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COMPATIBILITY OF TECHNOLOGICAL AND SOCIAL INNOVATION: EUROPEAN BENCHMARKING AND IMPLICATIONS FOR CARPE-COUNTRIES

Abstract

This paper aims to measure social innovation performance in the EU-27 by focussing on the main target (or vulnerable) groups identified by the European Commission in the Europe 2020 Strategy as: youth, women and people that are unemployed, non-educated or living in poverty. Despite the high frequency of social innovation appearance in academic and policy papers there is no or limited evidence of its quantitative character, features distinguishing it from traditional profit-driven technological innovation as well as cross-country comparisons. These aspects are partly investigated in this paper by calculating for every EU-27 member state two respective indices measuring social and technological innovation performance enabling a Europe-wide benchmarking. The findings demonstrate coherence of technological and social innovation for the selected country group. Furthermore, the results are used to scale up current social innovation performance in the EU-27 in contrast with the Europe 2020 headline targets. A special focus is set on five European countries involved in a strategic Consortium on Applied Research and Professional Education (CARPE) pursuing collaborative research on social innovation in Europe.

Keywords:
Social Innovation, Technological Innovation, Europe 2020, National Reform Programme

JEL Classification:
O32, O38, O52, O57, P48
1 Introduction

On June 17, 2010 the Europe 2020 strategy proposed by the European Commission and agreed by the European Council was introduced as a common agenda for the upcoming decade. The main focus is set on smart, sustainable and inclusive growth to overcome some current weaknesses caused by the ongoing economic and financial crisis and to underpin a sustainable social market economy. A special role in this working agenda was granted to social innovation understood by the European Commission as “...new ideas and new collaborations to improve effectiveness and meet social needs” (European Commission, Bureau of European Policy Advisors 2010). Thus, social innovation in its European interpretation shall primarily address the basic societal needs and demands of society’s most vulnerable groups – including youth, women and people that are unemployed, non-educated or living in poverty – and shall be then at first instance aimed at developing policies to eliminate inequality and social exclusion (European Commission, Bureau of European Policy Advisors 2010).

The Europe 2020 goals have their quantitative expression in form of headline targets set at the EU level and their further implications as national targets in frame of the National Reform Programmes introduced by individual member states. While some targets are clearly fixed both at the European as well as at a respective national level, e.g. employment rate of the population aged between 20 and 64 to be at a level of 75% by 2020 (Eurostat 2012); others are still in consideration as regards to the definition of respective quantitative indicators (e.g. risk-of-poverty level) to measure the national targets in individual member states.

An overview of existing literature on social innovation in Europe has shown a limited number of publications measuring social innovation performance based on criteria and headline targets prioritised by the European Commission and encompassing all target groups defined as society’s most vulnerable. There is a lack of comparable metrics for evaluation, which is important for a better understanding of where social innovation can be applied. Furthermore, there is a limited track of research providing European cross-country
comparisons of demand on social innovation focussed on specified target groups as well as analysis of potential outcomes of social innovation policies in the respective countries. One reference point in this context is the European Innovation Scoreboard (EIS), a tool to track innovation performance in individual member states, initiated by the European Commission (Hollanders and van Cruysen 2009), as well as his successor - the Innovation Union Scoreboard (European Commission 2013). The approach provides a general overview about innovation potential and performance in the EU-27 and some selected countries beyond the EU and is based on analysis of multiple indicators ranging from a level of human capital development in a country to a share of venture capital as % of GDP. However, the EIS approach contains no further specification of innovation into different types (e.g. social or technological) and provides no matches to the corresponding Europe 2020 headline targets for society’s vulnerable groups. The methodology developed for this paper in order to quantify social innovation performance in Europe is partly linked to the EIS methodology as regards to the core idea to use an index variable to measure and benchmark innovation performance. However, the author of this paper distinguishes between social and technological innovation and respectively selects and defines indicators appropriate for each type. Furthermore, a matching with Europe 2020 targets is provided and coherence between social and technological innovation is investigated. An additional perspective is provided for CARPE-countries regarding their social innovation performance.

It is obvious from the literature overview that modern approaches to quantify and evaluate social innovation are needed. Also there is a need for analytical country comparisons of selected indicators and measurement of social innovation contribution to economic growth that ideally should proceed in Europe as smart, sustainable and inclusive.

This paper primarily aims to measure social innovation performance in individual European member states based on indicators linked to the target groups in focus of Europe 2020: youth, women and people that are unemployed, non-educated or living in poverty - in order to:
1) Quantify current social innovation performance in the EU;
2) Match the results with the Europe 2020 headline targets to identify deficits;
3) Investigate relationship between social and technological innovation performance of individual countries;
4) Outline the results by focusing on CARPE-countries and their social innovation performance.

2 Data and methodology

In the meaning of the European Commission social innovation shall ideally address society’s most vulnerable groups and correspond to the respective headline targets set in the Europe 2020 strategy. The approach to quantify current social innovation performance in Europe applied in this paper is based – as shown in Table 1 – on five indicators reflecting policies pursued by the European countries in order to meet Europe 2020 goals.

The analysis applies statistical data on selected criteria provided by the Eurostat (Eurostat 2013). While calculating individual performance indicators the latest available country-data are used respectively. In a limited number of cases missing values are replaced with data from a previous year.

For the purpose of quantifying social innovation performance the last three indicators in Table 1 (numbers 3 to 5) are converted as follows:

a) Indicator 3 is converted in “People NOT at risk-of-poverty after social transfers as % of population” and is equal 83.1% (=100% – 16.9%, s. Table 1).

b) Indicator 4 is converted in “Young people aged 15-24 in Employment OR in any Education and Training (EET rate)” and is equal 86.8% (=100% - 13.2%, s. Table 1).

c) Indicator 5 assumes full inclusion and participation of female population in society and labour market with a target to reach a parity of healthy-life-years and life expectancy for female population by 2020.
Table 1: Indicators of social innovation performance

<table>
<thead>
<tr>
<th>No.</th>
<th>Target group</th>
<th>Corresponding indicator</th>
<th>EU-27 current</th>
<th>EU-27 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Unemployed</td>
<td>Employment rate as % of population aged 20-64</td>
<td>68.5%</td>
<td>75%*</td>
</tr>
<tr>
<td>2</td>
<td>Non-educated</td>
<td>Educational attainment as % of population aged 30-34 at ISCED 5/6 level</td>
<td>35.8%</td>
<td>40%*</td>
</tr>
<tr>
<td>3</td>
<td>Living in poverty</td>
<td>People at risk-of-poverty after social transfers as % of population</td>
<td>16.9%</td>
<td>0**</td>
</tr>
<tr>
<td>4</td>
<td>Youth</td>
<td>Young people aged 15-24 Not in Employment and not in any Education and Training (NEET rates)</td>
<td>13.2%</td>
<td>0**</td>
</tr>
<tr>
<td>5</td>
<td>Women</td>
<td>Balance of life expectancy at birth and healthy-life-years*** for female population</td>
<td>21 yrs</td>
<td>0**</td>
</tr>
</tbody>
</table>

* Average number for EU-27 is shown; the headline target varies at a national level as fixed in National Reform Programmes.
** Currently no unique definition of **-marked targets at the EU level is provided as respective quantitative targets are still a topic of the EU-wide discussion.
The author of this paper assumes that the best level of social innovation performance is achieved if current % of (excluded) population in vulnerable groups is fully taken out of them (= converted into included) by 2020. This generalized assumption enables to quantify absolute demand on social innovation in the EU-27.
*** Healthy-life-years is a term by Eurostat to measure the number of years of a person’s life that the person stays healthy.

For further calculations the following codes to the selected indicators are given (s. Table 2).

Table 2: Social innovation performance: corresponding indicator codes

<table>
<thead>
<tr>
<th>No.</th>
<th>Target group</th>
<th>Corresponding indicator code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Unemployed</td>
<td>iEMPL</td>
</tr>
<tr>
<td>2</td>
<td>Non-educated</td>
<td>iEDU</td>
</tr>
<tr>
<td>3</td>
<td>Living in poverty</td>
<td>iNPOOR</td>
</tr>
<tr>
<td>4</td>
<td>Youth</td>
<td>iEET</td>
</tr>
<tr>
<td>5</td>
<td>Women</td>
<td>iHEALTH</td>
</tr>
</tbody>
</table>

By applying the modified indicators and statistical data available for individual member states a respective index score for every target group indicated in Table 1 is calculated using the following equation:

\[ indY_j = \frac{x_j}{x_{EU2020}} \]  \hspace{1cm} (1)
where \( indY_j \) is an index score of social innovation performance for each corresponding indicator calculated as a ratio of current level of respective target in individual EU-countries \( (X_j) \) to a headline Europe 2020 target \( (X_{EU2020}) \).

While having several dimensions of social innovation to estimate one can need an overall score (or index) allowing a European benchmarking of individual member states performance in their efforts to boost social innovation in order to meet Europe 2020 targets reflected in corresponding indicators, e.g. employment rate, NEET rate or share of population living in poverty.

For that reason a composite index of social innovation performance for the European (EU-27) countries \( (indSI_j) \) is calculated as:

\[
indSI_j = \frac{\sum_{i=1}^{n} indY_j}{n}
\]  

(2),

In the next step of analysis technological innovation performance of the European countries is put in focus. In the context of this paper technological innovation is understood in its classic sense as innovation representing major drivers of economic growth in a knowledge-based economy (e.g. R&D expenditures) and primarily capturing indicators that reflect country's inventive performance and capacity to exploit knowledge and translate it into potential economic gains (e.g. number of patent applications), business activity and public-private cooperation in R&D sector (e.g. number of joint public-private publications).

The main objective of this step is to generate comparative data about current stand of technological innovation in Europe in order to: a) allow benchmarking of individual member states in the EU-27; b) investigate the (non-)coherence of technological and social innovation.
In order to quantify current technological innovation performance in the EU-27 a similar to social innovation approach is used. Table 3 contains selected indicators reflecting technological innovation potential of individual countries. Statistical data are provided by the Eurostat (Eurostat 2013).

**Table 3: Indicators of technological innovation performance**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Code</th>
<th>EU-27 current</th>
<th>EU-27 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total spending (incl. all sectors) on R&amp;D as % of GDP</td>
<td>iR&amp;D</td>
<td>2.03%</td>
<td>3%</td>
</tr>
<tr>
<td>Number of EPO* applications per million inhabitants</td>
<td>iEPO</td>
<td>112</td>
<td>n.a.**</td>
</tr>
<tr>
<td>Share of renewable energy as % in gross final energy</td>
<td>iRENEW</td>
<td>13%</td>
<td>20%</td>
</tr>
<tr>
<td>consumption</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of public-private publications per million inhabitants</td>
<td>iPUBL</td>
<td>36</td>
<td>n.a.**</td>
</tr>
<tr>
<td>Knowledge-intensive services exports as % of total services exports</td>
<td>iSERVEX</td>
<td>48.13%</td>
<td>n.a.**</td>
</tr>
</tbody>
</table>

* European Patent Office.
** The **-marked indicators are not a headline target of Europe 2020 strategy; current level is used to benchmark technological innovation performance in the EU.

First, for every indicator in Table 3 a respective index score is calculated using the following equation:

\[ indT_j = \frac{x_j}{x_{EU-27}} \]  (3),

where \( indT_j \) is an index score of technological innovation performance for selected indicator calculated as a ratio of current level of indicator in individual EU-countries \( X_j \) to the EU-27 average \( X_{EU-27} \).

Then a composite index of technological innovation performance for the European countries \( indTI_j \) is calculated as:
In the next step a probable coherence of technological and social innovation is investigated by the following equation:

\[
indTI_j = \frac{\sum_{i=1}^{n} indT_j}{n}
\]

(4).

\[
r = \frac{\sum_{j=1}^{n} (indSI_j - \bar{indSI}) \times (indTI_j - \bar{indTI})}{(n-1) \times SD_{indSI} \times SD_{indTI}}
\]

(5),

where \( r \) is Pearson correlation coefficient, \( \bar{indSI} \) and \( \bar{indTI} \) are the means of composite indices of social and technological innovation performance respectively and \( SD \) – their respective standard deviations.

3 Results

The main results of the analysis are demonstrated in Table 4, where a range for every target as well as current average for the EU-27 is indicated in comparison with EU 2020 level.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Range</th>
<th>EU-27 average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(EU 2020 =1)</td>
<td>(EU 2020 = 1)</td>
</tr>
<tr>
<td>( indSI ) (composite index)</td>
<td>0.78 – 0.97</td>
<td>0.85</td>
</tr>
<tr>
<td>( iEMPL )</td>
<td>0.790 – 0.996</td>
<td>0.913</td>
</tr>
<tr>
<td>( iEDU )</td>
<td>0.593 – 0.978</td>
<td>0.895</td>
</tr>
<tr>
<td>( iNPOOR )</td>
<td>0.777 – 0.902</td>
<td>0.831</td>
</tr>
<tr>
<td>( iEET )</td>
<td>0.785 – 0.957</td>
<td>0.868</td>
</tr>
<tr>
<td>( iHEALTH )</td>
<td>0.646 – 0.853</td>
<td>0.748</td>
</tr>
</tbody>
</table>
The table shows – respectively compared to the Europe 2020 headline targets - gaps in social innovation performance in Europe existing today and, thus, demonstrates demand on improvement. Furthermore, lasting divergence in performance between individual countries is evident and reflects heterogeneous levels of social inclusion in the EU-27 with the highest dispersion in the target group encompassing non-educated people. While countries like Italy, Malta and Romania have slightly above 20% of their population aged 30-34 educated at ISCED 5/6, nearly half of total population in Ireland (51.1%), Luxembourg (49.6%) and Sweden (47.9%) have already attained the respective level.

Another insight into the results is demonstrated in Diagram 1 showing respectively the three lowest and three highest results for the EU-27. In addition the results are matched to the EU-27 average and EU 2020 level.

Diagram 1: Social innovation performance in Europe -
Three lowest vs. three highest results (measured by indSI) for the EU-27 group

As regards to the technological innovation performance the following results for the EU-27 were calculated. Table 5 contains an overview of the main findings about the stand of technological innovation in individual member states while comparing them with the current average EU-27 level.
Also these results underline the heterogeneous efforts individual member states undertake to advance themselves technologically, which find their expression in e.g. ranging of $iR&D$ from 0.236 (equivalent 0.48% of GDP on R&D in Cyprus) to 1.862 (3.78% - in Finland). In other indicator groups similar dispersion is evident and reflected in a wide range the $indTI$ has in the EU-27. A comparison of the three highest and lowest results in technological innovation is shown in Diagram 2.

**Diagram 2: Technological innovation performance in Europe - Three lowest vs. three highest results (measured by $indTI$) for the EU-27 group**

* MT – Malta; EL – Greece; BG – Bulgaria; SK – Slovakia;
  DK – Denmark; FI – Finland; SE – Sweden;
A general observation of results let assume a certain level of coherence between social and technological innovation performance in individual countries. In order to investigate this assumption, Pearson correlation coefficient (as indicated in Chapter 2) is calculated.

As shown in Table 6 there is a significant level of correlation between social and technological innovation performance.

**Table 6: Pearson correlation coefficient**

<table>
<thead>
<tr>
<th></th>
<th>indSI</th>
<th>indTI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>indSI</strong>&lt;br&gt;<em>(Social Innovation)</em></td>
<td>Pearson correlation coefficient 1 .523**&lt;br&gt;Significance (2-sided) .005&lt;br&gt;Observations (N) 27 27</td>
<td></td>
</tr>
<tr>
<td><strong>indTI</strong>&lt;br&gt;<em>(Technological Innovation)</em></td>
<td>Pearson correlation coefficient .523**&lt;br&gt;Significance (2-sided) .005&lt;br&gt;Observations (N) 27 27</td>
<td>1</td>
</tr>
</tbody>
</table>

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

By taking the results of correlation analysis into account it could be, thus, assumed that countries technologically better advanced are closer to fulfil the Europe 2020 headline targets oriented on society’s vulnerable groups. Furthermore, it can be speculated that as technological and social innovation are interrelated, the progress in one dimension (e.g. technological) can be transferred to another (social). This result can obviously have some implications for the European policy-makers. The challenge is, however, to formulate and introduce appropriate policies as well as to find instruments enabling the transfer.

Subsequently, a closer look at CARPE-countries, locating partner institutions involved in research on social innovation in Europe, is taken. The countries are: Germany, Finland, Netherlands, Spain and United Kingdom. For every country an individual profile is developed. Each profile (s. Annex) demonstrates the country’s current position in the European comparison regarding social and technological innovation performance – with respective advantages and deficits – and a match of current social innovation stand with Europe 2020 headline targets.
4 Conclusion

This paper investigates positioning of social innovation in the European policy context with regards to Europe 2020 strategy and its coherence with classic technological innovation. The author undertakes a quantitative approach to measure social and technological innovation performance by identifying respectively five specific indicators for each group and calculating a composite index both for social as well as for technological innovation. Results show heterogeneous levels of social and technological advancement in the EU-27 member states. In addition, a significant correlation between social and technological innovation in the EU-27 is evident.

The results are used for Europe-wide benchmarking of member states regarding their innovation performance and for matching the levels reached with Europe 2020 headline targets. A special focus is put on CARPE-countries, whereby a country profile including an overview of current social, technological innovation performance is demonstrated and deficits to reach Europe 2020 targets are identified.

Further research is needed in order to expand cross-country comparative analysis beyond the European Union and to match the results for the EU-27 with its main competitors in the developed regions (e.g. USA, Canada, Japan) as well as leading emerging markets (e.g. BRICS states).

Regarding the approach applied to quantify social innovation in Europe several areas for further research could be identified. Additional factors distinguishing social from technological innovation could be considered. The assumptions made to match current level with Europe 2020 headline targets can be eliminated as soon as respective levels are fixed in National Reform Programmes. Furthermore, quantitative research is needed to calculate potential outcomes of social innovation and their impact on individual member states.
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Eurostat, 2013, 'Europe 2020 indicators',
ANNEX
CARPE-countries in focus

Diagram A.1: Germany

Diagram A.2: Finland
Diagram A.3: Netherlands

Diagram A.4: Spain
Diagram A.5: United Kingdom