



of VET on innovation and how they are related, which is done by analysing basic data and key figures from a variety of countries.

From world and local economy, we know that investment in education creates a more productive workforce and that, "it may be the backbone of a country's innovation system" (Cedefop, 2017). Especially in the times of the Covid-19 crisis, countries as for example the Austrian government (Bundesministerium für Digitalisierung und Wirtschaftsstandort, 2020), invest millions of Euros into higher qualification to bring people into work, to use slow economic times for reskilling and to thus strengthen the resilience, adaptability and therefore the competitiveness and productivity of companies and the economy. Competitiveness and productivity however are only made possible by innovation, which in turn is based on a well-trained workforce. "The globalization of markets is accelerating the diffusion of technology and the pace of innovation. New occupations are emerging and replacing others. Within each occupation required skills and competencies are evolving, while at the same time the knowledge content of production processes and services is rising" (ILO, 2010). This statement by the International Labor Organization (ILO) confirms that the economy is faced with new working methods and Covid-19, which influences all parts of life, has accelerated this development.

This paper shall sensitize a topic that becomes increasingly important for the work of companies' human development departments and explore the relation between VET and innovation on a macroeconomic level among developed, developing and less developed countries. The paper hypothesizes, that there exists a strong and positive connotation between innovation and VET. The purpose of this research is to prove whether there is a connection between key parameters regarding education and innovation when comparing developed, developing and less developed countries.

The paper will analyse and describe the precondition required to create innovation as well as the relation between vocational education and innovation. The results are drawn from literature research as a basis and further established by analysing different relevant key figures and parameters of selected countries.

The following paragraph gives an insight to literature on VET and its relation to human capital and finally to innovation. Paragraph 3 describes the methodology, the data sources and indicators used to demonstrate the relation between VET, innovation, and economic growth. The results are described in paragraph 4 and concluded in paragraph 5, which also provides an outlook.

## 2. Literature review

The world of work is amid a change process. The fourth industrial revolution expects new digital skills, artificial intelligence and therefore automation, which will substitute or change working places and jobs. While automation advances to previously unthought of dimensions, new jobs will be created while others disappear. In this context a workforce that can fulfil arising challenges and create new knowledge is growing innovation.

Nilsson (2010) describes the purpose of VET as a means to provide people with skills that have direct or indirect effects on productivity and further on economic growth. Nilsson's investigation of several studies regarding the effect of training on productivity brings forth a variety of results because in-company training is complex, and this as well as the heterogeneity of companies make VET difficult to measure in this context.

Mc Grath cites Anderson (2009), who sees "economic development as the ultimate goal of society" and derives that VET leads to productivity, economic growth, and therefore to

employability and jobs (Mc Grath, 2012). The results section of this paper documents the correlation between VET and innovation.

The 2019 Human Capital Trends study by Deloitte documents that, "many employers believe that large numbers of college graduates are missing skills in complex thinking" (Deloitte, 2019) and further reports that job candidates without a college degree too can become a highly effective staff. Eighty-four percent of the study's participants stated that they are increasing investments in reskilling. This is essential to upkeep the level of a highly qualified innovative work force. Lee, Har & Lee conclude that human capital is "crucial to economic growth" (Lee, Har & Lee, 2020) and that this topic is a niche in literature.

Even today companies find themselves in a war for talents to secure their markets. Talents are the output of an educational system as for example in Austria, where vocational education focusses on the combination of theory and practice both in companies and training institutes, to generate highly skilled workers that build the basis for economic growth (IBW, 2016).

The difference between general education and vocational education is defined in a Cedefop (European Centre for the Development of Vocational Training) research paper which cites from the International Standard of Classification of Education (ISCED) 2011 glossary: "vocational education is defined as education programs that are designed for learners to acquire the knowledge, skills and competences specific to a particular occupation, trade, or class of occupations or trades." and "General education is defined as education programs that are designed to develop learners' general knowledge, skills and competences, as well as literacy and numeracy skills, often to prepare participants for more advanced education programs at the same or a higher ISCED level and to lay the foundation for lifelong learning. These programs are typically school- or college-based" (Cedefop, 2018). Clearly vocational education is targeted to prepare individuals for their occupational career. Cedefop defines VET as "education and training which aims to equip people with knowledge, know-how, skills and/or competences required in particular occupations or more broadly in the labor market" (Cedefop, 2017).

Many further authors, as for example S. Billett or G. Moodie, create definitions of VET based on different views and dimensions but all similarly conclude that while "it is the least homogeneous part of the key educational fields" (Billet, 2011), it describes "the development and application of knowledge and skills for middle level occupations needed by society from time to time" (Moodie, 2008). From the view of an enterprise, it makes no sense to offer professional or vocational education and training without previously defined needs. This thesis focusses on the socioeconomic and labour market perspective as this is what makes VET so important for companies.

The correlation of the role of VET and its influence on innovation is researched by several authors. In 1964, Becker further developed the relationship between economic growth and investment in education, which had been established by Schultz in 1963 and which founds the modern human capital theory. (Bartak, 2016). This implies that employees transfer their achieved knowledge into their work, whereby labour productivity can increase, and thus human capital is a driver of technical development and implementation of new technologies.

A study by the WIFO (Austrian Institute of Economic Research), which looked at the role of future education in the Austrian economy, describes education as the source for innovation and states that it is not possible to develop or transfer innovation without formal education. Hence, a given education system leads to a continuous output of ideas and innovation, which subsequently influences economic growth and technological progress. The impact of education on economic growth through innovation on the one hand, brings dependencies for economic growth through education which in turn influences the success of innovation, while on the other hand it influences different factors such as innovation bonuses or R&D funds. (Bock-Schappelwein,

2012). This theory is better understood when reverting to Schumpeter's Innovation Trilogy with its three stages or processes, which are cited by Perihan (2015) as follows: invention process i.e., developing new ideas that come about by enabling knowledge; innovation process i.e., transforming the new ideas into products and processes; and the diffusion stage, "in which the new products and processes spread across the potential market" (Perihan, 2015).

The importance of human capital is documented in Solow's 1956 neoclassical growth model, which was extended by Mankiw, Romer and Weil in 1992. The model adds the human capital aspect as an additional factor of productivity to capital, work, and technology. (Schmidt, 2008). Through the significance of human capital, the quality of work is considered in relation to economic growth. Bartak, who cites Mankiw, purports that technological knowledge is the basis for technological progress and that it consists of both general and private knowledge. (Bartak, 2016). Thus, the factors capital, human resources, technology and the necessary organizational framework are preconditions to build and provide the basis for innovation in enterprises.

Further studies and improvements were made in later years and especially the human capital factor gained importance. Different calculations counted a human capital factor share of 22% to 49%. Sianesi and Van Reenen (2003) developed new theories of economic growth, where especially technological progress is related to the size of human capital. The relation is given because human capital leads directly to new technological know-how. (Romer, 1990).

Regarded from an innovation perspective, the increasing demand for relatively high-level skills are often related to science, technology, engineering, and mathematics (EU Commission, 2012). Skills are a key driver for growth, employment, and competitiveness: they lay the foundation for productivity and innovation (Cedefop, 2018). Romer (1990) writes that the number of innovations increases with the quota and the quality of the invested human capital for research and development and in 1998 Stewart documented that the genesis of innovation is human capital (Stewart, 1998).

Concluding from literature and the current scientific level of knowledge on the benefit of education and training, VET can derive impacts for the individual employee and the society but also impact companies through increasing productivity, benefit sharing between company and employee (win/win situation), an increase in profitability, employment stability, human resources management strategy and innovation. (Schmidt, 2008). According to their IBW report, a study by the Austrian researchers Böheim und Schneeweiss concluded that if a company doubles their investment in training, its productivity rises by 4% (Böheim, 2008), while a European survey, which is cited by WIFO, documents the lack of a highly qualified staff as an obstacle for innovation (Bock-Schappelwein, 2012). Further research by Lee concludes that "1% increase in the enrolment of upper secondary VET will lead to 0.187% improvement in economic growth" (Lee, 2020), which backs the results of prior studies purporting that VET is necessary for economic growth, as carried out by Asadullah et al. in 2018, Houten in 2017, and McGrath and Powell in 2016 (Lee, 2020).

The higher the development level of a national economy is, the higher its need for innovation-relevant knowledge. The economic and global situation today is characterized by permanent change and unpredictable events, as currently the Covid crisis. VET systems and institutions are therefore challenged more than ever. The VET system becomes more and more influenced by a number of external factors, which have different implications for the system and the labour market. VET institutions must focus as a think-tank and act as such. As a think-tank, VET would find solutions for the challenges of today; together with strong employer and labour organizations, VET has to find and to develop opportunities, concepts and models for jobs that do not yet exist, but which are a basis for future innovative products and services. This implicates

setting up and forcing both private and public investment in research and development and thereby in innovation.

Innovation, as described, leads to the development of new products, services, and production processes, including the automation of production systems that were previously labour intensive. The pace of technical change is substantial and the demand to create new products and services is increasing. Renewable technologies are one example for new products and resulting new job profiles. Taking the construction of wind turbines as an example, the chain of innovation starts with new materials, which require new technologies in the manufacturing process, which in turn require highly skilled maintenance and so forth.

While literature review confirms that innovation and education are indeed a driver of economic growth, the available articles, scientific studies, and books used and analysed mostly focus on VET in the context of a dual vocational education system as a form of secondary education. They disregard developmental VET in the sense of lifelong learning and at the same time lack corroboration on a global level. A comparison between a wider variety of countries and specifically chosen parameters give a better insight.

### **3. Methodology**

The research method for this paper was desk research with a focus on different recognized databases so as to gather relevant data and information, and subsequently make figures and indicators comparable for different countries by visualizing correlations accordingly.

The findings in this paper are based on a theoretical analysis and description of VET and innovation. Data derived from desk research were combined to analyse the topic from different perspectives. Findings document the role of VET and its influence on innovation. To prove and confirm the theoretic analysis of the relation between the various indicators, key figures were researched and afterwards brought into relation with the main parameters.

Facts leading to the conclusion are substantiated by a correlation analysis with different indicators to measure the intensity of the relationship between VET and innovation for the different countries. Comparing the DACH region a strong correlation between VET and innovation is given. To provide a more global view, countries that are regarded as developed, less developed or developing from different continents were selected for the study. VET systems are available in all the chosen countries, yet according to different specifications and depending on the political frameworks.

#### **3.1. Data sources and methods**

Basis for this desk research are data, which were derived from the World Economic Forum (WEF) and the IMD World Competitiveness Center. The former supplies a complex database which provides and combines data from different sets of information. The data includes statistical figures from internationally recognized organizations such as the World Bank, OECD, WHO, IMF and others. (Schwab, 2017). The IMD data focusses on countries' human resources development.

To find evidence for the connection between innovation and VET, the author carries out the following analyses: First the main WEF performance indices are compared and analysed by country, followed by a comparison and analyses of the IMD World Talent Ranking innovation & education indices for the same countries to identify gaps and similarities. A subsequent correlation coefficient analysis links the different indices. Findings are further underpinned by an

analysis of the Austrian Adult Education survey and the European Innovation Scoreboard to find evidence that countries which invest in education also have a high innovation rate.

In their 'Global Competitiveness Report' the WEF analysed 140 countries, developed indices, and compared the ranking of economies in the frame of their so-called 12 pillars i.e., institutions, infrastructure, macroeconomic environment, health and primary education, higher education and training, goods market efficiency, labour market efficiency, financial market development, technological readiness, market size, business sophistication and innovation. (Schwab, 2017). To document the correlation between innovation and VET, the pillars macroeconomic environment, higher education and training, labour market efficiency, innovation and sophistication factors, are of prior interest. The four selected pillars and their indicators used are defined and researched as shown in Table 1.

Table 1 - Country Performance Rankings: Four Selected Pillars

<b>Pillar (Index)</b>	<b>Main indicators (sub-indices)</b>	<b>Source of indicators</b>
macroeconomic environment	government budget balance; GDP; inflation rate; government debt; country credit rating.	International Monetary Fund; World Economic Outlook Database
higher education and training	gross secondary and tertiary education enrolment rate; quality of the education system (how well the education system meets the needs of a competitive economy); internet access in schools; local availability of specialized training services; staff training, management schools (quality of business schools).	UNESCO Institute for Statistics; Data Centre and World Economic Forum; Executive Opinion Survey
Innovation and sophistication factors	capacity for innovation; quality of scientific research institutes; availability of scientists and engineers; patents, university industry collaboration; company spending on e.g., R&D.	Organisation for Economic Co-operation and Development (OECD); Patent Database; World Economic Outlook Database; International Monetary Fund
Labour market efficiency	flexibility of wage determination; cooperation in labour-employer relation; hiring and firing practice; taxation of work; pay and productivity; capacity to attract talent; female participation in the labour force.	ILO; World Bank/International Finance Corporation; World Economic Outlook Database

### 3.2. Indicators

The indices of the four pillars derived from the World Economic Forum ranking were selected for the measurement of VET effectiveness against innovation rate. The macroeconomic environment was chosen because the index is a key for factor driven economies; higher education and training as well as labour market efficiency are the key for efficiency driven economies, and innovation and business sophistication are the drivers for innovative economies (Schwab, 2017). Having a VET infrastructure as a basis for skilled human resources is considered key and

therefore the sub-index 'local availability of specialized training services' was deemed specifically important for this research and consequently extracted to form a separate indicator.

The nations analysed and chosen are a representative cross section of countries over different continents, with different education systems, different governmental systems, different cultures and macroeconomic environments. Also, the countries' status in world policy was a factor for this selection. The country analysis points out the differences and distance between developed regions, developing regions and especially emerging countries.

The innovation rate can also serve as a measurement tool to provide insights into the education structure and especially a country's VET. While analysing the IMD study, key parameters were compared for the same countries named in the World Competitiveness Report.

Further indicators are researched and developed to observe the positioning of VET on a local and European level. For this, necessary data from the Statistik Austria database (Stöger, 2018) and the Austrian National Bank were applied for the following parameters: percentages of companies which are active in further education, of employees participating trainings, and costs of VET in relation to the personnel costs. The parameters and variables from literature that were chosen for this study are finally tested according to their relation and dependency between VET and innovation on the example of Austria.

On a company level the direct measurable results of innovative activities find their output in products, costs, quality, economy of time in production processes and finally result in the company's market competitiveness. Further key figures and parameters were compared on a country level with figures from the IMD World Competitiveness Center, who in their World Talent Ranking 2020, evaluate the factors "how an economy fosters the domestic talent ('investment and development'); the extent to which an economy retains homegrown talent and also draws from the international talent pool ('appeal'); and the quality of the skills and competences that are available in the economy ('readiness)" (IMD World Competitiveness Center, 2020).

## 4. Results

The author developed the thesis that the impact of VET's effectiveness on innovation can be measured through the combination of different parameters. In his analysis of 24 economies in accordance with the described key parameters, the author evaluated the relationship between innovation and education and the given influencing factors. The parameters were explained in the methodology part of this paper. Based on literature research and different studies that document education as a basis of innovation, it is clearly concluded that education is the main key for innovation, which is also based on different framework conditions governing both the macroeconomic environment and labour market conditions.

According to literature, innovation is based on relatively high-level skills, are a key driver for growth, employment, and competitiveness. Investment in training is therefore also an investment in innovation since much technical change results from incremental innovation by skilled workers and engineers on the factory floor. Traditionally, innovation is seen as a result of R&D activities carried out by highly qualified staff and thus a domain of higher education rather than VET. This is corroborated by the following results.

#### 4.1. Economic performance by country versus VET & Innovation

Table 2, which is based on the WEF Competitiveness Report 2017-2018 (Schwab, 2017), shows the chosen parameters and their dependency for measuring the effectivity of knowledge to innovation, and documents the influence and relation between higher education and training, as well as its influence on innovation and the macro-economic environment. Indicators are expressed as scores on a 1–7 scale, with 7 being the most desirable outcome. The highest scores are highlighted in the table.

Table 2 – Main Economic Indices Comparison by Country

	Macro-economic environment	Higher education & training	Local availability of specialized training services	Innovation & sophistication factors	Labour market efficiency
Germany	6.10	5.70	5.60	5.65	5.03
Austria	5.52	5.68	5.80	5.30	4.49
Switzerland	6.57	6.07	6.70	5.86	5.94
Czech Republic	6.23	5.25	5.50	4.24	4.49
Slovak Republic	5.40	4.54	4.20	3.76	4.01
United Kingdom	4.65	5.48	6.00	5.34	5.44
Albania	4.60	4.77	4.00	3.55	3.96
Bulgaria	5.72	4.62	3.70	3.57	4.25
Russian Federation	5.03	5.12	4.60	3.76	4.33
Hungary	5.13	4.33	4.00	3.52	4.21
Singapore	5.98	6.27	6.00	5.25	5.79
Japan	4.30	5.38	5.30	5.55	4.78
China	6.00	4.78	4.60	4.33	4.55
Indonesia	5.72	4.52	4.70	4.29	3.91
Korea (Rep.)	6.63	5.34	4.60	4.15	4.18
India	4.54	4.31	4.70	4.29	4.15
Brazil	3.44	4.21	3.70	3.66	3.68
Mexico	5.17	4.11	4.40	3.84	3.77
Argentina	3.38	5.00	4.90	3.56	3.29
Saudi Arabia	4.87	4.69	4.30	4.12	4.10
Iran	5.15	4.71	4.20	3.51	3.30
Algeria	4.63	3.95	3.60	3.13	3.27
USA	4.51	6.12	5.80	5.80	5.64
Australia	5.67	5.88	5.10	4.68	4.68

The above figures, especially those on innovation, conclude a workforce's readiness for higher technology processes, which also influence labour market efficiency. The parameters document the necessity of transferring know-how to close qualification gaps so as to build the basis for future economic growth.

One of the main observations were the gaps between the main indices. In a first analysis, the indicators of Table 2, which are colluded to the requirements of the research question, document

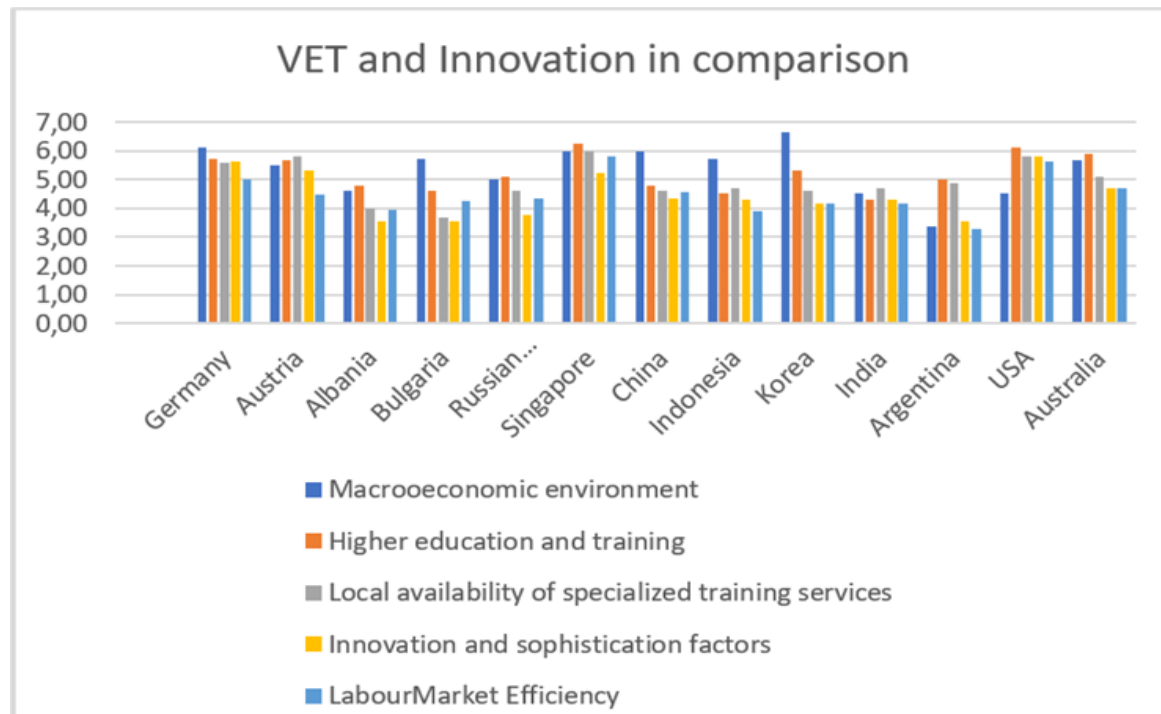


that if the higher level of education and training indicators are greater than 5 for the sample countries, the innovation rate too is higher than 5. This applies to 29.1%, i.e., seven states of the sample. Going more into detail, it is seen that in some countries, especially in Argentina and Australia the factor lies below 5 because of decreasing university/industry cooperation, as concluded from the sub-indices figures. In Australia, the factor is further influenced by the decreasing number of patents applied. In Korea and the Czech Republic, scientists and engineers are decreasing in number so the factor too is below 5, unlike Russia who have been increasing their quality of innovation over the past years.

The macroeconomic environment supports the education system and the innovation factor but is not always a precondition as for example in the USA, Japan, and the United Kingdom. The factor in these countries is below 5, because of their inflation rate. The labour market is a parameter for such analysis, but documents show that this is not a main influencing factor. For example, in Austria the factor is below 5, because the subfactor hiring and firing practice, and the taxation on incentives to work is too low. After delving deeper into the analyses, research showed that in all countries where the education and innovation factors are greater than five, the subfactor of local availability of specialized training services is lower than 5.

The figures derived from the pillars' subindices document that there is clearly a connection between VET and innovation. Vocational education needs specialized training services as provided by VET institutions, which focus on these frame conditions of local availability, and which offer specialized training to build the basis for those human resources that are needed by the economy.

Figure 1 - Indices related to VET and Innovation



The graph in Figure 1, shows an extract of countries from Table 2 to better visualise the close relation and also differences of the key parameters between the selected countries that are representative for less developed, developing and developed regions. Innovation and education correlate most in those countries where the parameter columns are most evenly balanced.

## 4.2. Innovation ranking versus education expenditures & skilled labour availability

A detailed analysis of further topics-related key figures, as pictured in Table 3, arrives at the same conclusion as the data already analysed from World Competitiveness Index (Table 2). Countries with a high level of education and training, in this IMD study employee training as well as high-level primary and secondary education, also lead in innovation indices.

For the innovation indices in Table 3, the author used the GII – global innovation index, which was jointly developed by Cornell University, Paris-based business school Insead, and the WIPO, and comprises more than 80 indicators exploring a broad vision of innovation, including political environment, education, infrastructure, and business sophistication. (Duta, 2020).

Table 3 - Innovation & Education Indices by Country (IMD World talent ranking)

<b>Indicators</b>	<b>total public expenditure on education</b>	<b>total public expenditure on education</b>	<b>employee training</b>	<b>primary &amp; secondary education</b>	<b>skilled labour</b>	<b>GII ranking</b>
	percentage of GDP	spending per enrolled pupil /student, all levels/ in US\$	is a high priority in companies 0 - 10	meets the needs of a competitive economy 0 - 10	availability 0 - 10	
Germany	4.20	10 166	7.61	7.86	5.36	9
Austria	4.80	12 570	7.67	8.19	5.17	21
Switzerland	5.60	24 292	7.31	8.84	7.06	1
Czech Republic	4.60	5 464	5.96	5.92	4.75	26
Slovak Republic	3.90	4 218	4.69	3.04	3.23	37
United Kingdom	4.80	9 052	5.65	6.62	6.03	5
Albania	no data available					83
Bulgaria	3.50	1 930	4.76	4.04	4.86	40
Russian Federation	3.50	1 993	5.00	5.60	6.46	46
Hungary	5.10	4 361	5.13	4.26	3.10	33
Singapore	2.60	13 453	6.82	8.87	7.34	8
Japan	3.10	7 704	6.24	6.09	5.13	15
China	3.50	1 755	6.64	7.56	6.60	14
Indonesia	3.00	454	6.09	5.94	5.59	
Korea	4.30	6 230	6.84	5.53	5.97	11
India	4.40	332	5.46	5.66	6.25	52
Brazil	6.00	2 110	4.85	2.74	4.12	
Mexico	3.00	983	5.47	4.19	5.92	56
Argentina	5.50	2 472	5.07	4.17	5.70	
Saudi Arabia	7.10	6 622	6.03	6.43	6.03	68
Iran	no data available					61
Algeria	no data available					113
USA	5.90	15 560	5.68	6.28	6.15	3
Australia	5.20	10 468.00	5.72	7.31	6.50	22

### 4.3. Correlation analysis

Correlation coefficient analyses were performed for nine different indicators, which were generated via standard analysis and compared in different constellations. The research documents the positive correlations and underpins the intensity between VET and innovation by implication of different parameters as shown in Table 4.

Table 4 - Correlation intensity: VET / innovation

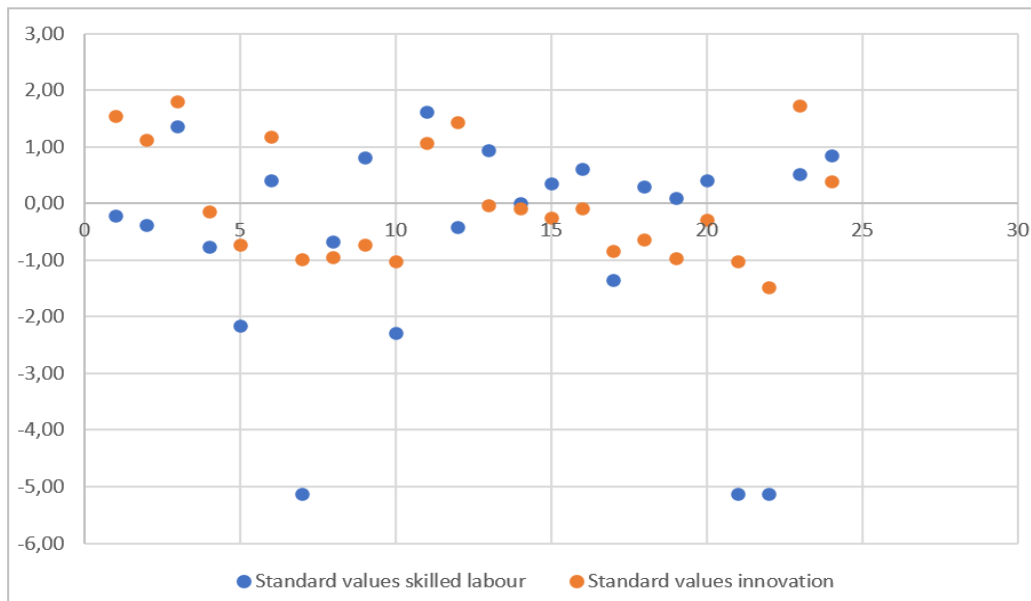
Indicators		Correlation coefficient
Total public expenditure on education (% GDP)	primary and secondary education (meets the needs of a competitive economy)	-0.05
Total public expenditure on education/student	skilled labour	0.37
Skilled labour	labour market efficiency	0.48
Skilled labour	innovation and sophistication factors	0.45
Macroeconomic environment	skilled labour	0.23
Macroeconomic environment	innovation and sophistication factors	0.29
Availability of training services	employee training as a priority in companies	0.67

The analysis is structured by the influences of the different parameters so that finally a bottom-up view leads to the result that VET influences innovation.

The correlation between total public expenditure on education to primary and second education is the only figure showing a weak correlation, which is related mainly to the figures of less developed and/or developing regions such as Mexico, Indonesia, Bulgaria, and Russia. All other correlation results confirm the above-mentioned findings as well as findings from literature reviews. What is interesting is also the "beside correlation" between availability of training services and employee training as the basis of future innovation, which is in line with Lee's statement that VET has a positive influence on economic growth and that alone the enrolment of students already leads to economic growth, as well as Böheim und Schneeweis' conclusion that productivity rises with investment in training.

An example is Figure 2, which pictures the correlation between skilled labour and innovation factors.

Figure 2 - Correlation Efficiency between Skilled Labour Availability and Innovation



#### 4.4. Austrian adult education versus European innovation

The Statistic Austria figures are substitutionary for developed countries with a high focus on VET which is also documented in the European Innovation Scoreboard 2020 (European Commission 2020). It documents the performance of EU member states as pictured in Figure 3.

Figure 3 - Performance of E U Member States' Innovation Systems

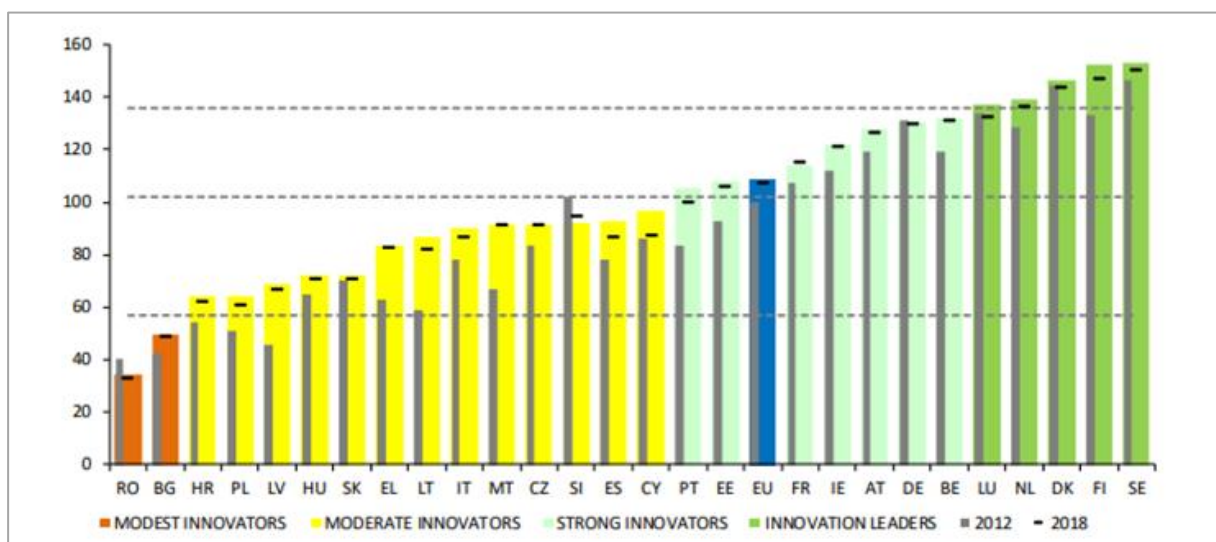


Figure 3 (European Commission, 2020) shows that countries with a strong education system, as documented in Table 2, are also regarded as innovation leaders and strong innovators. A survey of 130 international managers, by the Vienna Economic University, concluded that during the current Covid-19 crisis, the key factor to survive lies in the innovation activities of a company's own staff. 70% of the respondents named their staff's creativity as crucial for the company's

success. (Franke, 2020). The results of the documented figures show that there is a positive connection between VET and innovation. In the different rankings, countries and subsequently their companies that invest in VET are described as high performing economies, which eventually links a highly developed industry with high range of innovation.

Additional parameters that were analysed are based on the Austrian Adult Education Survey (Stöger, 2018), which documents that the percentage of companies that are active in further education, i.e., upskilling and/or reskilling, is very high with a percentage of 88% and is driven by a company's size of staff. Enterprises with more than 250 employees have a further education rate of 99%. The percentage of employees participating in training lies at 49% and the costs of VET in relation to the personnel costs are 1.3 percent for further vocational education. The purpose of participating in training are manifold but for 57% the main reason is to maintain stability in their job and the expectation of an occupational career enhancement for a further 49%. (Gallup Institut, 2018).

Thus, it can be derived that the hypothesis is true and proven. VET can be seen as a tool which creates and affects innovation.

## 5. Conclusion

This research investigated the relation between innovation and VET. The findings document that the availability of training services, which are the basis to build and maintain a skilled workforce, has an influence on other economic indices to strengthen a countries economy.

The insight that machines can substitute work in a production process cannot end in the vision that innovation can be accomplished by automatization. F. Taylor's mechanistic view is substituted by the perception that the human being is one of the key elements in an innovation process.

In a world where the requirements for jobs and technology are changing unpredictably, the individual as well as the companies they work for have the responsibility to recognize that learning is a necessity which not only has to be integrated into the daily workflow, but also into life. A precondition is the availability of respective services, as documented and analysed. Successful companies must train their existing employees and strengthen their expertise. Missing skills are a barrier for innovation. It must be noted however, that not all effects of VET will be measurable and attestable; important for companies and the economy will be a visible sustainable success.

The new economy is characterized by new technologies and automatization. Innovation becomes more relevant than before. It is not only driver for growth, but also part of specific business models and driver to reduce labour costs as well as a pioneer for new working processes. It can be seen as a positive way to strengthen the economy while on the other hand changing the world of work. Leadership competence in the 21st century also expects a high level of human performance management as the basis of a development culture which should "encourage leaders to embrace change and recognize opportunities to innovate and pursue excellence" (Deloitte. 2019).

Countries can achieve a high level of innovation performance by implementing an innovation system that performs well across all dimensions. An appropriate level of public and private investment in education, research and skills development is needed for this. (Hupfer. 2020).

"A KPMG report found that CEOs view talent risk as the top threat to growth thanks to the pandemic, and "building skills and critical competencies" is the top priority in 2021 for 68% of

HR leaders" (Zachary Totah, 2021). Deloitte (2019) data also found in a study that more than 50% of the employees will need to change their skills over the coming three years. The trend that organizations and companies have to face the challenges of the new digital revolution has increased in relevance. This assumes that personal development and training will become a major topic in the integration of a culture that combines work and continuous learning to foster the new demands of the future. The Covid-19 crisis of the years 2019 to 2021 enforced this trend and boosted technological innovation as it was necessary to master world-wide virtual collaboration. Thanks to this development the lack of talents in different markets and professions can be closed as it will be easier to transfer VET across the globe.

The global situation of gaps in the availability of a more and more highly qualified workforce and the growing technological progress requires the installation of VET talent training centres that provide companies and organizations with up-to-date knowledge, which in turn supports their innovation process. The power of innovation results from education and training and the willingness of people to learn, to become knowledge-based and highly skilled entrepreneurs or workforce members.

The crisis caused by the Covid pandemic created awareness that permanent further education is both preparation and key to master the uncertainties of the future. The globalization and the digitalization of today's evolving economies with the need for and pressure to innovate demands people with visions, but also experience and perspective. The time has arrived for students to become lifelong learners, and it is up to players in the education field to teach them how to explore different subjects and disciplines.

The challenges of today remain the collaboration of politicians, economic leaders and the workforce to foster the unpredictable situation of tomorrow. What is clear, is that an economy without innovation is an economy that stands still, and one which will inevitably fall into insignificance.

Given the EU Commission's claim that, "Vocational education and training can play a key role in the processes of economic restructuring" (EU Commission, 2012), it is necessary to continuously adjust occupations and their contents to economic developments as well as the requirements for qualifications. To do so VET institutions must move from being an implementor of training to becoming an innovation partner to the economy. The training institutions must enable students to put the fundamental knowledge taught in classrooms and work-labs into practice i.e., into action. Students must know that they are the backbone of every industry and company, and the drivers of innovation.

Thus, targeted investment in VET, namely initial and continuous training, is vital for innovation, growth, and competitiveness. The value of VET to transferring knowledge into innovation is based in the education system which later finds its way to productivity and economic growth of a country. Thus, highly motivated young people have the potential to become young innovators.

## References

- Aufner A (2018). Economic philosophy. Economics of Innovation. Macroeconomic Analysis and Policy. International *Joint Cross-Border PhD Programme Eisenstadt*.
- Bartak B (2016). Die grenzüberschreitende Erbringung von Bildungsdienstleistungen aus Österreich. *Alpen Adria Universität Klagenfurt*.



