

# How Continuing Vocational Education Training in Enterprises Influence Innovation Activities In SMEs in Bulgaria?

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## Abstract

This study investigates the correlation between supplementary training and qualifications of prospective human resources and their effectiveness and satisfactory performance in their respective roles, emphasizing CVT's impact on a company's innovation.

The majority of CVT research examines training time, cost, learning outcomes, and influence on labor force employment, youth employment, and pre-retirement generation as a labor market retention alternative. The principle remains the same: investing in CVT may boost enterprises' creative potential, help adapting, growing, and contribute to long-term economic development in their own nations and abroad.

A brief literature study synthesizes previous research on CVT and corporate innovation to integrate results and identify trends and patterns. The current research examines CVT and innovation using data from the National Statistical Institute of Bulgaria, Eurostat, and the Patent Office of the Republic of Bulgaria. The evaluated data aims to find correlations,

trends, and the influence of training on innovation indicators like patents and utility models. The main results illuminate Bulgaria's CVT development, availability, focus, and evaluation. Regression model is used to compare Bulgarian enterprises' CVT training (2005-2020) to their patents and utility models, to analyze the relationship between CVT in Bulgarian enterprises and their innovation capacity. Future research is proposed.

**Keywords:** Continuing vocational education and training, Education industry relationship, Planning of education and training, Return on education and training, Training within industry

**JEL:** M53, O30

## 1. Introduction

Globalization is undoubtedly a phenomenon that has opened up international markets for trade, the exchange of resources, and even labor. Today, international entrepreneurship produces and sells its products and services globally through digital platforms, saving costs and time. Digitization, in addition to driving the internationalization of large corporations, is also a determining factor in the competitive advantages of small and medium-sized

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enterprises. The changes in the way of work, in turn, require updating the professional competencies of the employees, the results of whose activities, in turn, improve the market share of the company (Ruseva, 2022). Continuing vocational education and training increases the quality of human capital at the company and country levels. In this regard, it is a key factor for innovations, a sustainable labor market, and growth (Neycheva, 2019).

According to the 2020 World Bank study (Verger, Bonal, 2011), the size and changes in industrial employment are major factors in determining the success of monetary expenditures in vocational education and training. Based on their prior work, the bank knows that investing in dynamic marketing of services and developing the managerial ability of training institutions, as well as in centers for non-formal learning, is where their money is best invested.

By investing in CVT programs, companies can equip their employees with the necessary skills, knowledge, and expertise to adapt to technological advancements, industry trends, and emerging market demands. One of the key advantages of CVT is its ability to foster a culture of continuous learning within organizations. By providing employees with opportunities to upgrade their skills and acquire new competencies, enterprises can enhance their innovative capacity. CVT programs often focus on developing critical thinking, problem-solving, creativity, and adaptability skills, which are essential for driving innovation in a rapidly changing business environment. Moreover, CVT contributes to the transfer of knowledge and best practices across borders. International collaboration and knowledge sharing are vital for fostering innovation on a global scale. When employees from different countries participate in CVT initiatives, they

bring diverse perspectives, experiences, and approaches to problem-solving. This cross-pollination of ideas and insights can fuel innovation by introducing new methods, processes, and technologies that have proven successful in other contexts. Furthermore, CVT can address skill gaps and promote economic development in different countries. By investing in training programs, enterprises can help bridge the skills mismatch between industry requirements and the available workforce. This not only benefits individual employees but also supports national economic growth by ensuring that industries have the skilled workforce needed to drive innovation and competitiveness.

The research question on which the present study focuses is: What is the impact of CVT on the innovative capacity of enterprises in different countries? The objectives of this study are:

- to assess changes in knowledge, skills, attitudes, and behaviors resulting from CVT programs.
- to evaluate the impact of CVT on the innovation capacity of enterprises.
- to analyze the statistical relationship between CVT participation and innovation-related outcomes using quantitative data analysis techniques.

The empirical analysis is based on data from the National Statistical Institute of Bulgaria and Eurostat. This enables us to evaluate the complementarity of the company's innovative activity with human capital development. We raise the following *hypothesis*:

*There is a positive relationship between the provision of CVT in enterprises and their innovative capacity, as measured by the number of patents and utility models.*

## 2. Review of the literature on the topic

The literature review in the section aims to emphasize the importance of CVT in SMEs to develop a skilled and competitive workforce, foster innovation, and gain a competitive advantage in the market. It draws attention to the benefits of CVT in terms of improved efficiency, product quality, and the potential for creating new products and business models.

CVT can have a significant impact on innovation activities in Small and Medium-sized Enterprises (SMEs). CVT programs provide opportunities for employees to enhance their skills and knowledge. As employees acquire new competencies, they become better equipped to address challenges, think creatively, and develop innovative solutions for the company's needs. Improved skill sets can lead to more efficient and effective processes, ultimately fostering innovation.

CVT can familiarize employees with the latest technological advancements and industry's best practices. As employees learn to use new tools and technologies, SMEs can adopt and implement these innovations in their operations, leading to increased efficiency, improved products/services, and competitive advantages. The enhancement of education quality is closely connected to the integration of contemporary information technology in the educational process. This will enable the optimization of the curriculum by including components of scientific research for pupils. Learning in the Internet age is characterized by its accessibility, since it is accessible online and can be accessed from distant areas at any time. Additionally, it offers the opportunity to acquire a vast amount of knowledge (Stereov, N., Stoyanova T., Kopeva D., 2017). Students acquire knowledge via the use

of diverse educational materials, including visual representations, pictures, simulated experiments, visual aids, audio recordings of literary passages, historical manuscripts, and narrated and captioned movies (Stereov, N., Nencheva, V., 2021). According to Iliev, the main focus is on evaluating the existing state of the student performance evaluation system, promoting and making known effective methods used by instructors, exploring new possibilities for enhancing the student evaluation system by incorporating successful practices from top educational institutions worldwide, and ultimately, fostering greater student involvement in the learning process (Iliev, Sterev et al., 2014)

Organizations that invest in CVT, demonstrate commitment to employee development and growth. Such a culture promotes a mindset of continuous learning, where employees are encouraged to explore new ideas, experiment, and share knowledge.

CVT programs often focus on developing problem-solving and critical-thinking skills. These skills are crucial for innovation as they enable employees to approach challenges from different perspectives, think outside the box, and generate innovative solutions to complex problems.

Some CVT programs also foster an entrepreneurial mindset among employees. This mindset encourages individuals to take calculated risks, explore new opportunities, and pursue innovative ventures within the company. In the context of a small or medium-sized enterprise (SME), this might result in the development of new goods, services, or approaches to business.

Employees are more inclined to work for companies that value their growth and offer opportunities for advancement. A talented and

engaged workforce is more likely to contribute to innovation efforts within the organization.

Multiple positive outcomes may result from CVT's implementation (Darryl Dymock & Mark Tyler, 2018): 1) CVT helps people maintain their competitive edge and embrace emerging career possibilities. 2) Greater productivity is noticed, since improved CVT results in more knowledgeable and capable workers. 4) Better results and better work quality may be accomplished when productivity is increased, which is beneficial for both people and businesses. 5) CVT's importance in promoting economic development and competitiveness on both the personal and national levels. CVT aids businesses and economies in adjusting to new technologies and shifting markets by equipping workers with the most current knowledge and abilities. A competitive economy relies on an innovative, productive, and competitive workforce. Through its emphasis on ongoing skill development and refinement, CVT fosters an environment of lifelong learning. By adopting a growth mindset, people are better able to adjust to changing situations in the workplace, gain new skills, and stay flexible in the context of technology and market shifts.

Despite numerous reasons to consider training an essential element of successful innovation, relatively few studies investigate firm-sponsored training as a predictor of firm-level innovation performance. (Bauernschuster, Falck, and Heblich, 2009) argued that continuous training ensures access to cutting-edge knowledge and thereby increases a company's innovation propensity. In fact, "lack of talent within the organization" was the second most cited barrier to innovation among Canadian businesses.

According to some scientists "the diversity of the workplace as a learning environment has become increasingly important as organizations have become more dynamic and diverse at the turn of the 21st century" (Mikkönen, Pylväs, Rintala, H., et al., 2017). As a fascinating metamorphosis of vocational education and counterpart of knowledge and knowing (DeFalco, 2010), this approach to education is best understood via Dew's interpretation of it as a "method of learning by doing" (DeFalco, 2016). Another research (Neycheva, M., Baltov, M., 2022) sheds light on the topic of (under)investments in CVT, which may have real-world ramifications for organizations, schools, and governments in their approaches to lifelong education.

There are a variety of techniques to quantify the value to businesses. Returns on investment in trainees' productive performance; money saved by not having to hire external skilled workers; reduced outage costs due to a shortage of skilled workers; differences in trainee and external skilled worker productivity; supply benefit (such as brand enhancement).

Organizational-level insights have concentrated on structural and job variables (e.g., firm characteristics, work practices) and employee demographics (Düll & Bellmann, 1999; Grund & Martin, 2010) such as education, age, and employment status, as well as a favorable correlation between company size, firm branch, and employment level, as well as continuous vocational education of workers.

The availability of human capital is a key factor in a company's capacity for innovation. Therefore, a rise in this resource pool as a result of company-sponsored education might boost creativity. To examine this claim, Benoit (Benoit, 2017) utilizes the Canadian Workplace and Employee Survey (1999-2006)

and its extensive database of information on the human capital investments and innovation performance of businesses. Taking into account workplace fixed effects and time-varying productivity shocks, the regression findings show that more education leads to greater invention, with on-the-job education being just as crucial as formal education. However, research into past events reveals that the effect gradually wanes.

In-house training has become more important to the success of modern knowledge-based economies, which must contend with increased competition on a worldwide scale and rapidly improving technological capabilities. As a result, these economies place a significant emphasis on this kind of creative activity. However, there aren't many types of research (Mohan, Preeya, Strobl, Eric, and Watson, 2018) that look at in-firm training in the Caribbean. This research presents empirical information about in-firm training in the area by making use of the World Bank Enterprise Survey (WBES) 2010 and Compete Caribbean's Productivity Technology Innovation Survey (PROTEqIN) 2014. Both of these surveys were conducted in 2014. There are considerable discrepancies across nations, which may be the consequence of differences in governmental support and impediments to in-firm training. The data show that the area as a whole has a relatively low incidence of training, despite the fact that there are large differences between countries. A number of aspects of the company, including its size, ownership, export status, connection with a bigger organization, inventive activity, employee structure, and educational level, all have a role in determining the in-company training that is provided. Last but not least, the findings imply that in-firm training in the region may play a relatively minor role or

may even be irrelevant for innovation and productivity. Despite the fact that this may be due to low levels of formal training and the metrics used to define and measure in-firm training, innovation, and productivity, given the limitations of the sample and the data that is available, the findings suggest that this may be the case.

In a different piece of research (Demirkan, I., Srinivasan, R., and Nand, A. 2022), the authors study how the product innovation capabilities of small and medium-sized businesses (SMEs) are affected by the degree to which effective resource and knowledge management is implemented. Specifically, the authors investigate how small and medium-sized enterprises (SMEs) manage their human resource investments in the form of employee training when boundary conditions such as employee education level, SME size, and the frequency of research and development (R&D) investments are taken into consideration. They also investigate the role that human resource investments play in developing a firm's innovation capabilities. The data uncovered 983 German small and medium-sized businesses across thirteen distinct sectors.

The authors of this study find that there is a positive association between greater investments in staff training and product innovation capabilities within the setting of SMEs by using hierarchical OLS regression to evaluate the hypotheses stated in this paper. To be more specific, the findings of the authors provide support for the following hypotheses: 1) the relationship between employee training and innovation capabilities is weaker in industries with a higher proportion of employees with university educations; 2) the effectiveness of investments in employee training is lower among larger SMEs than it is

among smaller SMEs; and 3) continuous R&D weakens the relationship between training expenditure and innovation capabilities. While the results of the authors add to the discourse surrounding the requirement of employee training for SMEs by reinforcing this concept, they also illustrate that investments in employee training have distinct consequences for small and big SMEs, subject to specific boundary conditions. While the findings of the authors contribute to the discourse regarding the necessity of employee training for SMEs, the authors acknowledge this notion. Furthermore, these results have important ramifications for the practical use of knowledge resource management for all managers of SMEs.

In addition, they show that such investments may boost the chance of survival for many of these companies owing to the beneficial influence that they have on product innovation. This is the case because of the favorable impact that such investments have.

The findings suggest that although investments in employee training are necessary, managers of specific small and medium-sized enterprises (SMEs) must be persistent in making such investments and make conscious efforts to obtain the benefits in terms of innovative capabilities. As a result, SMEs appear to be more entrepreneurial with their limited resources than large corporations, which have the financial means to conduct investments in a copious manner. This study makes a major contribution to the study of innovation in small and medium-sized businesses (SMEs) by revealing that employee training is particularly crucial for SMEs that are smaller in size, have a lower percentage of workers with bachelor's degrees, and do not continually invest in R&D. In addition, the authors show that investments in staff training are not useless expenditures but rather may

boost the chance of survival for a number of these businesses.

The data from an independent report by the World Bank is interesting. It claims that only 20 percent of the surveyed companies in Bulgaria provide formal training for their employees. One of the main factors hindering the good performance of the private business is an "under-educated workforce". At the same time, the rating given to Bulgaria in terms of product innovation, the Index (GII) is high, taking 27th place in terms of knowledge and technology (KTO), the GII index is low in research and human capital (Bulgaria ranks 65th, WIPO, 2021) and especially digital skills (Bulgaria ranks last, according to the Internet User Skills and Advanced Digital Skills indicator, IUS/ADS). Bulgaria faces problems in creating the framework for vocational education and training, as well as due to the fact that companies have not created internal rules for training, the shortage of qualified workers (WIPO, 2021; European Union, 2021), and the lack of supporting structures (Transparency International, 2022a; World Economic Forum, 2019). On-the-job training takes place through masters or trainers, which does not guarantee the quality transmission of the necessary skills, nor their correct assimilation. The report concludes that VET teaching at the workplace is a mandatory condition for the realization of quality personnel in Bulgaria.

### **3. Typical characteristics to present the important aspects of CVT**

This section presents the specific results of the study, which focuses on Bulgaria for the period 2005–2020, of the typical characteristics that represent important aspects of CVT that are associated with innovation and opportunities for enterprise



development. The provided data and results contribute to an understanding of the impact of CVT training on the innovativeness of enterprises in Bulgaria.

### 3.1. The main characteristics used to present CVT aspects

Eurostat, the statistical office of the European Union, provides data and insights on various aspects of CVT. While Eurostat does not explicitly define the main characteristics of CVT, it offers information that can help identify key features. Here are some relevant characteristics derived from Eurostat's data and publications: Participation Rates, Duration of Training, Employer-Sponsored Training, Fields of Training, Educational Attainment, Funding Sources, Digital Skills, Recognition and Certification, and International Comparisons.

While these characteristics are not explicitly outlined by Eurostat, they can be inferred from the data and information provided by the statistical office. They offer insights into the participation, nature, and impact of CVT activities in Europe, supporting evidence-based policy decisions and initiatives in the field.

Researchers often consider various key characteristics to present the most important aspects of CVT. Most often, they use the following main characteristics to present the most important aspects of CVT: the proportion of businesses offering CVT courses, the number of employees enrolled, the hours spent enrolled in CVT courses per employee, and the cost of CVT courses as a proportion of all labor costs. The following characteristics will be discussed in this section: the percentage of firms that provide CVT programs; the various types and forms of CVT; the main skills that these programs

target; and the specific methods used to evaluate the outcomes of training.

### 3.2. Data Sources

The NSI of Bulgaria provides data for the study, including information on the participation rate in CVT courses and statistics on continuing vocational training in Bulgarian enterprises. Eurostat's databases were used to gather data for the study, including information on enterprises providing CVT courses and other forms of CVT, skills targeted by CVT courses, and methods used to evaluate the outcomes of training. Eurostat also provides data on enterprises providing training by type of training for Bulgaria and the EU. Data from the Patent Office of the Republic of Bulgaria statistics were used to determine the impact of CVT on innovation capacity using the number of patents and utility models. These resources were utilized to gather data and conduct the analysis related to the characteristics, participation rates, types of CVT, skills targeted, and evaluation methods of CVT in Bulgarian enterprises.

### 3.3. Participation Rate in CVT Courses

The proportion of CVT course participants to the average workforce of the businesses offering CVT courses is known as the participation rate in CVT courses. Based on data from NSI Bulgaria, by size of enterprise, the highest rate of participation in CVT courses for 2020 (78.9%) was in large enterprises (250 employees and more). The small-size enterprises (10–49 employees) had the lowest rate of participation (37.3%). The participation rate in continuing vocational training courses for 2020 related to all employees of the respective company size is presented in Table 1 as a percent.

**Table 1.** The participation rate in continuing vocational training courses for Bulgaria in 2020

Company size	The participation rate in continuing vocational training courses, related to the employees of all companies of the respective company size
10 to 49 employees	37.3
50 to 249 employees	55.0
250 employees and more	78.9

Source: NSI Bulgaria

**Table 2.** Statistics on continuing vocational training in enterprises in Bulgaria for the 2015 and 2020 years

	2015 (Percentage)	2020 (Percentage)
Enterprises providing any form of CVT as % of all enterprises	42.2	41.1
Enterprises providing CVT courses as % of all enterprises	31.9	26.7
Participants in CVT courses as % of all employees in all enterprises	26.5	23.0
Participants in CVT courses as % of all employees in enterprises providing CVT courses	48.0	43.9
Hours spent in CVT – hours per person employed in all enterprises	7.5	4.6
Direct cost of CVT courses per person employed in enterprises providing CVT courses in EUR	89	45
The labor cost of participants of CVT courses per person employed in enterprises providing CVT courses in EUR	86	94
Enterprises providing IVT as % of all enterprises	7.6	3.8

Source: NSI Bulgaria

**Table 3.** Percentage of employees participating in CVT courses based on the employees of all companies.

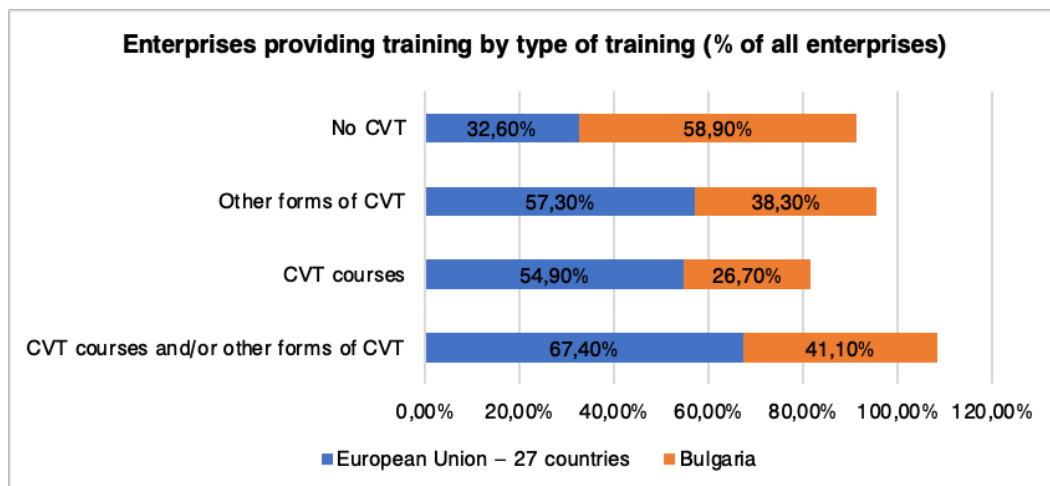
2020
↓ – 3.5% compared to 2015

### 3.4. Provision of CVT by Enterprises

In Table 2, information on the main characteristics for presenting the most important aspects of CVT for Bulgarian enterprises in 2015 and 2020 is provided. The quantity of training provided, the number of participants, and the quantity of hours necessary to conduct a CVT course have all decreased for 2020 compared to 2015.

The participation rate in CVT courses for 2020 was 23%, decreasing by 3.5 percentage points as against the year 2015 (Table 3). Enterprises that offer CVT to their employees make up 26.7% of the total number of businesses, while 38.3% choose to train their staff members via other CVT programs (a variety of courses) (Figure 1). Unfortunately, a large percentage of enterprises in Bulgaria





**Figure 1.** Data on enterprises providing training by types of training for Bulgaria and the EU for 2020

Source: Eurostat

do not provide CVT opportunities for their workers. This percentage is much higher than the average for the EU-27.

### 3.5. Internal vs. External CVT Courses

External CVT courses are those developed and maintained by entities external to the corporation, such as universities, training centers, or trade associations. Companies decide whether to train in-house if they have the necessary skills or to hire an outside firm if they don't in order to keep their competitive edge. Whether or not outsourcing is cost-effective depends heavily on the scope of the organization, as does whether or not the necessary level of education is achieved. Both outsourcing and insourcing may be organized to provide high-quality training, with the choice depending on the budget. By educating employees internally, businesses may create programs that are more suited to their requirements, increase employee engagement, and strengthen internal networks and communication. However, when training

is provided by an outside source, participants get exposure to industry standards and formal education. It is clear from the chart in Figure 2 that scheduled internal training for businesses in Bulgaria is slightly more prevalent for the year 2020. Enterprises in Europe are more likely to provide external rather than internal CVT training, according to data. It is noteworthy that both types of training are almost twice as low as their respective average European indicators. According to Bulgaria's 2020 data, companies of all sizes are almost equally likely to provide both internal and external training (Table 4).

### 3.6. Types of CVT Offered

A total of 25737 businesses—or 85.3% of all businesses—offer different types of CVT, including on-the-job training, job rotation, exchanges, secondments, study tours, seminars, workshops, learning circles, and self-directed learning. All percentages for these types of VET for 2020, with the exception of learning circles, are significantly

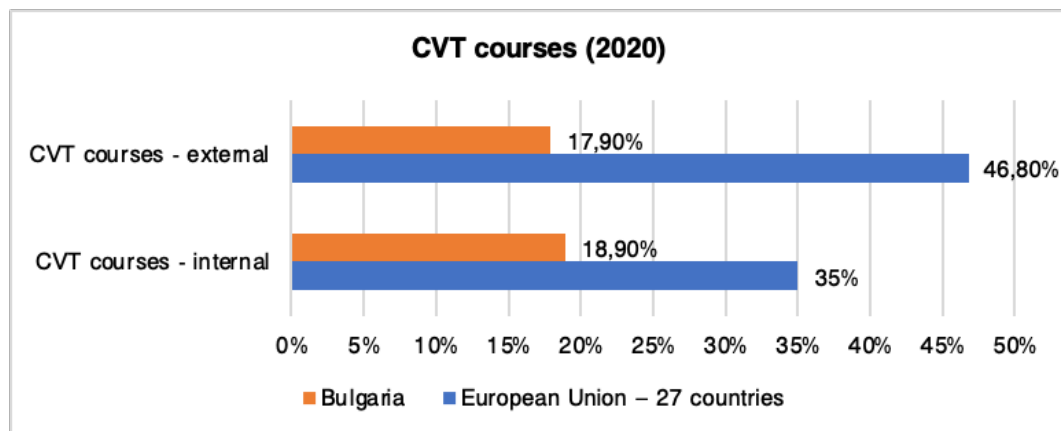


Figure 2. CVT by type of training

Source: Eurostat

Table 4. Provision of internal and external training (Source: NSI Bulgaria)

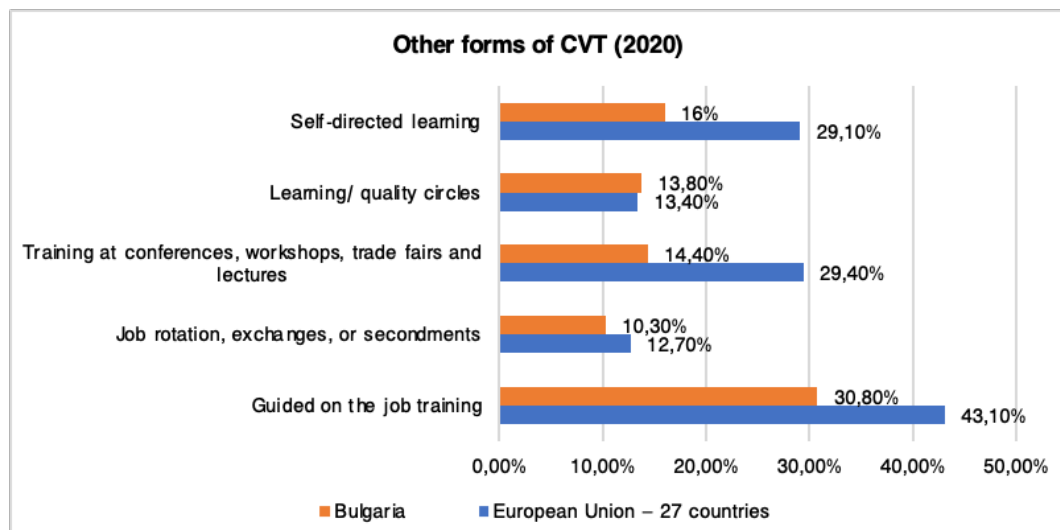
Groups of enterprises according to the number of employees in them	Enterprises providing training (Percentage)	
	CVT courses - internal	CVT courses - external
10 to 49 employees	15.4	13.7
50 to 249 employees	30.5	33.1
250 employees and more	60.8	59.8

lower than the average for the EU-27 (Figure 3). We note that for both EU-27 and Bulgarian enterprises, the preferred form of vocational training is on-the-job training.

### 3.7. Number of CVT Courses Offered

With a few notable exceptions, the data on completed CVT courses and/or other forms of CVT from the businesses engaged in economic activity for the year 2020 compared to 2015 show a decrease in the number of courses held for both the EU-27 and for Bulgaria (Table 5). The COVID-19 epidemic is, of course, the primary cause in this instance. Despite the decrease, businesses engaged in the information and communication, financial, and insurance sectors, both for the EU-27 and for Bulgaria, remain the most active in

offering CVT courses. It should be highlighted that the number of VET courses offered by businesses in the economic activity industry (except construction) for the EU-27 countries in 2020 indicates an increase and that these businesses are the second most active in offering courses. In contrast to them, construction-related businesses are the second most active in Bulgaria in terms of offering VET courses, with an increase in courses offered in 2020 compared to 2015. The influence on innovation is greater when learning activities are integrated into the regular performance of work duties and are firm-specific.



**Figure 3.** Different types of CVT

Source: Eurostat

**Table 5.** Enterprises providing CVT courses and/or other forms of CVT and NACE Rev. 2 activity (% of all enterprises)

	European Union – 27 countries			Bulgaria		
	2015	2020		2015	2020	
NACE_R2 (Labels)						
Industry (except construction)	69.5	70.5	↑ 1	41.8	38.6	↓ –3.21
Construction	69.4	64.1	↓ –5.3	47.4	51.0	↑ 3.6
Wholesale and retail trade, transport, accommodation, and food service activities	66.5	62.1	↓ –4.4	36.1	34.6	↓ –1.5
Information and communication; financial and insurance activities	84.5	82.8	↓ –1.7	61.2	58.8	↓ –2.4

Source: Eurostat

### 3.8. Skills Targeted by CVT Courses

The main objective of vocational training programs is to provide trainees with the skills required to do particular tasks, together with the certification that proves their competence to employers and other stakeholders. An essential component of a successful CVT system is effective assessment. The focus of Bulgarian businesses is mostly on

improving technical, practical, or job-specific skills. In 2020, 79.7% of businesses held such orientation-focused training courses, compared to an average of 61.6% across the EU-27 (Table 6). 22.2% of enterprises in Bulgaria considered customer handling to be a very important skill for enterprise development in the coming years. Compared to countries in the EU, substantially fewer

**Table 6.** Some main skills targeted by CVT courses (% of enterprises providing CVT courses)

Skills targeted by CVT courses	European Union – 27 countries	Bulgaria
Management skills	18.1	9.4
Office administration skills	11.6	6.9
Technical, practical, or job-specific skills	61.6	79.7
Customer handling skills	19.1	22.2

Source: Eurostat

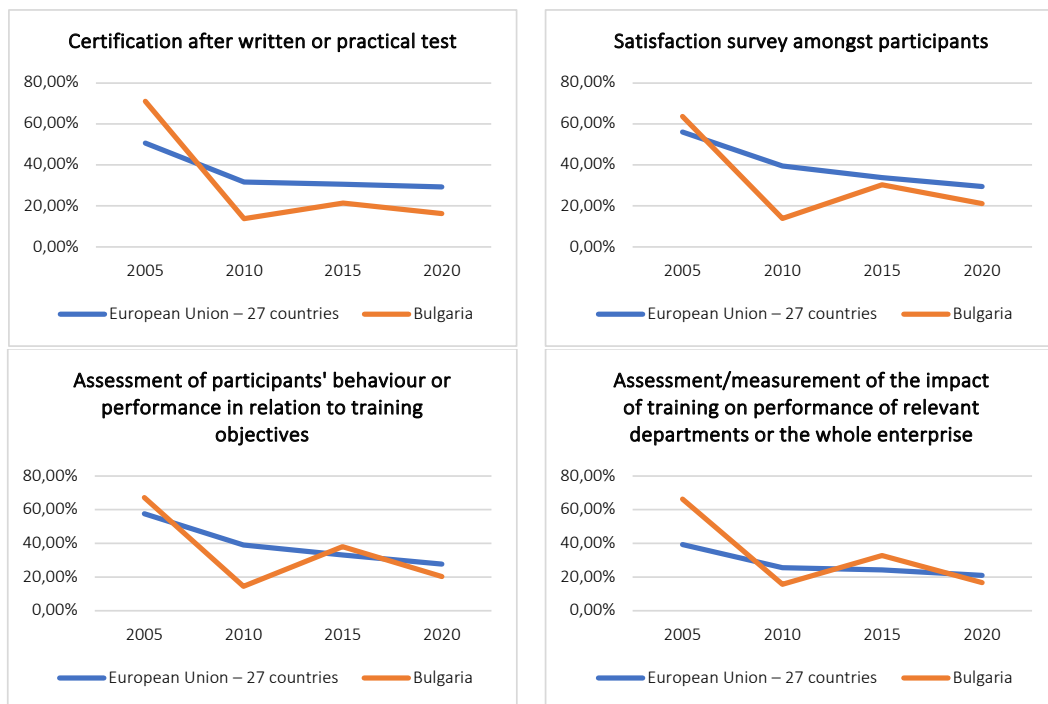
Bulgarian businesses focus on enhancing their managerial and office administration skills.

### 3.9. Evaluation of CVT Outcomes

There are a number of tools available to businesses for gauging CVT's effect on innovation inside the company. Some methods for determining whether or not CVT stimulates creative thinking are as follows: Case studies, success stories, pre- and post-training surveys, feedback on innovation outcomes, and employee surveys all fall under this category. When assessing CVT's effect on innovation, businesses should use a holistic strategy that incorporates both qualitative and quantitative approaches. This permits a thorough evaluation of the training's efficacy and aids in the discovery of ways to enhance future training efforts. The standard of training provided to employees by companies should likewise be reviewed. The results of this monitoring can help businesses understand how training affects employee performance and modify their future training decisions accordingly. 34.2% of enterprises in Bulgaria assessed the outcomes of their training activities in 2020.

Companies should also assess the quality of the training they supply their staff with. Using the data gathered from this tracking, companies can better comprehend the impact training has on worker productivity. Common

techniques used by businesses for measuring the effectiveness of training include training completion certificates, participant surveys, assessments of how well individuals performed in relation to the training's stated goals, and quantitative analyses of how much of an impact the training had on the performance of individual departments and the business as a whole. 34.2% of enterprises in Bulgaria assessed the outcomes of their training activities in 2020. Based on data from Eurostat, the diagrams in Figure 7 present the change in the percentage of enterprises using the specified methods for evaluating the results of training for Bulgarian enterprises and the average indicator for the EU-27 countries for the period 2005–2020. In 2020, 21.2% of Bulgarian enterprises conducted surveys among training participants. This result is slightly lower than the average indicator for the EU-27 (29.5%). In the same year, 20.4% of Bulgarian enterprises used the method of evaluating the behavior or performance of the participants in relation to the training objectives, which is 7.3% less than the average indicator for the EU-27 countries. About 16% of them used the other two methods, and again, these indicators are lower than the average indicator for the EU-27 countries. It should be noted that only 16.7% of enterprises measure the impact of training on the work of the relevant departments or the entire enterprise.



**Figure 7.** Percentage of enterprises using the methods to assess outcomes of training, EU-27, Bulgaria, 2005-2020

Source: Eurostat

The following main conclusions can be drawn:

- **Participation Rate:** The participation rate in CVT courses in Bulgaria decreased from 26.5% in 2015 to 23% in 2020. Large enterprises had the highest participation rate (78.9%), while small-size enterprises had the lowest (37.3%).
- **Decrease in Training Quantity:** The quantity of CVT training provided, the number of participants, and the hours spent on CVT courses decreased in 2020 compared to 2015.
- **Low Provision of CVT:** A significant percentage of enterprises in Bulgaria (58.9%) do not provide CVT opportunities for their workers, which is higher than the EU-27 average.
- **Internal vs. External Training:** Bulgarian enterprises are almost equally likely to provide both internal and external CVT training. Internal training is slightly more prevalent in Bulgaria compared to the European average.
- **Types of CVT:** On-the-job training is the preferred form of vocational training in Bulgaria. The percentages for various types of CVT, except for learning circles, are significantly lower in Bulgaria compared to the EU-27 average.
- **Industry Focus:** Despite a decrease in the number of courses offered, the information and communication, financial, and insurance sectors in Bulgaria remain the most active in providing CVT courses.

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- *Skill Focus*: Bulgarian businesses primarily focus on improving technical, practical, or job-specific skills through CVT courses. Fewer businesses prioritize managerial and office administration skills.
- *Evaluation of Training*: Around 34.2% of Bulgarian enterprises assessed the outcomes of their training activities in 2020.

### **Regression model of the number of patents/utility models depending on the number of enterprises in Bulgaria providing CVT training**

This section examines the relationship between the number of CVT trainings conducted by enterprises in Bulgaria for the period 2005–2020 and the number of patents or utility models for this period.

#### **1. Importance of Evaluating Training's Impact on Innovation**

Evaluating the effectiveness of training in relation to its impact on innovation is essential for companies for several reasons, some of which are:

- Return on investment may be calculated by evaluating whether or not training is having a beneficial effect on innovation. This helps companies evaluate the return on investment for training expenses and plan more effectively for the future.
- Assessment may be used to learn more about the connection between training and new ideas inside an organization. This can help us learn more about the processes and mechanisms that foster invention, and eventually zero in on the best approaches to train for innovation.
- Evaluating the effect of training on innovation helps businesses find and nurture top talent, which boosts productivity, efficiency, and ultimately, the company's ability to stay ahead of the competition.

#### **2. Relationship Between CVT and Patents/Utility Models**

According to the research results of numerous studies, there is an association between enterprise innovation and human resource development (Zheng et al., 2006). One of the key components that aids a company in becoming innovative is encouraging training participation and skill development (Rosli & Mahmood, 2013). In the present study, our attention is directed to the impact of CVT on the innovative capacity of the enterprise, and for this purpose, it is necessary to select an appropriate innovation indicator. Patents and utility models are used as substitute indicators of innovation (Ratanawaraha and Polenske, 2007).

Checking whether the data were suitable or not for factor analysis was done using Bartlett's test. A p-value less than 0.05 is strong evidence that the variances are not equal across the samples. The p-value from Bartlett's test for study data is 0.00081, which assures that the data are acceptable to conduct factor analysis.

When analyzing the connection between two quantitative variables, linear regression and correlation are the two most used techniques. Both regression and correlation assess the linear connection between two variables, but regression employs an equation to represent the relationship. The relationship between VET training and patents or utility models was found to be statistically significant in only two cases: first, enterprises providing in-house VET courses with patents, and second, businesses providing other forms of VET with utility models. In the first case, there is a weak positive correlation, and in the second, there is a very strong positive correlation (Table 7).



**Table 7.** Correlation between CVT and patents or utility models

	number of enterprises providing VET courses - internal	number of enterprises providing VET courses - external	number of enterprises providing other forms of	Number of patent applications filed	Number of requests submitted for utility models
number of enterprises providing VET courses - internal	1				
number of enterprises providing VET courses - external	0.932926509	1			
number of enterprises providing other forms of	0.572834907	0.531454984	1		
Number of patent applications filed	<b>0.351415709*</b>	0.123349819	-0.404066372	1	
Number of requests submitted for utility models	0.710715242	0.650558832	<b>0.98329928*</b>	-0.253499209	1

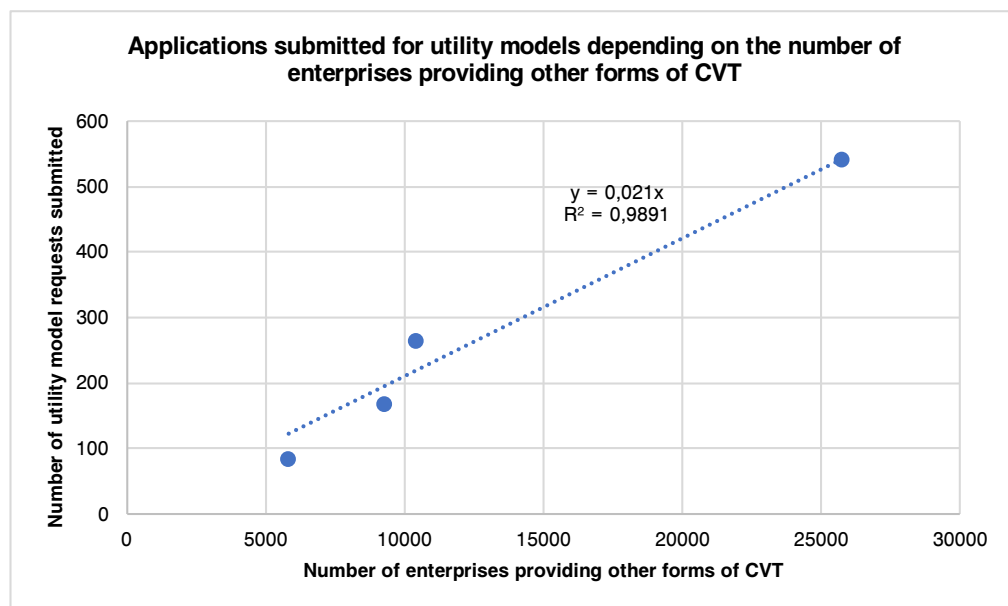
\* Correlation is significant at the 0.01 level (2-tailed)

### 3. Regression Models

Regression analysis is used to assess the strength of predictors and a trend in the relationship between correlated variables. In their study published in 2015, Austin and Steyerberg (P. Austin, E. Steyerberg, 2015) demonstrated that linear regression models may accurately estimate regression coefficients with just two subjects per variable. As a result, we have an argument to search for a regression model using the small quantity of data from the National Statistical Institute and the Patent Office of the Republic of Bulgaria that we have. In our case, the linear regression model (Model 1) is shown in Figure 8. When the number of other forms of CVT training in enterprises goes up by 1, the number of utility models will go up by 0.0222. A linear regression predicting the number of utility model applications from the number of establishments providing other forms of CVT has an  $R^2$  of 0.9891. From this  $R^2$  value, we know that: 1. 98.91% of the difference in the number of utility model

applications is accounted for by the number of businesses providing other forms of CVT; 2. only 1.09% of the differences in the number of submitted requests for useful models are not explained by the model, and 3. the number of enterprises providing other forms of CVT has a large impact on the number of applications for utility models.

Jenkins and Quintana-Ascencio investigate the problem of building a model based on a small amount of data. Specifically, they seek to answer the question, "What is the minimum  $N$  to identify the most plausible data pattern using regressions?" In their paper (D. Jenkins, P. Quintana-Ascencio, 2020), they show that when there are four data per variable, the quadratic model is the most plausible, regardless of the variance in the data. In our case, the quadratic model (Model 2) is shown in Figure 9. Unfortunately, the tests for the statistical significance of the coefficients of Model 2 and for the adequacy of Model 2 showed that its coefficients were statistically insignificant and that it was not adequate.



Model 1 was determined using only a small amount of data; however, it can be argued that doing various types of CVT in businesses increases the number of useful models. However, sufficient data must be gathered to make a conclusive judgment, so it is important to continually collect data rather than wait until every five years, as is now the case. Additionally, it can be noticed that companies may use this relationship to evaluate the impact of their CVT.

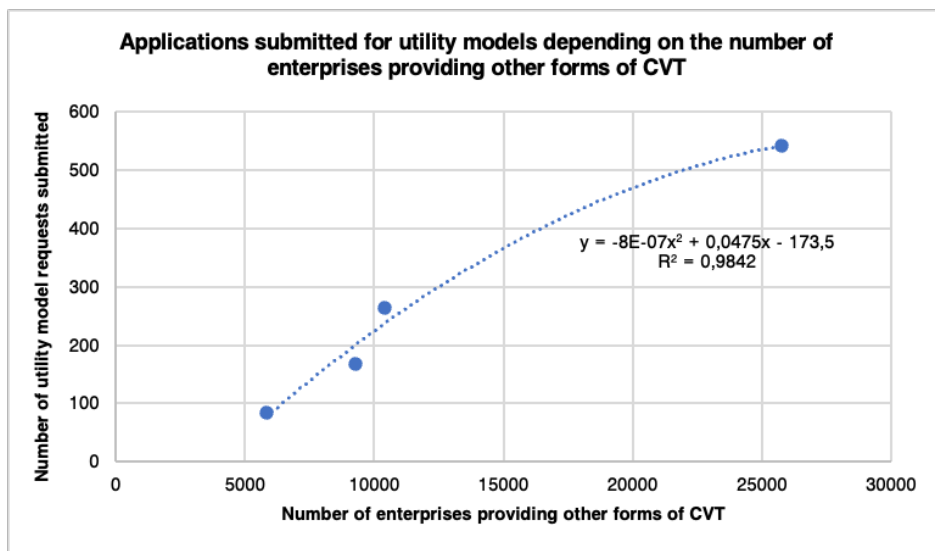
#### 4. Findings

The following are some of the most important takeaways:

- Companies may encourage creativity by providing opportunities for employees to acquire new skills and participate in training programs.
- The data shows a statistically significant link between CVT education and two types of patents or utility models. In the

first scenario, in-house CVT courses are positively correlated with patents, but in the second scenario, other types of CVT are positively correlated with utility models.

- The power of predictors and the direction of the link between correlated variables may be evaluated via regression analysis. According to the linear regression model, more utility models are submitted as the number of various types of CVT training in businesses grows.
- It indicates the requirement for continuous data gathering as opposed to depending on rare data updates to draw firm conclusions regarding the connection between CVT and utility models.
- The connection between CVT and utility-based approaches may be used by businesses to gauge the success of their particular CVT initiatives. This insight may help guide organizational choices and initiatives about training and innovation.



ANOVA						
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>	
Regression	2	117213.9088	58606.95	31.18899	0.125611907	
Residual	1	1879.091187	1879.091			
Total	3	119093				
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	-173.5012866	152.8720563	-1.13494	0.459814	-2115.924933	1768.922359
Number^2	-7.63314E-07	7.28043E-07	-1.04845	0.484947	-1.0014E-05	8.48735E-06
Number of enterprises providing other forms of CVT	0.047462907	0.024289984	1.954011	0.301132	-0.261170606	0.35609642

**Figure 9.** Quadratic model and results from the tests for statistical significance

## Conclusion and future work

The specific context of the study is Bulgaria's vocational training landscape and its impact on innovation capacity in enterprises. The study utilizes data from the NSI of Bulgaria, Eurostat's databases, and the Patent Office of the Republic of Bulgaria to analyze the relationship between CVT and innovation in Bulgarian enterprises.

The study focuses on the Bulgarian setting, offering insights into CVT practices and their

link with innovation in Bulgarian businesses. While there is literature on CVT and its impact on innovation, studies with a specific regional focus, such as Bulgaria, are uncommon. As a result, our study fills a void in the literature by offering useful insights regarding CVT dynamics in a specific country.

The findings for Bulgarian enterprises are compared to the average indicators of the EU-27 nations in the study. The study contributes to a better understanding of CVT

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practices in a variety of settings by stressing parallels, differences, and potential areas for improvement between Bulgaria and the European average.

The research conclusions have practical consequences not only for Bulgaria but also for other nations facing comparable issues in CVT and innovation. The findings of this study can help stakeholders build effective CVT programs and strategies for stimulating innovation.

The investigation of many aspects of the relationship between PPO and creativity in Bulgarian firms will continue in the future. The long-term influence of CVT on innovation is one element. It is critical to determine whether there are long-term, noticeable effects on innovation outcomes. Another consideration is sector analysis. To determine whether there are specific industries where CVT has a greater impact on innovation and, if so, what variables contribute to this variation.

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