# Intercriteria analysis of countries in transition from factor-driven to efficiency-driven economy

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**Abstract:** The intuitionistic fuzzy sets-based method of InterCriteria Analysis is applied here to datasets retrieved from the World Economic Forum's Global Competitiveness Reports (GCRs) from years 2013–2014 to 2017–2018 containing global economies whose stage of development is in the transition from factor-driven to efficiency-driven economy. These data are analysed in search of correlations between the twelve pillars of competitiveness and certain findings are outlined and commented.

**Keywords:** InterCriteria Analysis, Intuitionistic fuzzy sets, Factor-driven economy, Efficiency-driven economy, Competitiveness, Economic development, Knowledge discovery.

**2010 Mathematic Subject Classification:** 03E72.

## 1    Introduction

The present paper is a subsequent step in the research of application of the intuitionistic fuzzy sets-based method of InterCriteria Analysis of the performance of global economies against the

pillars of competitiveness in the methodology of the World Economic Forum. Previous applications of the method were over data for the countries in the efficiency-driven stage, [11] and those in transition from efficiency to innovation-driven economies, [8]. Here our focus of investigation are the economies in the transition phase between factor-driven and efficiency-driven economies (Stage 1 to Stage 2). The analysed datasets are from the 5-year period from year 2013–2014 to year 2017–2018 and are derived from the publicly available Global Competitiveness Report of the World Economic Forum, [18–22].

According to the World Economic Forum, the well-known economic theory of stages of development postulates that in the first stage, the economy is factor-driven and countries compete based on their factor endowments – primarily unskilled labor and natural resources. Companies compete on the basis of price and sell basic products or commodities, with their low productivity reflected in low wages, [22, p. 319]. The factors of competitiveness at this stage of development relies to the greatest extent on well-functioning public and private institutions (pillar 1), a well-developed infrastructure (pillar 2), a stable macroeconomic environment (pillar 3), and workforce that has received at least a basic education and healthcare (pillar 4). Factor-driven economies are highly sensitive to world economic cycles, commodity prices, and exchange rate fluctuations, mitigated only in countries with large internal market to attract investment independent of export potential.

Transition of an economy to efficiency-driven stage of development takes place as it becomes more competitive, with increased and more-efficient productivity, higher product quality, advancing development and rising wages. At this point, competitiveness is increasingly driven by higher education and training (5th pillar), efficient goods markets (6th pillar), well-functioning labor markets (7th pillar), developed financial markets (8th pillar), the ability to harness the benefits of existing technologies (9th pillar), and a large domestic or foreign market (10th pillar), [22, p. 319].

In the methodology, it is considered that all countries that export more than 70 percent of mineral products are considered to be to some extent factor driven. In countries that export less than 70 percent minerals, stages of development are dictated uniquely by income. [22, p. 323]. The methodology of WEF employs the following weights in order to determine the belonging of a country to a stage (see Table 1).

| | STAGE OF DEVELOPMENT | | | | |
|---|---|---|---|---|---|
| | Stage 1: Factor-driven | Transition from Stage 1 to Stage 2 | Stage 2: Efficiency-driven | Transition from Stage 2 to Stage 3 | Stage 3: Innovation-driven |
| **GDP per capita (US$) thresholds*** | <2,000 | 2,000–2,999 | 3,000–8,999 | 9,000–17,000 | >17,000 |
| **Weight for basic requirements** | 60% | 40–60% | 40% | 20–40% | 20% |
| **Weight for efficiency enhancers** | 35% | 35–50% | 50% | 50% | 50% |
| **Weight for innovation and sophistication factors** | 5% | 5–10% | 10% | 10–30% | 30% |

Table 1. Subindex weights and income thresholds for stages of development, [22, p. 320]

# 2 Presentation of the input data

In the investigated 5-year period, the countries that comprised the set of factor-to-efficiency driven economies has been repeatedly the smallest set of all the five sets of factor-driven economies (Stage 1), efficiency-driven economies (Stage 2), innovation-driven economies (Stage 3), and the two transition stages in between. Over the years, the set has the following appearing elements, as given in details in Table 2.

| 2013-2014 | 2014-2015 | 2015-2016 | 2016-2017 | 2017-2018 | Total # appear. |
|---|---|---|---|---|---|
| Algeria | Algeria | Algeria | Algeria | Algeria | 5 |
| Angola | Angola | | | | 2 |
| Armenia | | | | | 1 |
| Azerbaijan | Azerbaijan | Azerbaijan | Azerbaijan | Azerbaijan | 5 |
| Bhutan | Bhutan | Bhutan | Bhutan | Bhutan | 5 |
| Bolivia | Bolivia | | Bolivia | | 3 |
| Botswana | Botswana | Botswana | Botswana | Botswana | 5 |
| Brunei Darussalam | | | Brunei Darussalam | Brunei Darussalam | 3 |
| Gabon | Gabon | Gabon | Gabon | | 4 |
| Honduras | Honduras | Honduras | Honduras | Honduras | 5 |
| Iran, Islamic Rep | Iran, Islamic Rep | Iran, Islamic Rep | | | 3 |
| | | Kazakhstan | Kazakhstan | Kazakhstan | 3 |
| Kuwait | Kuwait | Kuwait | Kuwait | Kuwait | 5 |
| Libya | Libya | | | | 2 |
| Moldova | Moldova | Moldova | | | 3 |
| Mongolia | Mongolia | Mongolia | Mongolia | Mongolia | 5 |
| Morocco | | | | | 1 |
| | | | | Nicaragua | 1 |
| | | Nigeria | Nigeria | Nigeria | 3 |
| Philippines | Philippines | Philippines | Philippines | Philippines | 5 |
| | | | Russian Federation | | 1 |
| Saudi Arabia | Saudi Arabia | Saudi Arabia | | | 3 |
| Sri Lanka | | | | | 1 |
| | | | Ukraine | Ukraine | 2 |
| Venezuela | Venezuela | Venezuela | Venezuela | Venezuela | 5 |
| | | Vietnam | Vietnam | Vietnam | 3 |
| 20 | 16 | 16 | 17 | 15 | |

Table 2. Lists of factor-to-innovation driven economies in the investigated 5-year period

As we can see, the set of countries being analysed is interesting in that it contains some constant members, true representatives of this economic transition, but also countries which sporadically enter this group, or leave it over the years. Hence, the belongingness of the elements (countries) to the set depends on their performance according to the criteria within the predefined limits, which is a substancial difference from working with a set of fixed elements,

which belongingness does not depend on their performance, as in the case of analyzing the relations between the pillars of competitivess of EU28 member states, see e.g. [7, 9, 10].

Another aspect we need to remark on here is the relatively low number of objects for analysis, compared to related applications of ICA, for instance over the data for the efficiency-driven and innovation-driven economies in the world, which are about twice more, or some other applications of ICA with hundreds or even thousands numbers of objects. While the question of representability is irrelevant here, as these 15-20 objects are all possible elements of the set, exclusively and in the way it has been defined, we still shall mention that with a lower number of objects, the results cannot be considered as robust as in cases when ICA is applied on datasets with much bigger number of objects, as it has been shown in [24].

The input data, derived from the GCRs, represents the evaluation of these sets of countries (in ICA terms: objects) against the 12 pillars of competitiveness (in ICA terms: criteria), with the evaluations being numbers on the 1-to-7 scale with decimal precision of 0.1, where the 12 pillars of competitiveness have been formed on the basis of more than 110 sub-indicators derived from the countries' national statistics. The input datasets for the investigated years, from 2013–2014 to 2017–2018, are given in the following Tables 3 to 7.

| Factor-to-efficiency 2013-2014 | Algeria | Angola | Armenia | Azerbaijan | Bhutan | Bolivia | Botswana | Brunei Dar. | Gabon | Honduras | Iran, Isl. Rep | Kuwait | Libya | Moldova | Mongolia | Morocco | Philippines | Saudi Arabia | Sri Lanka | Venezuela |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Institutions | 3.0 | 2.8 | 4.0 | 4.1 | 4.4 | 3.4 | 4.7 | 5.0 | 3.7 | 3.1 | 3.7 | 4.2 | 3.2 | 3.2 | 3.3 | 4.1 | 3.8 | 5.1 | 4.1 | 2.3 |
| 2 Infrastructure | 3.1 | 1.9 | 3.8 | 4.1 | 3.6 | 3.0 | 3.4 | 4.3 | 2.8 | 2.8 | 4.1 | 4.4 | 3.2 | 3.6 | 2.9 | 4.3 | 3.4 | 5.2 | 4.0 | 2.6 |
| 3 Macroeconomic environment | 5.5 | 5.0 | 4.9 | 6.4 | 4.1 | 5.7 | 5.8 | 7.0 | 6.1 | 4.3 | 4.3 | 6.7 | 6.0 | 4.6 | 3.7 | 4.4 | 5.3 | 6.7 | 3.9 | 3.1 |
| 4 Health and primary education | 5.4 | 3.7 | 5.5 | 5.1 | 5.4 | 5.1 | 4.6 | 6.3 | 4.1 | 5.4 | 6.0 | 5.6 | 4.5 | 5.4 | 5.6 | 5.5 | 5.3 | 5.9 | 5.9 | 5.5 |
| 5 Higher education and training | 3.5 | 2.1 | 4.2 | 4.0 | 3.4 | 3.8 | 3.6 | 4.5 | 2.6 | 3.3 | 4.0 | 4.0 | 3.5 | 3.9 | 4.1 | 3.5 | 4.3 | 4.7 | 4.3 | 4.2 |
| 6 Goods market efficiency | 3.2 | 3.0 | 4.3 | 4.3 | 3.9 | 3.5 | 4.1 | 4.5 | 3.6 | 3.9 | 3.9 | 4.1 | 3.1 | 3.9 | 4.1 | 4.3 | 4.2 | 4.8 | 4.6 | 2.8 |
| 7 Labor market efficiency | 2.9 | 3.7 | 4.5 | 4.7 | 4.7 | 3.7 | 4.5 | 5.1 | 4.3 | 3.3 | 3.0 | 4.0 | 3.5 | 4.1 | 4.5 | 3.9 | 4.1 | 4.3 | 3.5 | 2.8 |
| 8 Financial market development | 2.6 | 2.4 | 3.9 | 3.8 | 3.3 | 3.4 | 4.3 | 4.3 | 3.6 | 4.2 | 3.2 | 4.0 | 2.3 | 3.6 | 3.2 | 4.0 | 4.4 | 4.7 | 4.5 | 3.0 |
| 9 Technological readiness | 2.5 | 2.5 | 3.7 | 4.2 | 2.6 | 2.8 | 3.1 | 3.8 | 3.0 | 3.1 | 3.0 | 3.8 | 2.7 | 3.9 | 3.8 | 3.5 | 3.6 | 4.6 | 3.3 | 3.1 |
| 10 Market size | 4.4 | 3.8 | 2.7 | 3.6 | 1.8 | 3.3 | 3.0 | 2.4 | 2.7 | 3.2 | 5.1 | 3.8 | 3.5 | 2.5 | 2.7 | 4.2 | 4.7 | 5.1 | 3.9 | 4.6 |
| 11 Business sophistication | 2.9 | 2.9 | 3.8 | 4.0 | 3.5 | 3.6 | 3.6 | 4.2 | 3.0 | 3.8 | 3.6 | 3.9 | 3.2 | 3.3 | 3.3 | 3.7 | 4.3 | 4.7 | 4.5 | 3.2 |
| 12 Innovation | 2.4 | 2.1 | 3.0 | 3.5 | 2.8 | 3.2 | 3.0 | 3.4 | 2.5 | 2.8 | 3.2 | 2.8 | 2.2 | 2.4 | 2.9 | 2.9 | 3.2 | 3.9 | 3.5 | 2.5 |

Table 3. Factor-to-efficiency economies in 2013–2014 (Source: [18]).

| Factor-to-efficiency 2014-2015 | Algeria | Angola | Azerbaijan | Bhutan | Bolivia | Botswana | Gabon | Honduras | Iran, Isl. Rep | Kuwait | Libya | Moldova | Mongolia | Philippines | Saudi Arabia | Venezuela |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Institutions | 3.4 | 2.6 | 4 | 4.5 | 3.5 | 4.5 | 3.7 | 3.4 | 3.4 | 4.0 | 2.6 | 3.2 | 3.4 | 3.9 | 5.0 | 2.1 |
| 2 Infrastructure | 3.1 | 2.0 | 4.1 | 3.5 | 3.0 | 3.2 | 2.9 | 3.2 | 4.1 | 4.3 | 2.9 | 3.7 | 2.9 | 3.5 | 5.2 | 2.6 |
| 3 Macroeconomic environment | 6.4 | 4.7 | 6.4 | 3.9 | 5.5 | 6.3 | 6.0 | 3.8 | 4.8 | 6.7 | 5.4 | 4.9 | 3.8 | 5.8 | 6.7 | 3.1 |
| 4 Health and primary education | 5.6 | 3.5 | 5.2 | 5.5 | 4.9 | 4.1 | 4.0 | 5.5 | 6.0 | 5.6 | 4.6 | 5.4 | 5.8 | 5.4 | 6.0 | 5.5 |
| 5 Higher education and training | 3.7 | 1.9 | 3.9 | 3.5 | 3.7 | 3.6 | 2.8 | 3.6 | 4.2 | 4.2 | 3.6 | 4.1 | 4.4 | 4.4 | 4.6 | 4.3 |

*Contd.*

87

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 Goods market efficiency | 3.5 | 2.9 | 4.3 | 4.0 | 3.6 | 4.1 | 3.8 | 4.2 | 3.9 | 4.0 | 3.3 | 4.1 | 4.2 | 4.3 | 4.7 | 2.8 |
| 7 Labor market efficiency | 3.1 | 3.5 | 4.6 | 4.7 | 3.6 | 4.6 | 4.2 | 3.5 | 3.0 | 3.8 | 3.4 | 4.1 | 4.5 | 4.0 | 4.2 | 2.6 |
| 8 Financial market development | 2.7 | 2.5 | 3.8 | 3.4 | 3.3 | 4.2 | 3.6 | 4.2 | 3.0 | 3.9 | 1.9 | 3.7 | 3.2 | 4.4 | 4.7 | 2.9 |
| 9 Technological readiness | 2.6 | 2.3 | 4.3 | 2.7 | 2.8 | 3.6 | 3.0 | 3.2 | 3.0 | 3.7 | 2.6 | 4.4 | 3.5 | 3.8 | 4.5 | 3.0 |
| 10 Market size | 4.4 | 3.8 | 3.7 | 1.8 | 3.4 | 3.1 | 2.9 | 3.2 | 5.1 | 3.8 | 3.3 | 2.6 | 2.7 | 4.7 | 5.1 | 4.6 |
| 11 Business sophistication | 3.2 | 2.6 | 3.9 | 3.6 | 3.6 | 3.5 | 3.2 | 4.0 | 3.5 | 3.9 | 3.0 | 3.4 | 3.5 | 4.3 | 4.6 | 3.0 |
| 12 Innovation | 2.6 | 2.1 | 3.3 | 2.9 | 3.1 | 3 | 2.7 | 3.2 | 3.1 | 2.9 | 2.0 | 2.5 | 2.9 | 3.5 | 3.8 | 2.4 |

Table 4. Factor-to-efficiency economies in 2014–2015 (Source: [19]).

| Factor-to-efficiency 2015-2016 | Algeria | Azerbaijan | Bhutan | Botswana | Gabon | Honduras | Iran, Isl. Rep | Kazakhstan | Kuwait | Moldova | Mongolia | Nigeria | Philippines | Saudi Arabia | Venezuela | Vietnam |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Institutions | 3.5 | 3.9 | 4.6 | 4.4 | 3.8 | 3.6 | 3.6 | 4.2 | 4.1 | 3.2 | 3.6 | 3.2 | 3.8 | 5.1 | 2.1 | 3.7 |
| 2 Infrastructure | 3.1 | 4.1 | 3.4 | 3.3 | 2.9 | 3.4 | 4.2 | 4.2 | 4.3 | 3.7 | 2.9 | 2.1 | 3.4 | 5.1 | 2.6 | 3.8 |
| 3 Macroeconomic environment | 5.3 | 6.4 | 3.6 | 6.5 | 6.0 | 4.1 | 4.8 | 5.7 | 6.7 | 4.9 | 3.2 | 4.6 | 5.7 | 6.6 | 2.9 | 4.7 |
| 4 Health and primary education | 5.6 | 5.2 | 5.4 | 4.5 | 4.7 | 5.4 | 6.0 | 5.4 | 5.6 | 5.4 | 5.7 | 2.9 | 5.5 | 6.0 | 5.5 | 5.9 |
| 5 Higher education and training | 3.7 | 3.9 | 3.6 | 3.7 | 2.8 | 3.8 | 4.3 | 4.5 | 4.0 | 4.1 | 4.5 | 2.8 | 4.5 | 4.7 | 4.5 | 3.8 |
| 6 Goods market efficiency | 3.5 | 4.3 | 4.0 | 4.1 | 3.8 | 4.3 | 4.0 | 4.5 | 4.1 | 4.1 | 4.2 | 4.1 | 4.2 | 4.7 | 2.8 | 4.2 |
| 7 Labor market efficiency | 3.2 | 4.6 | 4.8 | 4.5 | 4.2 | 3.7 | 3.2 | 4.9 | 3.7 | 4.1 | 4.5 | 4.5 | 4.1 | 4.3 | 2.6 | 4.4 |
| 8 Financial market development | 2.8 | 3.3 | 3.6 | 4.0 | 3.5 | 4.4 | 2.8 | 3.6 | 3.8 | 3.3 | 3.0 | 3.8 | 4.2 | 4.3 | 2.8 | 3.7 |
| 9 Technological readiness | 2.6 | 4.3 | 2.9 | 3.3 | 2.9 | 3.2 | 3.2 | 4.2 | 4.3 | 4.4 | 4.0 | 3.0 | 3.9 | 4.7 | 3.1 | 3.3 |
| 10 Market size | 4.7 | 3.9 | 1.8 | 3.0 | 2.9 | 3.1 | 5.2 | 4.5 | 4.2 | 2.7 | 3.0 | 5.1 | 4.9 | 5.4 | 4.7 | 4.8 |
| 11 Business sophistication | 3.3 | 3.9 | 3.6 | 3.5 | 3.2 | 4.1 | 3.5 | 3.8 | 4.0 | 3.3 | 3.5 | 3.7 | 4.3 | 4.5 | 3.0 | 3.6 |
| 12 Innovation | 2.8 | 3.3 | 2.9 | 3.0 | 2.6 | 3.4 | 3.1 | 3.3 | 3.0 | 2.6 | 3.1 | 2.8 | 3.5 | 3.8 | 2.4 | 3.2 |

Table 5. Factor-to-efficiency economies in 2015–2016 (Source: [20]).

| Factor-to-efficiency 2016-2017 | Algeria | Azerbaijan | Bhutan | Bolivia | Botswana | Brunei Dar. | Gabon | Honduras | Kazakhstan | Kuwait | Mongolia | Nigeria | Philippines | Russian Fed. | Ukraine | Venezuela | Vietnam |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Institutions | 3.5 | 4.2 | 4.7 | 2.9 | 4.5 | 4.2 | 3.7 | 3.3 | 4.2 | 4.1 | 3.5 | 3.3 | 3.6 | 3.6 | 3.0 | 2.2 | 3.8 |
| 2 Infrastructure | 3.3 | 4.3 | 3.4 | 3.2 | 3.5 | 3.9 | 3.1 | 3.3 | 4.2 | 4.4 | 2.9 | 2.1 | 3.4 | 4.9 | 3.9 | 2.6 | 3.9 |
| 3 Macroeconomic environment | 4.8 | 5.2 | 3.8 | 4.0 | 6.2 | 4.9 | 5.6 | 4.9 | 4.7 | 6.3 | 3.6 | 4.0 | 5.9 | 4.3 | 3.2 | 2.4 | 4.5 |
| 4 Health and primary education | 5.7 | 5.7 | 5.3 | 5.3 | 4.7 | 6.3 | 4.8 | 5.6 | 5.4 | 5.6 | 5.7 | 2.8 | 5.6 | 5.9 | 6.0 | 5.4 | 5.8 |
| 5 Higher education and training | 3.9 | 4.2 | 3.8 | 3.8 | 4.1 | 4.5 | 3.0 | 3.6 | 4.6 | 4.0 | 4.6 | 2.9 | 4.6 | 5.1 | 5.1 | 4.7 | 4.1 |
| 6 Goods market efficiency | 3.5 | 4.5 | 4.0 | 3.4 | 4.3 | 4.3 | 3.7 | 4.1 | 4.4 | 4.2 | 4.0 | 4.1 | 4.1 | 4.2 | 4.0 | 2.9 | 4.2 |
| 7 Labor market efficiency | 3.2 | 4.8 | 4.7 | 3.1 | 4.5 | 4.5 | 3.9 | 3.6 | 4.8 | 3.7 | 4.3 | 4.5 | 4.0 | 4.4 | 4.2 | 2.8 | 4.3 |
| 8 Financial market development | 2.9 | 3.5 | 3.9 | 3.9 | 4.0 | 3.7 | 3.5 | 4.5 | 3.5 | 4.0 | 3.1 | 3.7 | 4.2 | 3.4 | 3.0 | 3.1 | 3.9 |
| 9 Technological readiness | 3.1 | 4.5 | 3.2 | 3.0 | 3.6 | 3.6 | 3.1 | 3.1 | 4.4 | 4.3 | 4.1 | 3.1 | 3.6 | 4.3 | 3.6 | 3.1 | 3.5 |
| 10 Market size | 4.7 | 3.9 | 1.8 | 3.4 | 2.9 | 2.7 | 2.8 | 3.1 | 4.5 | 4.3 | 2.9 | 5.0 | 4.9 | 5.9 | 4.4 | 4.6 | 4.8 |
| 11 Business sophistication | 3.3 | 4.0 | 3.7 | 3.2 | 3.6 | 3.7 | 3.2 | 3.8 | 3.6 | 4.0 | 3.3 | 3.6 | 4.1 | 3.8 | 3.6 | 3.0 | 3.6 |
| 12 Innovation | 2.9 | 3.6 | 3.1 | 2.5 | 3.2 | 3.3 | 2.7 | 3.1 | 3.4 | 3.0 | 3.1 | 2.9 | 3.4 | 3.4 | 3.4 | 2.6 | 3.3 |

Table 6. Factor-to-efficiency economies in 2016–2017(Source: [21]).

| 2017-2018 | Algeria | Azerbaijan | Bhutan | Botswana | Brunei Dar. | Honduras | Kazakhstan | Kuwait | Mongolia | Nicaragua | Nigeria | Philippines | Ukraine | Venezuela | Vietnam |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Institutions | 3.6 | 4.6 | 4.8 | 4.4 | 4.4 | 3.2 | 4.0 | 4.0 | 3.4 | 3.2 | 3.2 | 3.5 | 3.2 | 2.2 | 3.8 |
| 2 Infrastructure | 3.6 | 4.5 | 3.6 | 3.6 | 4.3 | 3.2 | 4.2 | 4.3 | 3.1 | 3.6 | 2.0 | 3.4 | 3.9 | 2.6 | 3.9 |
| 3 Macroeconomic environment | 4.6 | 4.8 | 4.6 | 6.1 | 5.1 | 5.0 | 4.2 | 5.6 | 4.4 | 5.1 | 3.5 | 5.8 | 3.5 | 2.4 | 4.6 |
| 4 Health and primary education | 5.8 | 5.7 | 5.4 | 4.8 | 6.3 | 5.5 | 5.9 | 5.6 | 5.6 | 5.5 | 3.0 | 5.6 | 6.0 | 5.3 | 5.8 |
| 5 Higher education and training | 4.0 | 4.5 | 4.0 | 3.8 | 4.5 | 3.6 | 4.6 | 3.9 | 4.5 | 3.4 | 3.1 | 4.6 | 5.1 | 4.6 | 4.1 |
| 6 Goods market efficiency | 3.6 | 4.8 | 4.2 | 4.2 | 4.3 | 4.0 | 4.3 | 4.2 | 4.0 | 3.9 | 4.1 | 4.0 | 4.0 | 2.8 | 4.1 |
| 7 Labor market efficiency | 3.3 | 5.0 | 4.7 | 4.5 | 4.4 | 3.5 | 4.6 | 3.6 | 4.2 | 3.9 | 4.6 | 4.0 | 4.0 | 2.7 | 4.3 |
| 8 Financial market development | 3.1 | 3.8 | 4.0 | 4.0 | 3.7 | 4.5 | 3.3 | 4.1 | 3.0 | 3.6 | 3.7 | 4.2 | 3.1 | 3.1 | 4.0 |
| 9 Technological readiness | 3.4 | 4.6 | 3.2 | 3.6 | 4.5 | 3.3 | 4.6 | 4.3 | 4.2 | 3.1 | 3.0 | 3.8 | 3.8 | 3.0 | 4.0 |
| 10 Market size | 4.8 | 4.0 | 1.9 | 3.0 | 2.9 | 3.1 | 4.5 | 4.4 | 3.0 | 3.0 | 5.0 | 5.0 | 4.5 | 4.4 | 4.9 |
| 11 Business sophistication | 3.3 | 4.4 | 3.8 | 3.7 | 3.7 | 3.8 | 3.6 | 4.0 | 3.3 | 3.2 | 3.7 | 4.1 | 3.7 | 3.0 | 3.7 |
| 12 Innovation | 2.9 | 4.0 | 3.2 | 3.2 | 3.2 | 2.9 | 3.2 | 3.0 | 3.0 | 2.5 | 2.8 | 3.3 | 3.4 | 2.6 | 3.3 |

Table 7. Factor-to-efficiency economies in 2017–2018 (Source: [22]).

# 3    Results and discussion

Here we presume that the reader is already familiar with the InterCriteria Analysis and we are not going to present it in details. The theory of ICA has been presented in [1–3, 5, 12, 16, 17, 23]. We will only remind here that from each input dataset of evaluations of objects (in this case, countries) against criteria (i.e., pillars of competitiveness), ICA computes a new table that contains intuitionistic fuzzy pairs, [4], giving the measure of dependence between every pair of criteria. In ICA-specific terms, the IFP gives dependence between two criteria falls in one of the three possible categories: positive consonance, negative consonance or dissonance. Positive consonance in ICA is interpreted as the definite presence of relation between two criteria, with boundary value of $\langle 1; 0 \rangle$, negative consonance is interpreted as the definite absence of relation, with boundary value $\langle 0; 1 \rangle$; and dissonance is interpreted as uncertainty, where no particular conclusion can be derived, with boundary value $\langle 0; 0 \rangle$. Since every criterion perfectly correlates with itself, the IFPs along the main diagonal are all equal to $\langle 1; 0 \rangle$, and the intercriteria dependence is a commutative property, i.e. $\langle \mu_{Ci,Ck}; \nu_{Ci,Ck} \rangle = \langle \mu_{Ck,Ci}; \nu_{Ck,Ci} \rangle$.

The computations are performed with the two developed ICA software applications [13–15], which for the sake of simplicity return the computed result in the form of two tables, one giving the membership parts of the IF pairs, and the other giving the non-membership parts. Therefore, here we present the results of the application of ICA in tabular way by two tables per year with the membership and non-membership parts of the intercriteria pairs (Tables 8 a) and b) to 12 a) and b)), and in graphic way as points plotted on the intuitionistic fuzzy interpretational triangle, [6] (Figure 1, a) to d)). On this basis the findings are commented as follows.

| a) Membership | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Institutions | 1.000 | 0.779 | 0.642 | 0.579 | 0.621 | 0.779 | 0.721 | 0.747 | 0.653 | 0.421 | 0.732 | 0.716 |
| 2 Infrastructure | 0.779 | 1.000 | 0.600 | 0.695 | 0.674 | 0.747 | 0.600 | 0.679 | 0.679 | 0.526 | 0.737 | 0.679 |
| 3 Macroeconomic environment | 0.642 | 0.600 | 1.000 | 0.374 | 0.500 | 0.547 | 0.616 | 0.584 | 0.558 | 0.474 | 0.568 | 0.537 |
| 4 Health and primary education | 0.579 | 0.695 | 0.374 | 1.000 | 0.716 | 0.674 | 0.447 | 0.584 | 0.626 | 0.521 | 0.642 | 0.637 |
| 5 Higher education and training | 0.621 | 0.674 | 0.500 | 0.716 | 1.000 | 0.700 | 0.532 | 0.647 | 0.700 | 0.558 | 0.711 | 0.721 |
| 6 Goods market efficiency | 0.779 | 0.747 | 0.547 | 0.674 | 0.700 | 1.000 | 0.653 | 0.779 | 0.726 | 0.442 | 0.795 | 0.768 |
| 7 Labor market efficiency | 0.721 | 0.600 | 0.616 | 0.447 | 0.532 | 0.653 | 1.000 | 0.589 | 0.642 | 0.263 | 0.584 | 0.579 |
| 8 Financial market development | 0.747 | 0.679 | 0.584 | 0.584 | 0.647 | 0.779 | 0.589 | 1.000 | 0.679 | 0.511 | 0.821 | 0.732 |
| 9 Technological readiness | 0.653 | 0.679 | 0.558 | 0.626 | 0.700 | 0.726 | 0.642 | 0.679 | 1.000 | 0.442 | 0.726 | 0.647 |
| 10 Market size | 0.421 | 0.526 | 0.474 | 0.521 | 0.558 | 0.442 | 0.263 | 0.511 | 0.442 | 1.000 | 0.532 | 0.532 |
| 11 Business sophistication | 0.732 | 0.737 | 0.568 | 0.642 | 0.711 | 0.795 | 0.584 | 0.821 | 0.726 | 0.532 | 1.000 | 0.789 |
| 12 Innovation | 0.716 | 0.679 | 0.537 | 0.637 | 0.721 | 0.768 | 0.579 | 0.732 | 0.647 | 0.532 | 0.789 | 1.000 |

| b) Non-membership | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Institutions | 0.000 | 0.168 | 0.321 | 0.332 | 0.311 | 0.142 | 0.211 | 0.205 | 0.289 | 0.526 | 0.205 | 0.211 |
| 2 Infrastructure | 0.168 | 0.000 | 0.363 | 0.226 | 0.268 | 0.174 | 0.332 | 0.274 | 0.253 | 0.421 | 0.200 | 0.237 |
| 3 Macroeconomic environment | 0.321 | 0.363 | 0.000 | 0.553 | 0.447 | 0.389 | 0.332 | 0.384 | 0.389 | 0.489 | 0.384 | 0.395 |
| 4 Health and primary education | 0.332 | 0.226 | 0.553 | 0.000 | 0.189 | 0.253 | 0.447 | 0.332 | 0.279 | 0.389 | 0.258 | 0.263 |
| 5 Higher education and training | 0.311 | 0.268 | 0.447 | 0.189 | 0.000 | 0.195 | 0.384 | 0.289 | 0.216 | 0.374 | 0.211 | 0.179 |
| 6 Goods market efficiency | 0.142 | 0.174 | 0.389 | 0.253 | 0.195 | 0.000 | 0.253 | 0.137 | 0.179 | 0.468 | 0.105 | 0.121 |
| 7 Labor market efficiency | 0.211 | 0.332 | 0.332 | 0.447 | 0.384 | 0.253 | 0.000 | 0.347 | 0.274 | 0.679 | 0.337 | 0.332 |
| 8 Financial market development | 0.205 | 0.274 | 0.384 | 0.332 | 0.289 | 0.137 | 0.347 | 0.000 | 0.258 | 0.442 | 0.121 | 0.189 |
| 9 Technological readiness | 0.289 | 0.253 | 0.389 | 0.279 | 0.216 | 0.179 | 0.274 | 0.258 | 0.000 | 0.489 | 0.205 | 0.253 |
| 10 Market size | 0.526 | 0.421 | 0.489 | 0.389 | 0.374 | 0.468 | 0.679 | 0.442 | 0.489 | 0.000 | 0.405 | 0.384 |
| 11 Business sophistication | 0.205 | 0.200 | 0.384 | 0.258 | 0.211 | 0.105 | 0.337 | 0.121 | 0.205 | 0.405 | 0.000 | 0.126 |
| 12 Innovation | 0.211 | 0.237 | 0.395 | 0.263 | 0.179 | 0.121 | 0.332 | 0.189 | 0.253 | 0.384 | 0.126 | 0.000 |

Table 8. Results of ICA on the data of factor-to-efficiency economies in 2013–2014.

| a) Membership | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Institutions | 1.000 | 0.675 | 0.700 | 0.492 | 0.475 | 0.717 | 0.725 | 0.742 | 0.617 | 0.442 | 0.725 | 0.708 |
| 2 Infrastructure | 0.675 | 1.000 | 0.667 | 0.633 | 0.633 | 0.708 | 0.575 | 0.733 | 0.717 | 0.550 | 0.742 | 0.700 |
| 3 Macroeconomic environment | 0.700 | 0.667 | 1.000 | 0.458 | 0.517 | 0.592 | 0.583 | 0.642 | 0.600 | 0.600 | 0.583 | 0.583 |
| 4 Health and primary education | 0.492 | 0.633 | 0.458 | 1.000 | 0.733 | 0.567 | 0.417 | 0.517 | 0.558 | 0.617 | 0.600 | 0.592 |
| 5 Higher education and training | 0.475 | 0.633 | 0.517 | 0.733 | 1.000 | 0.633 | 0.433 | 0.600 | 0.692 | 0.675 | 0.617 | 0.617 |
| 6 Goods market efficiency | 0.717 | 0.708 | 0.592 | 0.567 | 0.633 | 1.000 | 0.692 | 0.817 | 0.792 | 0.458 | 0.792 | 0.792 |
| 7 Labor market efficiency | 0.725 | 0.575 | 0.583 | 0.417 | 0.433 | 0.692 | 1.000 | 0.650 | 0.633 | 0.283 | 0.600 | 0.600 |
| 8 Financial market development | 0.742 | 0.733 | 0.642 | 0.517 | 0.600 | 0.817 | 0.650 | 1.000 | 0.783 | 0.525 | 0.817 | 0.783 |
| 9 Technological readiness | 0.617 | 0.717 | 0.600 | 0.558 | 0.692 | 0.792 | 0.633 | 0.783 | 1.000 | 0.500 | 0.700 | 0.700 |
| 10 Market size | 0.442 | 0.550 | 0.600 | 0.617 | 0.675 | 0.458 | 0.283 | 0.525 | 0.500 | 1.000 | 0.525 | 0.592 |
| 11 Business sophistication | 0.725 | 0.742 | 0.583 | 0.600 | 0.617 | 0.792 | 0.600 | 0.817 | 0.700 | 0.525 | 1.000 | 0.833 |
| 12 Innovation | 0.708 | 0.700 | 0.583 | 0.592 | 0.617 | 0.792 | 0.600 | 0.783 | 0.700 | 0.592 | 0.833 | 1.000 |

| b) Non-membership | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Institutions | 0.000 | 0.200 | 0.217 | 0.383 | 0.400 | 0.192 | 0.175 | 0.175 | 0.275 | 0.467 | 0.175 | 0.183 |
| 2 Infrastructure | 0.200 | 0.000 | 0.258 | 0.267 | 0.283 | 0.208 | 0.350 | 0.225 | 0.200 | 0.383 | 0.150 | 0.217 |
| 3 Macroeconomic environment | 0.217 | 0.258 | 0.000 | 0.467 | 0.408 | 0.367 | 0.367 | 0.325 | 0.342 | 0.358 | 0.333 | 0.358 |
| 4 Health and primary education | 0.383 | 0.267 | 0.467 | 0.000 | 0.167 | 0.350 | 0.508 | 0.425 | 0.358 | 0.333 | 0.292 | 0.325 |
| 5 Higher education and training | 0.400 | 0.283 | 0.408 | 0.167 | 0.000 | 0.283 | 0.492 | 0.358 | 0.225 | 0.258 | 0.275 | 0.300 |
| 6 Goods market efficiency | 0.192 | 0.208 | 0.367 | 0.350 | 0.283 | 0.000 | 0.250 | 0.142 | 0.142 | 0.492 | 0.117 | 0.158 |
| 7 Labor market efficiency | 0.175 | 0.350 | 0.367 | 0.508 | 0.492 | 0.250 | 0.000 | 0.317 | 0.308 | 0.675 | 0.317 | 0.342 |
| 8 Financial market development | 0.175 | 0.225 | 0.325 | 0.425 | 0.358 | 0.142 | 0.317 | 0.000 | 0.175 | 0.450 | 0.117 | 0.175 |
| 9 Technological readiness | 0.275 | 0.200 | 0.342 | 0.358 | 0.225 | 0.142 | 0.308 | 0.175 | 0.000 | 0.450 | 0.208 | 0.233 |
| 10 Market size | 0.467 | 0.383 | 0.358 | 0.333 | 0.258 | 0.492 | 0.675 | 0.450 | 0.450 | 0.000 | 0.400 | 0.358 |
| 11 Business sophistication | 0.175 | 0.150 | 0.333 | 0.292 | 0.275 | 0.117 | 0.317 | 0.117 | 0.208 | 0.400 | 0.000 | 0.075 |
| 12 Innovation | 0.183 | 0.217 | 0.358 | 0.325 | 0.300 | 0.158 | 0.342 | 0.175 | 0.233 | 0.358 | 0.075 | 0.000 |

Table 9. Results of ICA on the data of factor-to-efficiency economies in 2014–2015.

| a) Membership | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Institutions | 1.000 | 0.667 | 0.717 | 0.442 | 0.467 | 0.608 | 0.650 | 0.633 | 0.600 | 0.433 | 0.658 | 0.658 |
| 2 Infrastructure | 0.667 | 1.000 | 0.675 | 0.617 | 0.625 | 0.642 | 0.492 | 0.542 | 0.700 | 0.558 | 0.675 | 0.667 |
| 3 Macroeconomic environment | 0.717 | 0.675 | 1.000 | 0.417 | 0.492 | 0.550 | 0.500 | 0.592 | 0.650 | 0.525 | 0.600 | 0.575 |
| 4 Health and primary education | 0.442 | 0.617 | 0.417 | 1.000 | 0.658 | 0.450 | 0.300 | 0.383 | 0.517 | 0.633 | 0.492 | 0.567 |
| 5 Higher education and training | 0.467 | 0.625 | 0.492 | 0.658 | 1.000 | 0.583 | 0.383 | 0.417 | 0.675 | 0.600 | 0.542 | 0.625 |
| 6 Goods market efficiency | 0.608 | 0.642 | 0.550 | 0.450 | 0.583 | 1.000 | 0.617 | 0.658 | 0.700 | 0.517 | 0.733 | 0.783 |
| 7 Labor market efficiency | 0.650 | 0.492 | 0.500 | 0.300 | 0.383 | 0.617 | 1.000 | 0.533 | 0.542 | 0.383 | 0.575 | 0.550 |
| 8 Financial market development | 0.633 | 0.542 | 0.592 | 0.383 | 0.417 | 0.658 | 0.533 | 1.000 | 0.558 | 0.517 | 0.733 | 0.658 |
| 9 Technological readiness | 0.600 | 0.700 | 0.650 | 0.517 | 0.675 | 0.700 | 0.542 | 0.558 | 1.000 | 0.492 | 0.642 | 0.642 |
| 10 Market size | 0.433 | 0.558 | 0.525 | 0.633 | 0.600 | 0.517 | 0.383 | 0.517 | 0.492 | 1.000 | 0.600 | 0.608 |
| 11 Business sophistication | 0.658 | 0.675 | 0.600 | 0.492 | 0.542 | 0.733 | 0.575 | 0.733 | 0.642 | 0.600 | 1.000 | 0.825 |
| 12 Innovation | 0.658 | 0.667 | 0.575 | 0.567 | 0.625 | 0.783 | 0.550 | 0.658 | 0.642 | 0.608 | 0.825 | 1.000 |

| b) Non-membership | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Institutions | 0.000 | 0.250 | 0.233 | 0.442 | 0.417 | 0.275 | 0.258 | 0.275 | 0.342 | 0.508 | 0.275 | 0.275 |
| 2 Infrastructure | 0.250 | 0.000 | 0.275 | 0.283 | 0.258 | 0.225 | 0.417 | 0.367 | 0.225 | 0.383 | 0.242 | 0.250 |
| 3 Macroeconomic environment | 0.233 | 0.275 | 0.000 | 0.500 | 0.442 | 0.350 | 0.442 | 0.350 | 0.308 | 0.450 | 0.350 | 0.375 |
| 4 Health and primary education | 0.442 | 0.283 | 0.500 | 0.000 | 0.208 | 0.383 | 0.575 | 0.508 | 0.375 | 0.275 | 0.392 | 0.317 |
| 5 Higher education and training | 0.417 | 0.258 | 0.442 | 0.208 | 0.000 | 0.267 | 0.492 | 0.458 | 0.217 | 0.308 | 0.342 | 0.258 |
| 6 Goods market efficiency | 0.275 | 0.225 | 0.350 | 0.383 | 0.267 | 0.000 | 0.258 | 0.217 | 0.175 | 0.375 | 0.133 | 0.100 |
| 7 Labor market efficiency | 0.258 | 0.417 | 0.442 | 0.575 | 0.492 | 0.258 | 0.000 | 0.383 | 0.375 | 0.567 | 0.350 | 0.358 |
| 8 Financial market development | 0.275 | 0.367 | 0.350 | 0.508 | 0.458 | 0.217 | 0.383 | 0.000 | 0.358 | 0.433 | 0.175 | 0.250 |
| 9 Technological readiness | 0.342 | 0.225 | 0.308 | 0.375 | 0.217 | 0.175 | 0.375 | 0.358 | 0.000 | 0.458 | 0.283 | 0.283 |
| 10 Market size | 0.508 | 0.383 | 0.450 | 0.275 | 0.308 | 0.375 | 0.567 | 0.433 | 0.458 | 0.000 | 0.358 | 0.333 |
| 11 Business sophistication | 0.275 | 0.242 | 0.350 | 0.392 | 0.342 | 0.133 | 0.350 | 0.175 | 0.283 | 0.358 | 0.000 | 0.108 |
| 12 Innovation | 0.275 | 0.250 | 0.375 | 0.317 | 0.258 | 0.100 | 0.358 | 0.250 | 0.283 | 0.333 | 0.108 | 0.000 |

Table 10. Results of ICA on the data of factor-to-efficiency economies in 2015–2016.

| a) Membership | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Institutions | 1.000 | 0.640 | 0.669 | 0.449 | 0.434 | 0.728 | 0.735 | 0.566 | 0.618 | 0.324 | 0.588 | 0.596 |
| 2 Infrastructure | 0.640 | 1.000 | 0.610 | 0.632 | 0.625 | 0.706 | 0.625 | 0.463 | 0.728 | 0.515 | 0.662 | 0.735 |
| 3 Macroeconomic environment | 0.669 | 0.610 | 1.000 | 0.412 | 0.368 | 0.654 | 0.522 | 0.640 | 0.529 | 0.441 | 0.625 | 0.507 |
| 4 Health and primary education | 0.449 | 0.632 | 0.412 | 1.000 | 0.676 | 0.522 | 0.485 | 0.338 | 0.544 | 0.529 | 0.522 | 0.610 |
| 5 Higher education and training | 0.434 | 0.625 | 0.368 | 0.676 | 1.000 | 0.507 | 0.500 | 0.301 | 0.625 | 0.588 | 0.478 | 0.684 |
| 6 Goods market efficiency | 0.728 | 0.706 | 0.654 | 0.522 | 0.507 | 1.000 | 0.757 | 0.522 | 0.721 | 0.471 | 0.647 | 0.713 |
| 7 Labor market efficiency | 0.735 | 0.625 | 0.522 | 0.485 | 0.500 | 0.757 | 1.000 | 0.478 | 0.647 | 0.434 | 0.588 | 0.669 |
| 8 Financial market development | 0.566 | 0.463 | 0.640 | 0.338 | 0.301 | 0.522 | 0.478 | 1.000 | 0.390 | 0.390 | 0.588 | 0.426 |
| 9 Technological readiness | 0.618 | 0.728 | 0.529 | 0.544 | 0.625 | 0.721 | 0.647 | 0.390 | 1.000 | 0.456 | 0.588 | 0.721 |
| 10 Market size | 0.324 | 0.515 | 0.441 | 0.529 | 0.588 | 0.471 | 0.434 | 0.390 | 0.456 | 1.000 | 0.485 | 0.507 |
| 11 Business sophistication | 0.588 | 0.662 | 0.625 | 0.522 | 0.478 | 0.647 | 0.588 | 0.588 | 0.588 | 0.485 | 1.000 | 0.654 |
| 12 Innovation | 0.550 | 0.733 | 0.483 | 0.592 | 0.675 | 0.683 | 0.633 | 0.450 | 0.683 | 0.492 | 0.625 | 1.000 |

| b) Non-membership | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Institutions | 0.000 | 0.279 | 0.272 | 0.463 | 0.478 | 0.169 | 0.199 | 0.338 | 0.228 | 0.625 | 0.272 | 0.294 |
| 2 Infrastructure | 0.279 | 0.000 | 0.338 | 0.272 | 0.294 | 0.184 | 0.301 | 0.434 | 0.140 | 0.441 | 0.206 | 0.162 |
| 3 Macroeconomic environment | 0.272 | 0.338 | 0.000 | 0.515 | 0.574 | 0.257 | 0.426 | 0.279 | 0.331 | 0.537 | 0.250 | 0.397 |
| 4 Health and primary education | 0.463 | 0.272 | 0.515 | 0.000 | 0.235 | 0.360 | 0.419 | 0.551 | 0.272 | 0.404 | 0.324 | 0.250 |
| 5 Higher education and training | 0.478 | 0.294 | 0.574 | 0.235 | 0.000 | 0.375 | 0.419 | 0.603 | 0.206 | 0.360 | 0.382 | 0.221 |
| 6 Goods market efficiency | 0.169 | 0.184 | 0.257 | 0.360 | 0.375 | 0.000 | 0.147 | 0.338 | 0.125 | 0.449 | 0.169 | 0.147 |
| 7 Labor market efficiency | 0.199 | 0.301 | 0.426 | 0.419 | 0.419 | 0.147 | 0.000 | 0.449 | 0.206 | 0.522 | 0.279 | 0.213 |
| 8 Financial market development | 0.338 | 0.434 | 0.279 | 0.551 | 0.603 | 0.338 | 0.449 | 0.000 | 0.419 | 0.537 | 0.235 | 0.426 |
| 9 Technological readiness | 0.228 | 0.140 | 0.331 | 0.272 | 0.206 | 0.125 | 0.206 | 0.419 | 0.000 | 0.412 | 0.191 | 0.103 |
| 10 Market size | 0.625 | 0.441 | 0.537 | 0.404 | 0.360 | 0.449 | 0.522 | 0.537 | 0.412 | 0.000 | 0.397 | 0.404 |
| 11 Business sophistication | 0.272 | 0.206 | 0.250 | 0.324 | 0.382 | 0.169 | 0.279 | 0.235 | 0.191 | 0.397 | 0.000 | 0.169 |
| 12 Innovation | 0.325 | 0.150 | 0.417 | 0.258 | 0.225 | 0.158 | 0.233 | 0.400 | 0.117 | 0.408 | 0.183 | 0.000 |

Table 11. Results of ICA on the data of factor-to-efficiency economies in 2016–2017.

| a) Membership | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Institutions | 1.000 | 0.640 | 0.669 | 0.449 | 0.434 | 0.728 | 0.735 | 0.566 | 0.618 | 0.324 | 0.588 | 0.596 |
| 2 Infrastructure | 0.640 | 1.000 | 0.610 | 0.632 | 0.625 | 0.706 | 0.625 | 0.463 | 0.728 | 0.515 | 0.662 | 0.735 |
| 3 Macroeconomic environment | 0.669 | 0.610 | 1.000 | 0.412 | 0.368 | 0.654 | 0.522 | 0.640 | 0.529 | 0.441 | 0.625 | 0.507 |
| 4 Health and primary education | 0.449 | 0.632 | 0.412 | 1.000 | 0.676 | 0.522 | 0.485 | 0.338 | 0.544 | 0.529 | 0.522 | 0.610 |
| 5 Higher education and training | 0.434 | 0.625 | 0.368 | 0.676 | 1.000 | 0.507 | 0.500 | 0.301 | 0.625 | 0.588 | 0.478 | 0.684 |
| 6 Goods market efficiency | 0.728 | 0.706 | 0.654 | 0.522 | 0.507 | 1.000 | 0.757 | 0.522 | 0.721 | 0.471 | 0.647 | 0.713 |
| 7 Labor market efficiency | 0.735 | 0.625 | 0.522 | 0.485 | 0.500 | 0.757 | 1.000 | 0.478 | 0.647 | 0.434 | 0.588 | 0.669 |
| 8 Financial market development | 0.566 | 0.463 | 0.640 | 0.338 | 0.301 | 0.522 | 0.478 | 1.000 | 0.390 | 0.390 | 0.588 | 0.426 |
| 9 Technological readiness | 0.618 | 0.728 | 0.529 | 0.544 | 0.625 | 0.721 | 0.647 | 0.390 | 1.000 | 0.456 | 0.588 | 0.721 |
| 10 Market size | 0.324 | 0.515 | 0.441 | 0.529 | 0.588 | 0.471 | 0.434 | 0.390 | 0.456 | 1.000 | 0.485 | 0.507 |
| 11 Business sophistication | 0.588 | 0.662 | 0.625 | 0.522 | 0.478 | 0.647 | 0.588 | 0.588 | 0.588 | 0.485 | 1.000 | 0.654 |
| 12 Innovation | 0.550 | 0.733 | 0.483 | 0.592 | 0.675 | 0.683 | 0.633 | 0.450 | 0.683 | 0.492 | 0.625 | 1.000 |

| b) Non-membership | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Institutions | 0.000 | 0.162 | 0.286 | 0.333 | 0.429 | 0.114 | 0.200 | 0.324 | 0.219 | 0.581 | 0.229 | 0.219 |
| 2 Infrastructure | 0.162 | 0.000 | 0.333 | 0.190 | 0.343 | 0.171 | 0.333 | 0.400 | 0.152 | 0.514 | 0.276 | 0.219 |
| 3 Macroeconomic environment | 0.286 | 0.333 | 0.000 | 0.495 | 0.581 | 0.333 | 0.438 | 0.219 | 0.400 | 0.543 | 0.267 | 0.371 |
| 4 Health and primary education | 0.333 | 0.190 | 0.495 | 0.000 | 0.229 | 0.343 | 0.438 | 0.524 | 0.190 | 0.400 | 0.371 | 0.257 |
| 5 Higher education and training | 0.429 | 0.343 | 0.581 | 0.229 | 0.000 | 0.400 | 0.476 | 0.571 | 0.267 | 0.362 | 0.419 | 0.210 |
| 6 Goods market efficiency | 0.114 | 0.171 | 0.333 | 0.343 | 0.400 | 0.000 | 0.114 | 0.324 | 0.181 | 0.495 | 0.200 | 0.219 |
| 7 Labor market efficiency | 0.200 | 0.333 | 0.438 | 0.438 | 0.476 | 0.114 | 0.000 | 0.429 | 0.333 | 0.524 | 0.286 | 0.267 |
| 8 Financial market development | 0.324 | 0.400 | 0.219 | 0.524 | 0.571 | 0.324 | 0.429 | 0.000 | 0.448 | 0.438 | 0.133 | 0.362 |
| 9 Technological readiness | 0.219 | 0.152 | 0.400 | 0.190 | 0.267 | 0.181 | 0.333 | 0.448 | 0.000 | 0.476 | 0.305 | 0.200 |
| 10 Market size | 0.581 | 0.514 | 0.543 | 0.400 | 0.362 | 0.495 | 0.524 | 0.438 | 0.476 | 0.000 | 0.390 | 0.410 |
| 11 Business sophistication | 0.229 | 0.276 | 0.267 | 0.371 | 0.419 | 0.200 | 0.286 | 0.133 | 0.305 | 0.390 | 0.000 | 0.181 |
| 12 Innovation | 0.220 | 0.231 | 0.385 | 0.231 | 0.198 | 0.220 | 0.264 | 0.374 | 0.209 | 0.418 | 0.187 | 0.000 |

Table 12. Results of ICA on the data of factor-to-efficiency economies in 2017–2018.
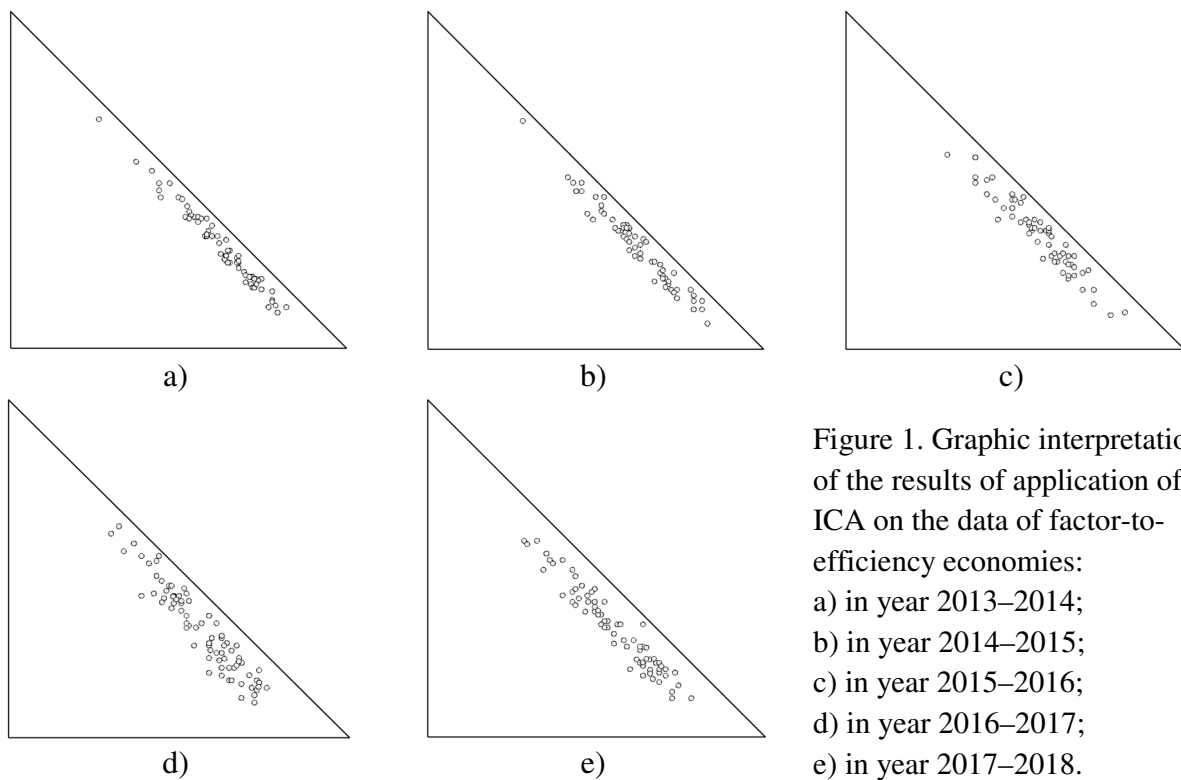


Figure 1. Graphic interpretation of the results of application of ICA on the data of factor-to-efficiency economies:
a) in year 2013–2014;
b) in year 2014–2015;
c) in year 2015–2016;
d) in year 2016–2017;
e) in year 2017–2018.

In the results over the years we notice the strong and persistent presence of pillar "6 Goods market efficiency", with high positive consonances with pillar "8 Financial market development", "9 Technological readiness" and "12 Innovation". In some years, two of the traditionally lowest correlating pillars, the basic requirement "3 Macroeconomic environment" (2015–2016) and the economy enhancer "10 Market size" (2014–2015), exhibit atypically high levels of correlation with many of the other criteria. We can explain this with the varying sets of countries in these years. Another basic requirement, "2 Infrastructure", also often appears to strongly correlate with another economic enhancers, "9 Technological readiness". This is a

noteworthy finding in the context of researching these intercriteria relations on the background of countries in transition from factor-driven to efficiency-driven economy.

# 4    Conclusions

The two considerations about the essence of the analyzed dataset in this leg of the ICA research on GCR data, about the size of the analyzed set, and its elements' variability over time, are important to weigh up in discussing the results and their reliability and comparability to prior results of similar ICA applications. From the results in Tables 8 to 12 and Figure 1, is seen that the majority of the intercriteria pairs are in the dissonance zone, and despite the relatively low uncertainty (lower in the beginning, and higher in the end of the period) the pairs of criteria with relatively similar values of membership and non-membership are not conclusive for more categorical decisions on this basis, for the countries in the transition from factor- to efficiency-driven economy. These results, however, can obtain a better interpretation after we complete the research of all global economies, and we are able to compare the performance of the pillars and the dependences between them within these different contexts, and over time.

# Acknowledgements

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