
A share of ideas passed on a stage of development	A share of ideas passed on a stage of development	A share of ideas passed on a stage of development
		Number of innovations on invested 10000 BGN
		Percentage of revenue from innovation
		Percentage of profit from innovation
Enhancing the competence of the individual: – acquiring new competencies; – developing existing ones.		Enhanced intellectual capital of the enterprise
		Percentage of optimized costs due to innovation
Abbreviated time (deadline) for generation, development, deployment	Abbreviated execution time: – development; – spreading.	Abbreviated execution time: – development; – delivery.
Increased product/service quality	Increased product/service quality	Increased product/service quality
		Percentage of increased market share due to sales of innovations
		Opening a new market
Achieved goals (relative share)	Achieved goals (relative share)	Achieved goals (relative share)
		Diversification of products or services
Number of patent applications Number of registered patents	Number of patent applications Number of registered patents	Number of patent applications Number of registered patents
		Number of licenses
		A share of attracted additional financial resources from private and international sources
		A share of sales of innovation in total sales A share of innovation in total exports
Number of scientific publications Number of citations	Number of scientific publications Number of citations	Number of scientific publications Number of citations
Customer satisfaction	Customer satisfaction	Customer satisfaction
Using previous experience to create and implement innovation	Using previous experience to create and implement innovation	Using previous experience to create and implement innovation
Innovation awards from national and international events	Innovation awards from national and international events	Innovation awards from national and international events

The innovation results of the R&D personnel cannot be clearly and explicitly described and measured, which makes it difficult to categorize and cannot always give them a quantitative evaluation. Innovation is a collective activity and in the scientific literature and practice, more attention is paid to the collective results and overall performance of the enterprise rather than taking into account the individual contribution of each innovator. In the literature and practice, the evaluation criterion of innovation in enterprises is complex. Despite the individual contribution of each innovator and the assessment of his/her innovation activity, the teamwork projects for the creation of innovation in the enterprise should be taken into account (the collective innovation results).

The innovation results are the main criterion for assessing the job performance of the R&D personnel, but they are influenced by various factors, not all of which are clearly defined, easily measurable and not fully dependent on the innovators (see Figure 4). That is why management needs, in addition to performance-related criteria, criteria such

as professional and personal competencies and behavior in accordance with the accepted corporate culture in the enterprise.



Figure 4. The relationship between innovation results and innovation factors of the R&D personnel (source: adapted from Dimov, 2017– unpublished dissertation)

The combination of motivation, competencies and organizational capabilities forms the expectations of the employees’ innovation performance and it is the basis for defining their innovation goals. Figure 4 shows the relationship between the factors that influence innovation results.

The motivation and the quantity and quality of competencies determine the innovation potential of the R&D personnel. The motivation coupled with the provision of the necessary and appropriate conditions and opportunities leads to higher work satisfaction, which affects productivity and quality of work. The organizational capabilities and conditions are associated with providing and delivering the necessary environment and resources to perform the innovation work tasks, including support from management and other employees in the innovative enterprise. The innovation organizational conditions largely predetermine the success of the innovation work and ensure the competitiveness of the enterprise. They and the innovation competencies of the personnel ensure the employee development opportunities. When recruiting and assessing people at the entrance of the innovative enterprise, managers rely on employees’ innovation potential and personal development skills and attitude. Evaluating the personality and the innovation potential of the employee is too subjective, which is a problem in terms of organizing and managing the human factor.

The distribution of the motivation for innovation, according to the internal and external factors, is shown in Figure 5.

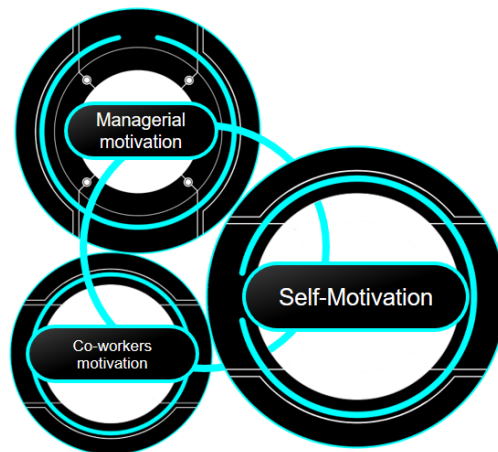


Figure 5. Motivation factors, influencing the innovation activity in the innovative enterprise (source: the authors)

The innovation activity corresponds to the frequent and rapid changes in the environment, where the deadlines for tasks are short, and efforts must focus on priorities and teamwork, networking and relationships not only in the enterprise but also with external research, scientific and educational institutions. The innovative climate is inextricably linked to the effectiveness of creative and innovative collectives, with the quantity and quality of their results. Building an innovative culture is the basis for increasing the innovation activity of the enterprise. Competencies that foster the development of an innovative organizational culture are: teamwork skills and networking, developing relationships

and partnerships. If managers in an innovative enterprise want not only to improve the level of employees' performance but also to increase and develop the innovation capacity of the enterprise, personnel competencies for innovation must be identified and developed. They need to be improved by creating an inter-company environment that stimulates creativity, entrepreneurship, and innovation. In innovative enterprises, an essential part of the organizational culture is that all contributors are involved in innovation, no matter what position they have and in which department they work. The managers in innovative enterprises help to build and to develop R&D personnel by stimulating and supporting its innovation potential.

The organization of the innovation activity is characterized by a variety of organizational structures and the use of modern structures such as project, matrix, network, cluster, etc. (Taneva, 2015).

5. A discrepancy model and approach for managing R&D personnel's competencies and performance

To identify the key areas of discrepancy between desirable and actual R&D personnel's status in the innovative enterprise, a new model is developed in Figure 6. The approach combines the factor model of the innovation results (Figure 4) and a discrepancy model for the innovation potential, innovation goals and innovation performance (see Figure 6). The model uses several innovation categories which describe what the R&D personnel in the innovative enterprise is able to do, what does it know, what and how it is doing in the company. The elements of the approach are the innovation results' factors, the discrepancy innovation model and the outcomes of their maintenance. This requires the presence of a relevant competency profile of the R&D personnel and organizational conditions for the improvement of the current state by training and development of the personnel. The difference between the competencies held and the desired ones determines a discrepancy incompetencies, which is called Innovation Potential Discrepancy. It reveals the gap between innovation capabilities and knowledge and real innovation skills and know-how and knowledge management, which is essential for the innovation process. The aim is to ensure that this discrepancy is at the lowest level by appropriate training and qualifications. Another important element of the model is not only what the R&D personnel can do and should do, but also the focus and efforts of management and employees on the way they are doing it. The difference between innovation knowledge and innovation experience and turning them into expertise is called Innovation Goals Discrepancy. Together with the gap between innovation attitude and innovation behavior, it formulates the innovation performance discrepancy.

The model can serve as a framework for managing the R&D personnel's competencies and performance in the innovative enterprise and through it to compare and validate good practices as well as to improve the overall organizational performance for innovations. It creates the conditions for the continuous improvement of the innovation results through higher innovation activity of the enterprise. The model will help to develop and improve the knowledge, habits, and behavior of the innovators in order to achieve higher innovative results that correspond to the organizational goals and values.

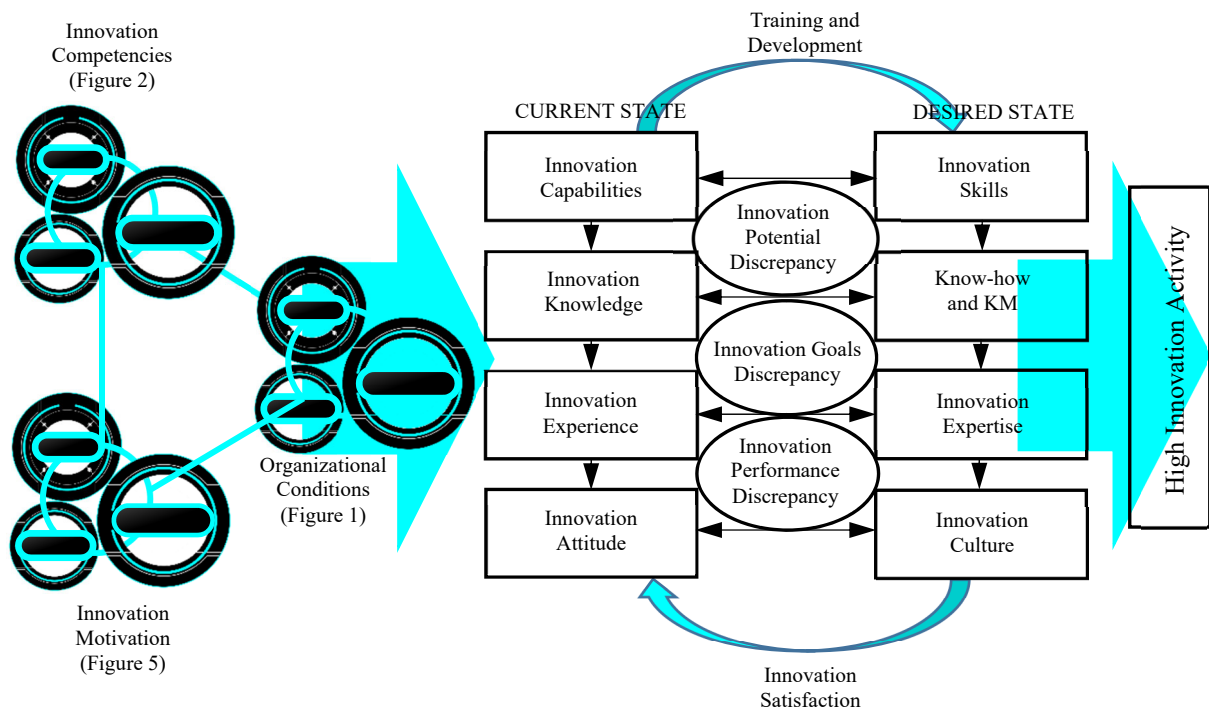


Figure 6. Model to identify incompatibilities in an innovative enterprise (source: the authors)

With this approach, managers understand better the gap between the R&D personnel and the organizational needs, they become partners and mentors within the overall structure to achieve the required results and manage through negotiation rather than by orders and coercion. The model shows a continuous and evolutionary process in which innovation performance improves over time and develop the professional profile of the innovator.

The requirements of the R&D job can be summarized into a job competency profile. The individual competencies form a personal competency profile of the employee. The indicators that characterize the R&D personnel are specific to the various innovative enterprises. The specific competencies related to professional knowledge acquired through formal education and professional experience. The professional competencies relate to the nature of the innovation work, while personal competencies help with the relationships with the managers, other employees in the enterprise and customers. The personal characteristics of the R&D personnel are focused on the development of creativity, motivation, and adaptability to change. Competencies, such as teamwork and interpersonal skills, are common rather than functional and specialized competencies and they are required for all the employees in the innovative enterprise.

In order to facilitate and improve the choice of competencies required for the work, a competency profile needs to be developed for each job group. It contains a list of the competencies held by the personnel and a quantitative measure. Competencies can be measured and assessed with a degree of proficiency. The competency profile can be used to determine the competency deficit of an employee that he or she needs to acquire or develop to do the job. In addition, it may be evidence that the employee has a certain set of competencies when recruiting. When selecting the innovative enterprise, the competency profiles of the position and of the applicant are compared and their correspondence is sought. A comparison can be made between the profiles for the position and that of the individual. Thus for the management of the enterprise will be easier to determine which employees to choose, how to train them and how long it will take to develop the needed skills through training and mentoring. The comparison between the role and the status of the professional and the personal competencies will determine the positive or negative balance of the specific competencies each employee has. The assessment of competencies can be done on an annual basis and the development of the personnel is monitored over time. The competency profile consists only of proven and tested competencies, it can be compared with estimates of the budget of competencies that will be required and develop during the reporting period based on participation in projects for the creation, development, and implementation of innovation, and to determine if the annual training programmes in innovative enterprises.

It is important to have a balance between the skills and the competencies, required for the job or the innovation project because if there is a discrepancy, there will be a shortage of knowledge and skills or a surplus, which will show poor management of the potential and the abilities of the innovators. Poor management leads to unauthorized and unregulated costs and the risk of demotivation and loss of highly qualified personnel is increasing. The competency profile can be used to assess the individual contributor as well as to evaluate the different teams and departments within the enterprise. When this percentage breaks, managers seek out people to supplement it with their knowledge, skills, and experience. Through comparisons of different competency profiles, conclusions can be drawn for the innovator's performance. In this way, the management will know what competencies to look for when recruiting and selecting innovation personnel, and when training and developing collaborators. The competency profile can be used to direct employees to a specific type of innovation activity for the needs of the enterprise. This shows that depending on the job performed and the specific work tasks, some competencies are more important and more common than others are. Even if an innovator has a specific competency profile, he/she must apply the general competencies that are required to do the job, and the others, that are not used, remain hidden and in a longer period may lead to impairment or loss of competence. The competency profile can serve the management when hiring people and selecting them for a specific innovation task or project.

Conclusions

Innovation is a complex, multi-stage, iterative activity that takes place under conditions of frequent and rapid changes to the environment. The deadlines for innovation tasks are short, and efforts need to focus on priorities, teamwork, networking, and relationships with internal and external contributors. That requires skillful and qualified R&D personnel with high potential and relevant innovation experience. The role of the R&D personnel in innovative enterprises in Bulgaria is not well explored, neither its competencies' contribution to innovation results nor their distribution among individuals, teams and the organization.

The scientific literature and management theory do not address the peculiarities and advantages of R&D personnel management and its impact on enhancing the innovation activity in innovative enterprises. The internationally recognized indicators for the assessment of the R&D personnel are formal education and occupation, but not all innovative enterprises have their R&D unit. This means that the R&D personnel may not be categorized as researchers and technical staff only. Professionals, who generate ideas for innovation, develop and implement them, are called innovators. These specialists can belong to different personnel's categories and hierarchical levels in innovative businesses. The indicators of the different innovative enterprises, which characterize the results, the organizational capacities and the motivation to carry out and develop the innovation activity, are specific. In most cases, business executives do not have the necessary expertise to assess the R&D personnel's achievements and contribution. It is

difficult to determine the outcome of the R&D personnel work if you do not have classified the expected innovation results and goals on individual, collective and organizational level. The skills of the R&D personnel are specific and strictly individual to each enterprise. The R&D personnel has a higher level of education and a higher qualification, so its specific competencies are more prominent. The specific and general competencies are predominant in innovative enterprises. The classifications of the different innovators' competencies will help the managers to identify the specific ones for the business and industry.

The proposed discrepancy model can be used to identify the differences and gaps between the necessary goals, competencies, performance and quality requirements of the R&D personnel and the organization in order to achieve higher innovation outcomes, to increase the innovation activity and the competitiveness of the innovative enterprise as a whole. This approach can be implemented in the enterprise's innovation system to distinguish the R&D personnel's needs for improving their innovation competencies, motivation or performance measurement, and management.

The increased innovation activity of the Bulgarian enterprises will help the country to move from the group of the modest to the group of moderate innovators.

Disclosure statement

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