National culture as a correlate of research impact and productivity [version 1; referees: awaiting peer review]

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Abstract
National culture has been overlooked in discussions related to research productivity and impact owing to individual, socio-political structure, and economic factors. This study shows the relationships between the dimensions of cultural value orientation of the nation and research performance indicators. More than 60 countries were included and Pearson correlation analysis was employed. The variables were taken from Geert Hofstede and Scimago Journal & Country Rank worksheets. This study found that (1) Individualism has significant correlations with the majority of the indicators; (2) Power distance and indulgence correlate with a country’s research impact in the form of citation per document; (3) Masculinity, long term orientation, and uncertainty avoidance do not correlate with the indicators. Owing to the fact that the national culture is relatively enduring, countries need to measure their elasticity of hopes and action plans in an effort to boost research productivity and impact, by integrating the national culture in the estimate.

Keywords
research impact, research productivity, national culture, individualism, indulgence, power distance, citations per document, self citations

This article is included in the Science Policy Research gateway.

Corresponding author: Juneman Abraham (juneman@binus.ac.id)
Author roles: Abraham J: Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Resources, Writing – Original Draft Preparation, Writing – Review & Editing
Competing interests: No competing interests were disclosed.
Grant information: The author(s) declared that no grants were involved in supporting this work.
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How to cite this article: Abraham J. National culture as a correlate of research impact and productivity [version 1; referees: awaiting peer review] F1000Research 2019, 8:237 (https://doi.org/10.12688/f1000research.18283.1)
First published: 28 Feb 2019, 8:237 (https://doi.org/10.12688/f1000research.18283.1)
Introduction
Makri (2018) recently released a report on the increasing number of publications in various countries. She stated that it’s unclear what has triggered and driven the strong gains in Egypt and Pakistan. Throughout the report, various variables believed to be responsible for the increasing number of publications, such as indexation duration, funding, global engagement, international collaboration, and political policies on science and higher education, are explained.

Several predictors of research productivity and impact had been identified, i.e. author characteristics, co-authorship networks, citation history, journal impact factors, twits (Xiaomei et al., 2017), cohort effects (in terms of scientific discipline), age, career stages, gender, the country of origin of the PhD holders, and reward structure of the research enactment (Claudia & Francisco, 2007). They are mostly at the individual and institutional level. At the country level, the predictors are the number of universities, GDP per capita, control of corruption, civil liberties (Mueller et al., 2016), country’s wealth and population size, country’s value of research tradition, tenure and promotion criterion, experimental costs, IRB (Institutional Review Boards) review flexibility, language barrier, and the training of new young researchers (Demaria, 2009).

However, national cultural orientation is yet to be analyzed, with the present study assuming that individual, institutional, and structural factors are also influenced by the cultural values of a nation. Hofstede Insights (2019) defined culture as the collective mental programming of the human mind which distinguishes one group of people from another, consisting of six dimensions, i.e. (1) power distance (PD) – acceptance on the unequal power distribution in a society; (2) uncertainty avoidance (UA) – intolerance of ambiguity and uncustomary thoughts and practices; (3) individualism (IND) – projection of individuals’ “I” in a society rather than “we” (collectivism); (4) masculinity (MAS) – the toughness and competitiveness rather than the tenderness and cooperativeness (femininity) orientation; (5) long term orientation (LTO) – the society’s preference of time-honored rather than pragmatic approaches (short term normative orientation); and (6) indulgence (IVR) – the society facilitation towards a fun and enjoyable life rather than restraint (suppression of needs gratification by strict social norms).

National culture is relatively stable (Maseland & van Hoorn, 2017) and is widely used to explain various performances at the country level, such as learning and academic performance (Signorini et al., 2009). The present study hypothesized that there are correlations between the national culture dimensions and research performance indicators. The research performance is assumed to be mediated by research culture, and the culture experiences stimulations and challenges from the national culture; as happened in China, the bureaucratic (high power distance) and nepotistic culture suppresses an innovative and meritocratic research culture (Shi & Rao, 2010).

Methods
All following data were retrieved on December 18, 2018 and compiled into a worksheet (see Underlying data (Abraham, 2019)) as the material of this present analysis. Countries’ research impact (citations per document/CPD, citations, self-citations) and productivity (total documents) were obtained from the Scimago Journal & Country Rank (https://www.scimagojr.com/countryrank.php?out=xls), while national cultural orientations (pd=power distance, idv=individualism, mas=masculinity, uai=uncertainty avoidance, ltovs=long term orientation, ivr=indulgence) were acquired from Geert Hofstede web site (https://geerthofstede.com/wp-content/uploads/2016/08/6-dimensions-for-web-site-2015-08-16.xls). Pearson product-moment correlation analysis was conducted using IBM SPSS Statistics version 20 for Windows.

Results
The descriptive and correlational statistics are presented in Table 1 and Table 2. As shown, among 68 countries, IND is positively correlated with CPD (r=0.506, p<0.01), total documents (r=0.351, p<0.01), citations (r=0.405, p<0.01), and self-citations (r=0.304, p<0.05). MAS, UA, and LTO do not correlate with these four: PD (r=−0.555, p<0.01, N=68) and IVR (r=0.480, p<0.01, N=91) correlate with CPD. Total documents, citations, and self-citations correlate with each other with r>0.90, p<0.01, N=239. CPD is positively, but weakly, correlated with total documents, total citations and total self-citations, with r<0.20, p<0.05, N=239.

Among 54 countries, even after controlling the Log GDP per capita (taken from the World Happiness Report), the correlations between IND and CPD (r=0.439, p<0.01), total documents (r=0.268, p<0.05), and citations (r=0.320, p<0.05), between PD and CPD (r=−0.504, p<0.01), as well as between IVR and CPD (r=0.411, p<0.01) persist (see Table 3).

Table 1. Descriptive statistics of research impact (CPD, CIT, SELF) and productivity (DOC) as well as national culture dimensions (PD, IND, MAS, UA, LTO, IVR).

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOC</td>
<td>204893.92</td>
<td>878342.00</td>
<td>239</td>
</tr>
<tr>
<td>CIT</td>
<td>3558474.20</td>
<td>19007535.44</td>
<td>239</td>
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<tr>
<td>SELF</td>
<td>1076044.63</td>
<td>8178012.17</td>
<td>239</td>
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<tr>
<td>CPD</td>
<td>13.35</td>
<td>6.15</td>
<td>239</td>
</tr>
<tr>
<td>PD</td>
<td>59.12</td>
<td>22.02</td>
<td>68</td>
</tr>
<tr>
<td>IND</td>
<td>43.85</td>
<td>24.16</td>
<td>68</td>
</tr>
<tr>
<td>MAS</td>
<td>48.60</td>
<td>19.96</td>
<td>68</td>
</tr>
<tr>
<td>UA</td>
<td>67.13</td>
<td>23.26</td>
<td>68</td>
</tr>
<tr>
<td>LTO</td>
<td>46.05</td>
<td>24.30</td>
<td>90</td>
</tr>
<tr>
<td>IVR</td>
<td>45.41</td>
<td>22.56</td>
<td>91</td>
</tr>
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</table>

DOC = Total documents; CIT = Total citations; SELF = Total self-citations; CPD = Citations per document; PD = Power distance; IND = Individualism; MAS = Masculinity; UA = Uncertainty avoidance; LTO = Long term orientation; IVR = Indulgence
The positive correlations between IND and CPD, total documents, citations, and self-citations could be explained using the findings of Deschacht & Maes (2017). They found that in countries with more individualistic cultures: (1) the scientists prioritize their self-development, (2) the records of scientific work are historically longer (usually Western countries), and (2) self-citations flourish more. This does not necessarily mean that there have been citation abuses, but that self-citation is used to refer to their prior works, thereby, preventing unnecessary repetitiveness of ideas in newer works (Deschacht, 2017). Although IND and collaboration are often contested (e.g. Kemp, 2013), a “collaborative individualism” (Limerick & Cunnington, 1993) – stressing both working together and self-emancipation – is possible, explaining the positive correlation.

PD has a negative correlation with CPD. In this case, PD might manifest itself in academic writing in the form of rigid, authoritative, defensive, and dogmatic styles (Koutsantoni, 2005). In addition, PD negatively correlates with democracy (Maleki & Hendriks, 2014). The lower level of democracy reduces the opportunity of the academic community to exchange

### Table 2. Correlations results between national cultures dimensions and research impact and productivity.

<table>
<thead>
<tr>
<th></th>
<th>DOC</th>
<th>CIT</th>
<th>SELF</th>
<th>CPD</th>
<th>PD</th>
<th>IND</th>
<th>MAS</th>
<th>UA</th>
<th>LTO</th>
<th>IVR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>r</strong></td>
<td>1</td>
<td>0.958**</td>
<td>0.933**</td>
<td>0.153*</td>
<td>-0.144</td>
<td>0.351**</td>
<td>-0.194</td>
<td>0.124</td>
<td>0.124</td>
<td>0.088</td>
</tr>
<tr>
<td><strong>p</strong></td>
<td>0.000</td>
<td>0.000</td>
<td>0.018</td>
<td>0.241</td>
<td>0.003</td>
<td>0.082</td>
<td>0.013</td>
<td>0.246</td>
<td>0.405</td>
<td></td>
</tr>
<tr>
<td><strong>N</strong></td>
<td>239</td>
<td>239</td>
<td>239</td>
<td>68</td>
<td>68</td>
<td>68</td>
<td>90</td>
<td>91</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

### Table 3. Partial correlations results between national cultures dimensions and research impact and productivity, controlling Log GDP per capita (LGDP).

<table>
<thead>
<tr>
<th>Control Variables</th>
<th>DOC</th>
<th>CIT</th>
<th>SELF</th>
<th>CPD</th>
<th>PD</th>
<th>IND</th>
<th>LGDP</th>
<th>IVR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>r</strong></td>
<td>1</td>
<td>0.954</td>
<td>0.940</td>
<td>0.218</td>
<td>-0.019</td>
<td>0.268</td>
<td>0.031</td>
<td></td>
</tr>
<tr>
<td><strong>p</strong></td>
<td>0.000</td>
<td>0.000</td>
<td>0.016</td>
<td>0.887</td>
<td>0.046</td>
<td>0.819</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>N</strong></td>
<td>54</td>
<td>54</td>
<td>54</td>
<td>54</td>
<td>54</td>
<td>54</td>
<td>54</td>
<td></td>
</tr>
</tbody>
</table>

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

Discussion

The positive correlations between IND and CPD, total documents, citations, and self-citations could be explained using the findings of Deschacht & Maes (2017). They found that in countries with more individualistic cultures: (1) the scientists prioritize their self-development, (2) the records of scientific work are historically longer (usually Western countries), and (2) self-citations flourish more. This does not necessarily mean that there have been citation abuses, but that self-citation is used to refer to their prior works, thereby, preventing unnecessary repetitions of ideas in newer works (Deschacht, 2017). Although IND and collaboration are often contested (e.g. Kemp, 2013), a “collaborative individualism” (Limerick & Cunnington, 1993) – stressing both working together and self-emancipation – is possible, explaining the positive correlation.

PD has a negative correlation with CPD. In this case, PD might manifest itself in academic writing in the form of rigid, authoritative, defensive, and dogmatic styles (Koutsantoni, 2005). In addition, PD negatively correlates with democracy (Maleki & Hendriks, 2014). The lower level of democracy reduces the opportunity of the academic community to exchange
and market (in the broad sense) scientific information, as well as debate openly. Likewise, democracy that does not flourish deters the use of research results in creating public policies. In addition, science is co-opted or used as just a tool to achieve exclusive interests by ideologues, pundits and political leaders; they ignore the state-of-the-art nature of the research (Branscomb & Rosenberg, 2012). All the conditions could reduce CPD.

IVR is positively correlated with CPD; this may be because IVR facilitates academic freedom (Olthmann, 2011) and manifests itself in a “lovely” academic writing style (Kiriakos & Tienari, 2018). This style is not dry and cold, but rather dialogical, humanistic, more reflective, and capable of showing authors’ courage and vulnerability. Compelling insights are more easily born from the writings that embody those qualities; as mentioned, “a thin line exists between interesting insights and self-indulgence” (Nadin & Cassell, 2006, p. 214). Scientific authors who read such works would be attracted to cite them, leading to an increase in the works’ CPD. In addition, “strategic indulgence” is possible and known to be a creative process that enables one to balance academic activity (such as writing) with non-academic ones (Jia et al., 2018) – fostering insight.

The weak correlation between CPD and other research performance indicators shows that CPD is more difficult to manipulate or be an object of the author’s “engineering”.

**Conclusion**

National culture dimensions, especially individualism, power distance, and indulgence, are pivotal variables that are to be considered in justifying research impact and productivity. National culture can be integrated as a moderating variable in the predictive relationship between GDP per capita and research impact and productivity. Diversification of this study – based on the document and authors’ collaboration types, the indexing databases, the disciplines, the open science practices, as well as the history and development of the research in a country – is a future opportunity for further study.

**Data availability**

**Source data**


All source data was accessed and retrieved on the 18/12/2018

**Underlying data**


Data are available under the terms of the Creative Commons Zero “No rights reserved” data waiver (CC0 1.0 Public domain dedication).

**Grant information**

The authors declared that no grants were involved in supporting this work

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