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The Relationship Between 'Higher Education and Training' and 'Business Sophistication'

Abbas Bazargan[1], Rohollah Ghasemi[*2], Mohammad Eftekhar Ardebili[3], Mohammad Zarei[4]

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Abstract

Economics of education which investigates economic issues related to education - presents a framework which leads to better schedules and policy-making. On the other hand, the concept of competitiveness has drawn increasing attention of both scholars and governors in the past decade. The World Economic Forum (WEF) has published Global Competitiveness Index (GCI) in order to measure national competitiveness. The purpose of this paper is to investigate the interaction between the two sets of 'Higher Education and Training' (One of the pillars of GCI) and 'Business sophistication' both of which have been addressed by education of economics and not been profoundly investigated. To achieve the research aims, a descriptive correlational study has been used. The sample is 144 countries whose data were included in 2014-2015 report. Moreover, a canonical correlation analysis (CCA) has been employed to investigate the interaction between two sets of 'Higher education and training' and 'Business sophistication'. The findings of the research revealed that a significant and positive relationship between two sets and more than 77.85% of changes in 'Business sophistication' can be predicted by changes in 'Higher education and training'. In 'Higher education and training' sub-indexes 'Local availability of research and training services', 'Extent of staff training', 'Internet access in schools', and 'Quality of management schools' had the highest effect in creating this relationship.

Keywords: Education Economics, Higher Education and Training, Global Competitiveness, Business sophistication, Canonical Correlation Analysis.
JEL Classification: I25, I23, F00, M19, C13.

1. Introduction

Education economics has been an interesting field of study for many researchers (Chapman and Sinning, 2014; Pritchett and Viarengo, 2015). Return of investment in education have been explored for more than 40

1. Faculty of Psychology and Education, University of Tehran, Tehran, Iran (abazarga@ut.ac.ir).
2. Faculty of Management, University of Tehran, Tehran, Iran (Corresponding Author: ghasemir@ut.ac.ir).
3. Faculty of Management, University of Tehran, Tehran, Iran (m.eftekhar@ut.ac.ir).
4. Faculty of Entrepreneurship, University of Tehran, Tehran, Iran (mohammad.zarei@ut.ac.ir).

years (Patrinos and Psacharopoulos, 2002; Psacharopoulos and Patrinos, 2004). The benefits and positive impacts of education have been discussed from both theoretical and practical points of view - *e.g. human-capital theory's* viewpoint (Menon, 1997; Psacharopoulos and Patrinos, 2004; Tan, 2014) or *nations' experiences* (Jackman and Bynoe, 2014; Gander, 2015). For some countries – such as the United Kingdom – higher education is a key sector which contributes over 70£ billion of output (Gander, 2015). On the other side, the effects of education and training are not just limited to business. In truth, through various ways, societies have been affected by education and trainings. Furthermore, Morrisson and Murtin (2009) argued global development of education has been enhanced, and without doubt the century has obviously been the '*Century of Education*'. On the other hand, competitiveness has become an important target for both developed and developing countries (Ülengin et al., 2011; Lall, 2001) and it can be speculated that education plays an essential part in this regard. In truth, in the era of competitiveness both developed and developing countries need to pay more attention to their human capital (training, education and other professional initiatives) to stay stronger in the international arena (Marimuthu et al., 2009).

Generally, *competitiveness* is defined as '… the set of institutions, policies, and factors that determines the level of productivity of a country.' (Schwab, 2014: 4). In this regard, Lall (2001) defined national competitiveness as economies which compete with each other, can measure competitive performance, and mount competitiveness strategy. So the concept was used for enterprises and industries in both national and global scale (Porter and Schwab, 2008). This also needs greater efforts to reform *education* and *science* to promote advanced technologies and to strengthen the private sector (Ivaniashvili-Orbeliani, 2009). Thus, education has an important role (Sum and Jessop, 2013) and globalization increasingly affects higher education and training sector around the world (Li-Hua et al., 2011). World Economic Forum (WEF) has developed Global Competitiveness Index (GCI) to measure competitiveness of countries around the world with the purpose of providing benchmarking tools for business leaders and policymakers to identify obstacles to competitiveness improvement, thus stimulating discussion on the best strategies and policies to overcome them (Schwab, 2010). The GCI components are grouped into 12 pillars in three main sub-indexes which are classified in Table 1:

Table 1: The Global Competitiveness Index Framework (Schwab, 2014: 9).

Global Competitiveness Indexes	Pillars
Basic Requirements Sub index	1st .Institutions 2nd. Infrastructure 3rd. Macroeconomic environment 4th. Health and primary education
Efficiency Enhancers Sub index	5th. Higher education and training 6th. Goods market efficiency 7th. Labor market efficiency 8th. Financial market development 9th. Technological readiness 10th. Market size
Innovation and Sophistication Factors Sub index	11th. Business sophistication 12tn. Innovation

Some researchers have shown interest in investigating the relationships among global reports (e.g. see Vachon and Mao, 2008; Wu et al., 2012) or especially *The Global Competitiveness Report* and its sub-indexes' (e.g. see Razavi et al., 2011; Vesal et al., 2013). Two important pillars of the *Global Competitiveness Report* are 'Higher education and training' and 'Business sophistication'. Tight (2012) pointed out that the emersion of knowledge society, developments in technology, globalization and increasing international competition, made increasing investment in education and training, a necessary issue for governments. Schwab (2014: 7) argues, in particular, today's globalizing economy necessitates nurturing pools of well-educated labor who can perform complex tasks and react quickly to their changing environment and the emerging needs of the production system. On the other hand, sophisticated business practices are conducive to *higher efficiency* in the production of services and goods and business sophistication concerns two elements that are intricately linked: the quality of a country's overall business networks and the quality of individual firms' operations and strategies (Schwab, 2012: 7-8).

The relationship between the industry-government and academia in knowledge based economies has been an interesting issue for researchers. But the role of government as policy makers for development of universities – in order to solve business issues - has received less attention (Leydesdorff and Etzkowitz, 2001). Policymaking in this field urges the understanding of mutual relationship between **'**Higher education and training**'** and 'Business

sophistication'. To our knowledge, no existing research considers the relations between 'Higher education and training' and 'Business sophistication' and their sub-indexes; as a result, there is a gap which should more closely be investigated. Therefore, our research aims to answer this question: Is there any meaningful relationship between **'**Higher education and training**'** and 'Business sophistication'?

2. Literature Review

2.1. Competitiveness and Global Competitiveness Report

Competitiveness can be classified in three levels: firm, industry and national (McFetridge, 1995). Generally, the concept of competitiveness tries to explain why some countries develop faster than others; and, it connects the macro- and micro- economic perspective of social-economic development (Kovacic, 2007). Competitiveness has become a milestone for all three factor-driven, efficiency-driven, and innovation-driven countries. Porter (1990) believed that 'the only meaningful concept of competitiveness at the national level is national productivity' (Porter, 1990, p. 6). Competitiveness depends on improving long-run productivity of existing employees and high participation of working age citizens in the workforce (Porter and Rivkin, 2012). Furthermore, Heap (2007) pointed out that 'improving productivity is the only way of baking a bigger cake – most other changes simply give us different sized slices' (Heap, 2007: 171).

Since 1979, annual Global Competitiveness Reports of WEF have examined the factors enabling national economies to achieve sustained economic growth and long-term prosperity. In these reports *competitiveness* has been defined as the set of institutions, policies, and factors that determine the level of productivity of a country (Porter and Schwab, 2008). Also, since 2005, the WEF has developed the GCI. As a highly comprehensive index, GCI captures the microeconomic and macroeconomic foundations of national competitiveness. According to GCI reports, the future prosperity of a country depends on the level of its competitiveness (Schwab, 2009). The GCI captures the open-ended dimension of competitiveness by providing a weighted average of many different components, each of which reflects one aspect of the complex concept of competitiveness (Schwab, 2009). By reviewing the literature, 'Higher education and

training' and 'Business sophistication' appear to be two important indexes of GCI. What is more, studies can be found which have emphasized on the relation between skills training and national performance (Hallier and Butts, 1999). On the other hand, up to the time neither the relation between 'Higher education and training and Business sophistication', nor their sub-indexes have been considered.

In the following part of the study, 'Higher education and training' pillar will be discussed along with its sub indexes. Then the aspects of 'Business sophistication' will be described. In the end, the literature that supports the relationship between these two pillars will be considered and after identifying the gap of research, the proposed model and questions of research will be discussed.

2.2. Higher Education and Training

Hazelkorn (2015) described higher education as 'a provider of human capital through education and training, a primary source of new knowledge and knowledge/technology transfer, and a beacon for international investment and talent' (Hazelkorn, 2015: 3). Higher education provides highly skilled workers, makes international collaboration and cross-cultural exchange possible, and leads to higher capacity for innovation and related researches which determine competitiveness in the knowledge-based global economy (OECD, 2009). These sub-indexes will also be explained.

Higher education and training is the fifth pillar of GCI. Based on GCI report; '*This pillar measures secondary and tertiary enrollment rates as well as the quality of education as evaluated by business leaders. The extent of staff training is also taken into consideration because of the importance of vocational and continuous on-the-job training—which is neglected in many economies—for ensuring a constant upgrading of workers' skills*' (Schwab, 2014: 7).

The 8 sub-indexes of 'Higher education and training' are shown in Table 2.

Table 2: The Sub-Indexes of "Higher Education and Training" (Schwab, 2014).

Sub-indexes	Measure	Top three countries
HET1. Secondary education enrollment rate	Gross secondary education enrollment rate 2012 or most recent year available	Australia, Spain, Netherlands
HET2. Tertiary education enrollment rate	Gross tertiary education enrollment rate 2012 or most recent year available	Greece, Korea, Rep., United States
HET3. Quality of the education system	the extent to which a country's educational system meet the needs of a competitive economy (2013-14 weighted average)	Switzerland, Finland, Qatar
HET4. Quality of math and science education	The quality of math and science education in a given country's schools (2013-14 weighted average)	Singapore, Finland, Belgium
HET5. Quality of management schools	The quality of business schools in a given country (2013-14 weighted average)	Switzerland , Belgium, Spain
HET6. Internet access in schools	The extent to which Internet access in a schools of a given country is widespread (2013-14 weighted average)	Iceland, Estonia, Norway
HET7. Local availability of specialized research and training services	The extent to which high-quality, specialized training services are available in a given country (2013-14 weighted average)	Switzerland, Netherlands, Germany
HET8. Extent of staff training	The extent to which companies of a given country invest in training and employee development (2013-14 weighted average)	Switzerland, Japan, Luxembourg

2.3. Business sophistication (BS)

Business sophistication is considered as an attractive field of research. For example, Razavi et al. (2011) used Canonical correlation analysis to investigate relationship between 'Business sophistication' and 'innovation' and argued that 70.68% of changes in 'Business sophistication' is interpreted by changes in 'Innovation'. Additionally, Vesal et al., (2013) have shown that there is a meaningful relationship between 'Labor Market Efficiency' and 'Business Sophistication'. Based on their findings, 64.01% of changes in 'Business Sophistication' are predictable by changes in 'Labor Market

Efficiency'. These kinds of researches have helped policy makers to develop better legislation and investment.

Business sophistication is the eleventh pillar of GCI. Based on GCI report;

Sophisticated business practices lead to higher efficiency in manufacturing goods and delivering services (Schwab, 2014). The 9 sub-indexes of 'Business sophistication' are shown in Table 3.

Table 3: The Sub-Indexes of "Business Sophistication" (Schwab, 2014: 520-528).

Sub-indexes	Measure	Top three countries
BS1. Local supplier quantity	The number of local suppliers in a given country (2013-14 weighted average)	Japan, Germany, United Kingdom
BS2. Local supplier quality	The quality of local suppliers in a given country (2013-14 weighted average)	Japan, Switzerland, Austria
BS3. State of cluster development	The extent to which Clusters in a given country are well-developed and deep (2013-14 weighted average)	Italy, Taiwan, Germany
BS4. Nature of competitive advantage	The basis of a given country's companies competitive advantage in international markets (2013-14 weighted average)	Japan, Switzerland, Denmark
BS5. Value chain breadth	The breadth of a given country's companies presence in the value chain (2013-14 weighted average)	Japan, Germany, Switzerland
BS6. Control of international distribution	The extent of domestic companies ownership and control over international distribution and marketing in a given country (2013-14 weighted average)	Japan, Qatar, United Arab Emirates
BS7. Production process sophistication	The sophistication of Production Processes in a given country (2013-14 weighted average)	Switzerland, Japan, Finland
BS8. Extent of marketing	The extent of use of sophisticated marketing tools and techniques by a given country's companies (2013-14 weighted average)	United States, United Kingdom, Puerto Rico
BS9. Willingness to delegate authority	The willingness to delegate authority to subordinates in a given country (2013-14 weighted average)	Denmark, Norway, Netherlands

2.4. Higher Education and Business Sophistication

Based on a meta-analytically study and 70 samples Unger et al. (2011) found that a small but significant relationship exists between human capital and entrepreneurial success. Moreover, according to Aragon-Sanchez et al. (2003), a unanimous agreement exists on the importance of training as an instrument that helps companies to achieve sustainable competitive advantages based on their human resources. Furthermore, Business schools play a significant role in achieving business competence by transferring the required knowledge, teaching how to use that knowledge in reality, and developing personal qualities (Gordon and Howell, 1959). Contrary to what has normally been accepted in the literature, Ramírez-Alesón and Fleta-Asín (2016) discussed business sophistication (or business climate) as a location factor and highlighted that the greater innovation and business sophistication aren't specific to the more advanced economies. Besides, Feyen and Van Hoof (2013) by investigating the Latin American case have found that higher education has a beneficial effect on a country's socio-economic and technological performance and a country's business sophistication powerfully defines a country's GCI. Therefore, based on the foregoing and gaps, the proposed model investigates the mutual relationship between **'**Higher education and training**'** and 'Business sophistication' as in the following figure.

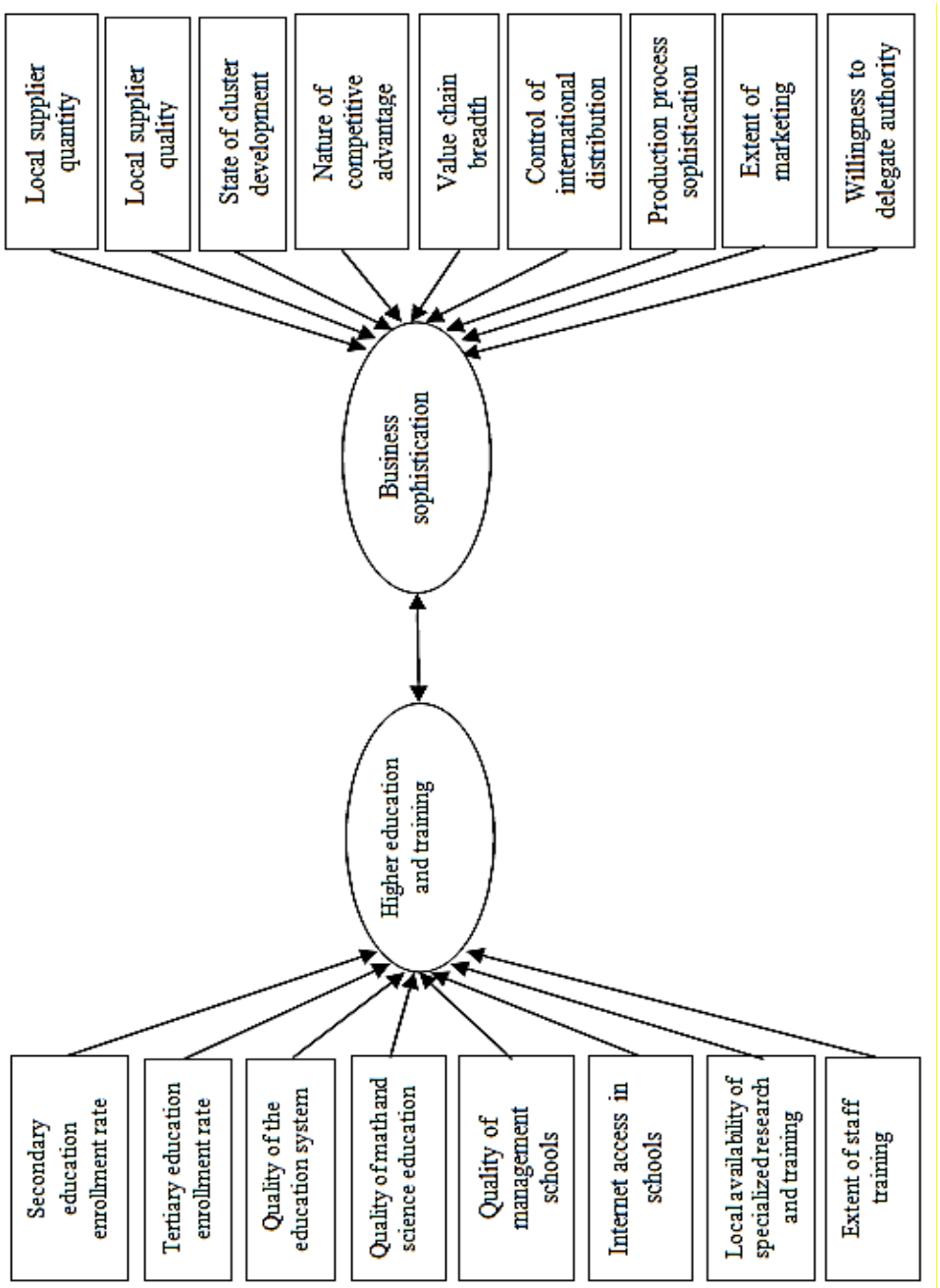

Figure 1: The Research Proposed Model

According to the Figure 1, the research questions are:

1. Is there a meaningful relationship between **'**Higher education and training**'** and 'Business sophistication'?

And the research sub questions are:

1. Is there a correlation between **'**Higher education and training**'** sub-index and 'Business sophistication' sub-index?
2. In the set of **'**Higher education and training**'**, which sub-index has the most and which one has the least impact on creating a meaningful relationship between **'**Higher education and training**'** and 'Business sophistication'?
3. In the set of 'Business sophistication', which sub-index has the most and which one has the least impact on creating a meaningful relationship between **'**Higher education and training**'** and 'Business sophistication'?

3. Research Methodology

This study uses a descriptive-correlation study. Firstly, we studied the literature. Then, we used the GCI report data in 2014 to answer our research questions. The Statistical population in this study was 144 countries whose data was included in GCI report in 2014-2015. Finally, we utilized Canonical Correlation Analysis (CCA) by STATISTICA 12.6 software; thereafter, analysis output was obtained. CCA is 'the most general of the traditional least-squares methods for the analysis of data structures' (Thorndike, 2000, p. 237). Safari et al. (2012) stated that CCA is obtaining linear composition of predicting variables that has the most correlation with linear combination of criteria variables. These combinations are shown as follow:

$$W = a_1x_{1+} a_2x_2 + \ldots + a_px_p \qquad (1)$$

$$V = b_1y_{1+} b_2y_2 + \ldots + b_qy_q \qquad (2)$$

This research tries to find correlations between two data sets of 'Higher education and training' and 'Business sophistication'. Table 4 is showing some researches in CCA field.

Table 4: Some Previous Research Which Applied CCA Technique

Author(s)	Methodology
Safari et al. (2012)	Using by Canonical Correlation Analysis, this study examined the interdependencies between 'people criterion and people results criterion in EFQM model in Tavanir Companies.
Sun and Richardson (2012)	They used CCA to study relationship between Course Experience Questionnaire (CEQ) and Revised Approaches to Studying Inventory (RASI) scores of Chinese and British students.
Vares et al. (2011)	Using Canonical Correlation Analysis, this study examined the Efficiency-Driven Economy to Innovation-Driven: A Secondary Analysis of Countries Global Competitiveness
Norton et al. (2005)	They used CCA to study relationships between teaching beliefs (which consist of nine subscales) and teaching intentions (which also consist of nine subscales) in higher education.

4. Data Analysis and Findings

In this study we used the sub-index scores of "Higher education and training" and "Business sophistication" pillars. The study population was 144 countries whose data was gathered by WEF and included in GCI report in 2014-2015. Some of the sub-index scores are the result of an assessment which is done by the experts and some of the sub-index scores are extracted from international reports such as UNESCO Institute for Statistics. The measurement method of each sub-index of "Higher education and training" (Schwab, 2014, pp. 463-456) and "Business sophistication" (Schwab, 2014, pp. 528-520) is described in GCI report.

The Correlation between two sets of **'**Higher education and training**'** and 'Business sophistication' was estimated by using CCA (with the help of STATISTICA 12.6 software).

Based on Table 5, a meaningful positive correlation in the significance level of 0.05 was found between 'Higher education and training' sub-indexes and 'Business sophistication' sub-indexes. 'Local availability of research and training services' and 'State of cluster development' have the strongest correlation and 'Tertiary education enrollment rate' and 'Production process sophistication' have the least correlation.

In Summary 'Local availability of research and training services' has the most correlation with 'Business Sophistication' sub-indexes.

Table 6 has represented enveloped data variation by CCA. The

extracted variance for 'Higher education and training' and 'Business sophistication' is showing that 100% of canonical roots are covered by internal 'Higher education and training' variation and also 97.30% of canonical roots are covered by internal 'Business sophistication' variation. These findings are considerable and they will support the use of CCA method in the research.

Table 5: Correlation Coefficient between "Higher Education and Training" and "Business Sophistication"

Business sophistication / Higher education and training	Local supplier quantity	Local supplier quality	State of cluster development	Nature of competitive advantage	Value chain breadth	Control of international distribution	Production process sophistication	Extent of marketing	willingness to delegate authority
Secondary education enrollment rate	.556**	.632**	.631**	.538**	.509**	.569**	.428**	.634**	.436**
Tertiary education enrollment rate	.463**	.600**	.605**	.474**	.474**	.537**	.338**	.594**	.371**
Quality of the educational system	.730**	.702**	.744**	.621**	.705**	.719**	.670**	.703**	.480**
Quality of math and science education	.520**	.583**	.629**	.521**	.591**	.627**	.483**	.632**	.455**
Quality of management schools	.692**	**.811****	.795**	.670**	.747**	.705**	.678**	**.801****	.583**
Internet access in schools	.719**	**.809****	**.806****	.652**	.692**	.701**	.626**	**.810****	.502**
Local availability of research and training services	**.820****	**.929****	**.938****	.754**	**.902****	**.843****	**.836****	**.927****	.712**
Extent of staff training	**.872****	**.860****	**.858****	.701**	.786**	.747**	.764**	**.809****	.545**

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

Table 6: Canonical Correlation Analysis summary

144=N	Higher education and training	Business sophistication
Number of variables	8	9
Extracted variance	100%	97.30%
Redundancy index	66.70%	77.85%
Variables: 1	Secondary education enrollment rate	Local supplier quantity
2	Tertiary education enrollment rate	Local supplier quality
3	Quality of the educational system	State of cluster development
4	Quality of math and science education	Nature of competitive advantage
5	Quality of management schools	Value chain breadth
6	Internet access in schools	Control of international distribution
7	Local availability of research and training services	Production process sophistication
8	Extent of staff training	Extent of marketing
9		Willingness to delegate authority

Table 7: Statistical Tests

Canonical roots	Chi-square Tests With Successive Roots Removed					
	Canonical R	Canonical R^2	Chi-square	df	P-value	Lambda Prime
0	0.9760	0.9526	579.720	72	**0.0000**	**0.011970**
1	0.6459	0.4171	180.209	56	**0.0000**	0.252676
2	0.6058	0.3671	109.483	42	**0.0006**	0.433547
3	0.4676	0.2186	49.5579	30	**0.0138**	0.685022
4	0.2494	0.0622	17.2328	20	0.6377	0.876737
5	0.1816	0.0329	8.8140	12	0.7187	0.934931
6	0.1414	0.0199	4.4209	6	0.6199	0.966815
7	0.1160	0.0134	1.7749	2	0.4117	0.986543

The common meaningful level for interpretation in CCA is 0.05 (Kettenring, 1971). As it's shown in Table 7, with the P-value that is used for this research, first, second, third and fourth canonical variables are statistically meaningful. In addition, other statistical tests like 'Lambda Prime' and 'χ^2' support our results. Based on Table 7 we considered the first canonical variable and ignored interpretation of second, third and fourth variables because of their weak canonical loading and redundancy index. Since lambda prime test is only meaningful for the first canonical variables and it's below 5%, then

only the first canonical variable should be considered. Diagram 1 shows the paired correlation between first canonical variable.

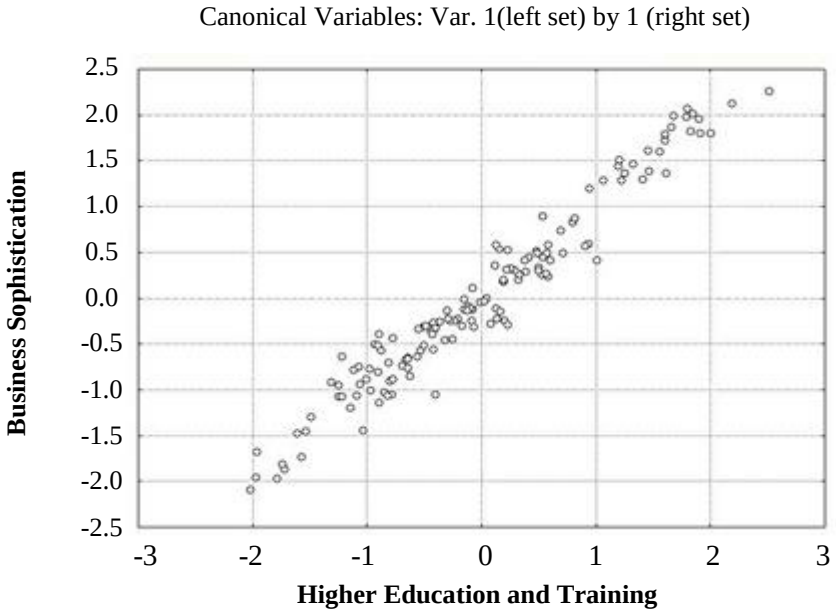

Diagram 1: Paired Correlation between First Canonical Variable

Based on Tables 6 and 7, the importance of relationship between **'**Higher education and training**'** and 'Business sophistication' is estimated by canonical correlation (R_c) and Eigen value (R_c^2).

As shown in Table 7, the first variable R_c is 97.60% and R_c^2 is 95.26%. Because R_c cannot directly demonstrate the shared variation, we utilize redundancy index. Redundancy index for R_c^2 is in multiple regression analysis.

Table 6 shows that more than 77.85% of changes in 'Business sophistication' are predicted by the changes in **'**Higher education and training**'**. Furthermore, more than 66.70% of changes in 'Higher education and training' can be predicted by changes in **'**Business sophistication**'**. These findings indicate a meaningful relationship between **'**Higher education and training**'** pillar and 'Business sophistication' pillar. In addition, **'**Higher education and training**'** pillar has a positive effect on 'Business sophistication' pillar.

Table 8: Canonical Loading for Meaningful Canonical Variables in "Higher Education and Training" and "Business Sophistication"

Variables	Root 1	Root 2
Higher education and training sub-indexes		
Secondary education enrollment rate	0.6604	-0.3844
Tertiary education enrollment rate	0.6145	-0.5912
Quality of the educational system	0.7716	0.1729
Quality of math and science education	0.6391	-0.3013
Quality of management schools	**0.8358**	-0.1395
Internet access in schools	**0.8487**	-0.2045
Local availability of research and training services	**0.9748**	-0.0564
Extent of staff training	**0.9065**	0.2772
Extracted variance (%)	**62.61**	**9.49**
Redundancy index (%)	**59.64**	**3.96**
Business Sophistication sub-indexes		
Local supplier quantity	0.6793	-0.1801
Local supplier quality	**0.9543**	-0.1628
State of cluster development	0.8407	0.2734
Nature of competitive advantage	0.8690	-0.0078
Value chain breadth	**0.9032**	0.0376
Control of international distribution	0.7909	-0.0174
Production process sophistication	**0.9769**	-0.0212
Extent of marketing	**0.9742**	-0.0572
Willingness to delegate authority	0.8930	0.3300
Extracted variance (%)	**77.41**	**2.75**
Redundancy index (%)	**73.74**	**1.15**

To answer the 2nd and 3rd sub-questions, canonical loading (factor structure correlations) is used for evaluating the importance of each sub-index in canonical root 1(Hair, 1998). According to Table 8, all variables in both sets have a high canonical loading in creating a canonical variable in their sets. All of them are very effective in creating a meaningful relationship between 'Higher education and training' and 'Business sophistication'. In 'Higher education and training' sub-indexes, 'Local availability of research and training services', 'Extent of staff training', 'Internet access in schools' and 'Quality of management schools' have the highest effect and 'Tertiary education enrollment rate' has the lowest effect in creating this

relationship. Furthermore, in the 'Business sophistication' sub-indexes, 'Production process sophistication' 'Extent of marketing', 'Local supplier quality' and 'Value chain breadth' have the highest effect and 'Local supplier quantity' has the lowest effect in creating this relationship. In addition, based on the high amount of canonical loading in both sets, we can conclude that **'**Higher education and training**'** sub-indexes have a positive impact on 'Business sophistication' sub-indexes. Also, for CCA validity, we used sensitivity analysis on independent variables. For this validation, we eliminate one of 'Higher education and training' sub-indexes each time and utilize CCA. Outputs depicted no impression change in construct coefficient of variables. Therefore, we could make sure that data were valid.

5. Conclusion

The concept of competitiveness has drawn increasing attention of both scholars and governors during the past decade. So the framework needs to be updated by using the concepts of competitiveness, to make education more efficient. One of the global organizations which have been monitoring competitiveness is *The World Economic Forum*, and for the purpose of the above mentioned issues the *Global Competitiveness Index (GCI)* is developed. Different economies – factor-driven, efficiency-driven, and innovation-driven – have different *key economic drivers*, as coming in the GCI. But this doesn't mean that the role of one's key economic drivers is not important in another. Totally 12 Pillars are introduced by GCI. Two of these pillars are 'Higher education and training' and 'Business sophistication' which have important role in efficiency-driven and innovation-driven economies, respectively (Vares et al., 2011). On the other hand, *higher efficiency* in the manufacturing of goods and delivering of services is the result of more sophisticated business practices (Schwab, 2012: 7-8).

To our best knowledge the mutual relationship between 'Higher education and training' and 'Business sophistication' and the importance of their sub-indexes have been overlooked in the literature. Since understanding these relationships can be determinant in national policy-making, this article seeks to investigate a meaningful relationship between these two pillars of GCI using Canonical

Correlation Analysis.

By using CCA for GCI 2014-2015 data, first, we studied literature of competitiveness, GCI, higher education and training, business sophistication, and CCA. Then, we used the Global Competitiveness report data of 2014-2015 to conduct our secondary analysis. The population in this study was 144 countries whose data was included in GCI report in 2014-2015. Eventually, we utilized CCA using STATISTICA 12.6 software to obtain analysis output.

In this research the Global Competitiveness report data of 2014-2015 was used to conduct a secondary analysis. Although Vares et al., 2011 confirmed the positive relationship between HET and BS by using Spearman correlation method; they only considered the scores of pillars and not their sub-indexes, so this reduced the accuracy of their results. We investigated the relationship between HET and BS based on the relationship between their sub-indexes. Since we used canonical correlation analysis, in addition to the existence of a positive relationship, the intensity of mutual relationship is determined. This means that the effect of HET on BS and BS on HET are both considered. Furthermore, one of the innovations of this research is the exploration of priorities that reinforce this relationship and helps policy makers to understand their priorities based on the experience of the countries which have been considered in this research.

According to research findings, there is a meaningful relationship between 'Higher education and training' pillar and 'Business sophistication' pillar and 'Higher education and training' pillar have a positive effect on 'Business sophistication' pillar. In 'Higher education and training' sub-indexes, 'Local availability of research and training services', 'Extent of staff training', and 'Quality of management schools' and in 'Business sophistication' sub-indexes, 'Extent of marketing', 'Production process sophistication' and 'Local supplier quality' have the most [important?] impact on creating the relationship. Jafarnejad et al. (2012) argue being familiar with 'national competitiveness indexes' offers an appropriate ability for different industry agents to examine their country's environment compared to other countries.

Generally, the findings of this research increased our knowledge

about the relationship between pillars of 'Higher education and training' and 'Business sophistication'. These findings indicate a meaningful relationship between **'**Higher education and training**'** pillar and 'Business sophistication' pillar and based on our results (see Table 6 & 7) more than 77.85% of changes in 'Business sophistication' are predicted by changes in **'**Higher education and training**'**. Also, more than 66.70% of changes in 'Higher education and training' can be predicted by changes in **'**Business sophistication**'**.

In 'Higher education and training' sub-indexes, 'Local availability of research and training services', 'Extent of staff training', 'Internet access in schools' and 'Quality of management schools' have the highest effect and 'Tertiary education enrollment rate' has the lowest effect in creating this relationship. Furthermore, in 'Business sophistication' sub-indexes, 'Production process sophistication' 'Extent of marketing', 'Local supplier quality' and 'Value chain breadth' have the highest effect and 'Local supplier quantity' has the lowest effect in creating this relationship.

In addition, based on the high amount of canonical loading in both sets, we can conclude that **'**Higher education and training**'** sub-indexes have a positive impact on 'Business sophistication' sub-indexes.

5.1. Limitation and Recommendation for Future Research

Every research including ours has some limitations. For instance, it is important to consider that this research is based on GCI 2014-2015 data. Using the data based on any other time span would probably affect the results. Thus for Future research, the use of other methods such as panel data analysis to analyze the data of several years is suggested.

Furthermore, the countries the data of which has been used are in different stages of economical development. Consequently, further studies can explore the relationship between 'Higher education and training' and 'Business sophistication' based on the extent of economical development.

Moreover, although we used the sub-indexes of 'Business sophistication' as presented in GCI report, there are other aspects of innovation and business sophistication that weren't considered in this article. For instance, the sub-indexes of *the global innovation index* (Dutta, 2012) can be used to measure other aspects of innovation. Some

of the sub-indexes in *Ease of Doing Business* report (The World Bank, 2013) can also be utilized for measuring business sophistication.

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