A MODEL PROPOSAL TO MEASURE NATIONAL INTELLECTUAL CAPITAL

Ahmet Beşkese, F. Tunç Bozbura, Gökhan Aldemir
Bahçeşehir University, Department of Industrial Engineering
34353, Beşiktaş, Istanbul
Turkey

ABSTRACT
Being the true source of competitive advantage in the 21st century, intellectual capital of the companies is a well-studied topic in the literature. However, there still is a strong need to research its application in the national level. Considering these, this study proposes a model to measure the national intellectual capital. Its components and their indicators are weighed using AHP yielding a ready-to-use model. Then the model is used for 11 European countries and the results are discussed.
Keywords: National Intellectual Capital, AHP, European Countries.

1. INTRODUCTION

Intellectual capital (IC), a vital source for sustainable competitive advantage, can be defined as the cumulative value of intellectual assets those could be used to create wealth, and the processes facilitating the utilization of those assets. Intellectual capital theory and its framework initially were developed for individual firms. However, the initial conceptual level then extrapolated to include nations. It is essential for national economic growth, human development, and quality of life [1]. Successfully utilizing the knowledge which is the core of IC contributes to the progress of society [2].

"Particularly, the results of national level intellectual capital studies and ranking provide a direction for nations to benchmark and to make wise decisions in the effective investment of national intangible assets and their development in the era of the knowledge economy" [1]. Malhotra argues that the leaders of national economies are searching for reliable ways to measure national intellectual capital [3]. Considering this, this study aims to propose a model mainly based on National Intellectual Capital index (NICI) to measure national intellectual capital. Priority weights of the components of IC and their indicators are calculated using Analytic Hierarchy Process (AHP). By using this model, the national intellectual capital indices for eleven European countries are calculated.

2. MEASURING NATIONAL INTELLECTUAL CAPITAL

There is a thorough literature on intellectual capital, but the national view of this phenomenon is in its infancy [4]. Various models were used for measuring national intellectual capital, but the most widely used one is Skandia Navigator model. Lin and Edvinsson [5] provide a list of the models found in the literature used for the measurement of national IC including their dimensions and the nature of indicators used. Based on these studies, a model for measuring national intellectual capital was built as in Figure 1, and briefly explained below:

1. National human capital
The first component of national intellectual capital relates to people. It is defined as competencies, knowledge and education of citizens in releasing national tasks and goals [6]. The fundamental issue of human capital is education. Therefore, in this study, qualifications about education such as literacy rate, number of tertiary schools and number of tertiary students are used as indicators of human capital.
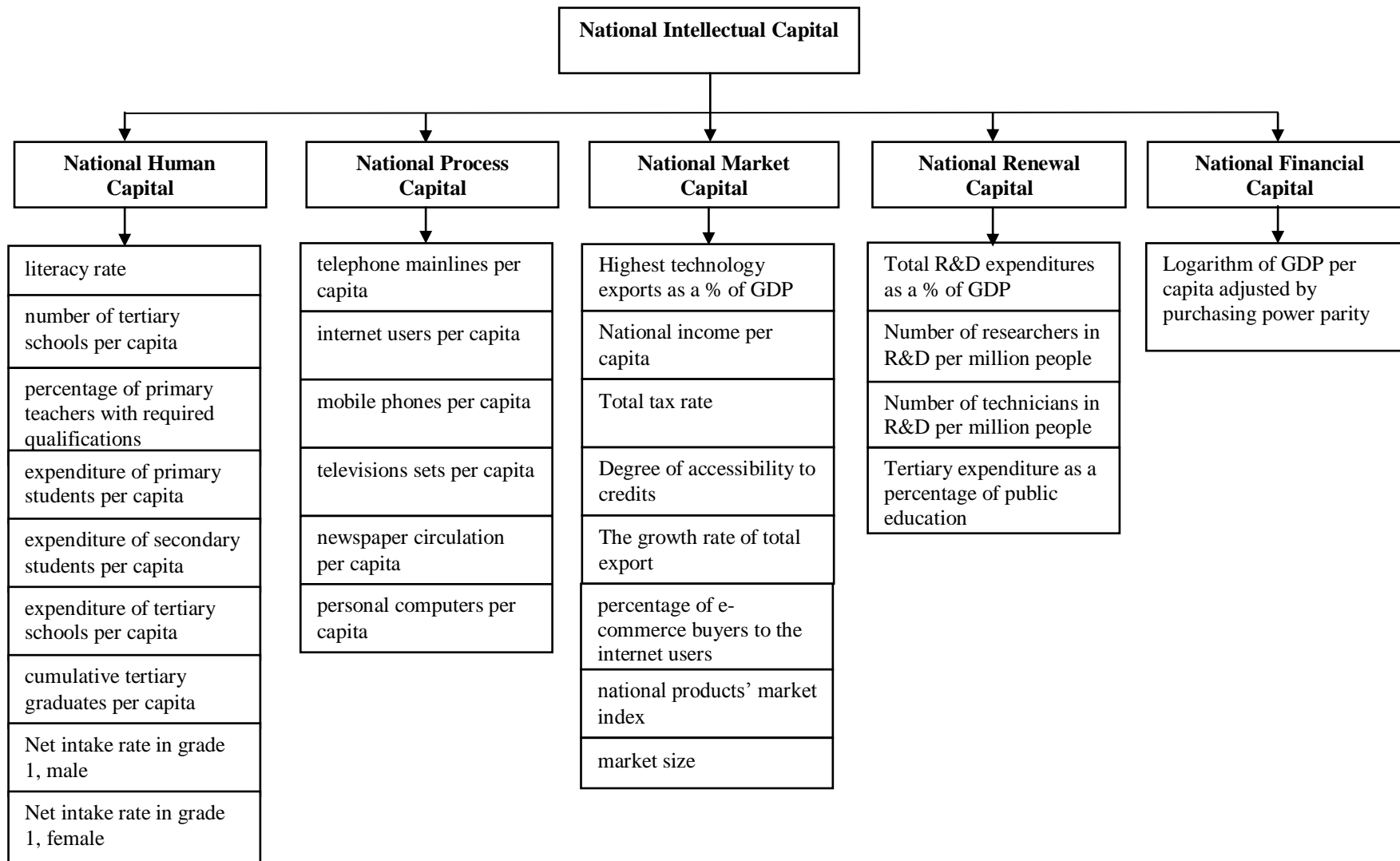
Figure 1. Measurement model of national intellectual capital.

2. National process capital

Bontis [6] defines national process capital as "non-human storehouses of knowledge, which are embedded in its technological, information and communications systems as represented by its hardware, software, databases, laboratories and organizational structures". That is why; the indicators of process capital are related to telephone mainlines, internet hosts and users, mobile phones, radio receivers and television. It is obviously seen that technology is the basic building block of process capital.

3. National market capital

It represents a country's capabilities and success in providing an attractive and competitive incentive in order to meet the needs of international clients, while also sharing knowledge with the rest of the world [6]. Therefore; international meetings, international trade and supporting events are key issues in market capital.

4. National renewal capital

Renewal capital is defined as a nations' future intellectual wealth and the capability for innovation that sustains a nation's competitive advantage. R&D is the basic building block of renewal capital.

5. National financial capital

The last but not least, financial capital is a very essential capital of a nation. It is measured with a single indicator which is the logarithm of GDP per capita adjusted by purchasing power parity.

After building the model, two experts are asked to evaluate the components of National Intellectual Capital, and their indicators. They used pairwise comparisons and priority weights are then calculated using Analytic Hierarchy Process (AHP). This method, developed by Saaty became very popular in assessing criteria weightings in various multi-criteria decision-making (MCDM) problems [7].

The next step was finding the values of the indicators in the model for 11 European countries; Germany, Austria, France, Netherlands, Turkey, Bulgaria, Belgium, Italy, UK, Greece, and Spain. These countries are selected from a larger list of European countries because of the availability of data. For calculating the score of a country against an indicator, the value found for that country was normalized against the highest value in this particular indicator.

The weight of the component, the local weights of their indicators, and scores and weighted scores of 11 countries against these indicators are shown in Table 1 thru 5.

Table 1. Scores of European countries for National Human Capital

		Germany	Austria	France	Netherlands	Turkey	Bulgaria	Belgium	Italy	UK	Greece	Spain
National Human Capital (w=0.318)	NHC1 (w=0.032)	0.032	0.032	0.032	0.032	0.03	0.031	0.032	0.32	0.032	0.031	0.031
	NHC2 (w=0.111)	0.11	0.015	0.096	0.015	0.064	0.013	0.016	0.033	0.111	0.018	0.029
	NHC3 (w=0.025)	0.025	0.025	0.025	0.025	0.022	0.021	0.025	0.025	0.025	0.022	0.025
	NHC4 (w=0.274)	0.194	0.274	0.202	0.168	0.192	0.165	0.185	0.231	0.168	0.179	0.205
	NHC5 (w=0.213)	0.139	0.172	0.166	0.152	0.136	0.142	0.213	0.149	0.174	0.12	0.158
	NHC6 (w=0.179)	0.108	0.175	0.165	0.179	0.137	0.108	0.154	0.106	0.084	0.104	0.12
	NHC7 (w=0.075)	0.032	0.03	0.054	0.059	0.021	0.064	0.064	0.048	0.053	0.023	0.075
	NHC8 (w=0.045)	0.043	0.043	0.043	0.041	0.045	0.041	0.04	0.042	0.042	0.043	0.042
	NHC9 (w=0.045)	0.043	0.042	0.043	0.041	0.045	0.041	0.041	0.041	0.042	0.044	0.043
	Total	0.726	0.808	0.826	0.712	0.692	0.626	0.77	0.995	0.731	0.584	0.728
	Weighted Score	0.231	0.257	0.263	0.226	0.220	0.199	0.245	0.316	0.232	0.186	0.232

Table 2. Scores of European countries for National Process Capital

		Germany	Austria	France	Netherlands	Turkey	Bulgaria	Belgium	Italy	UK	Greece	Spain
National Process Capital (w=0.108)	NPC1 (w=0.08)	0.08	0.054	0.07	0.055	0.031	0.038	0.055	0.051	0.063	0.068	0.05
	NPC2 (w=0.377)	0.338	0.325	0.324	0.377	0.171	0.207	0.318	0.231	0.334	0.216	0.275
	NPC3 (w=0.114)	0.1	0.086	0.088	0.093	0.071	0.108	0.087	0.114	0.095	0.083	0.086
	NPC4 (w=0.03)	0.028	0.026	0.03	0.026	0.016	0.02	0.023	0.026	0.026	0.011	0.02
	NPC5 (w=0.164)	0.149	0.159	0.073	0.142	0.029	0.088	0.078	0.056	0.164	0.025	0.05
	NPC6 (w=0.236)	0.188	0.209	0.198	0.236	0.018	0.02	0.12	0.126	0.207	0.03	0.095
	Total	0.883	0.859	0.783	0.929	0.336	0.481	0.681	0.604	0.889	0.433	0.576
	Weighted Score	0.095	0.093	0.085	0.100	0.036	0.052	0.074	0.065	0.096	0.047	0.062

Table 3. Scores of European countries for National Market Capital

		Germany	Austria	France	Netherlands	Turkey	Bulgaria	Belgium	Italy	UK	Greece	Spain
National Market Capital (w=0.062)	NMC1 (w=0.28)	0.151	0.163	0.085	0.256	0.089	0.186	0.28	0.089	0.074	0.031	0.07
	NMC2 (w=0.192)	0.171	0.186	0.164	0.192	0.04	0.025	0.177	0.136	0.146	0.094	0.119
	NMC3 (w=0.026)	0.017	0.02	0.025	0.015	0.015	0.011	0.022	0.026	0.013	0.017	0.014
	NMC4 (w=0.052)	0.042	0.043	0.039	0.052	0.034	0.028	0.035	0.049	0.043	0.021	0.037
	NMC5 (w=0.115)	0.07	0.064	0.047	0.039	0.057	0.115	0.049	0.053	0.039	0.003	0.068
	NMC6 (w=0.237)	0.237	0.194	0.187	0.187	0.187	0.128	0.141	0.138	0.237	0.072	0.141
	NMC7 (w=0.067)	0.043	0.042	0.035	0.034	0.067	0.041	0.043	0.049	0.039	0.052	0.048
	NMC8 (w=0.032)	0.032	0.003	0.014	0.007	0.004	0.003	0.006	0.018	0.013	0.003	0.009
	Total	0.763	0.715	0.596	0.782	0.493	0.537	0.753	0.558	0.604	0.293	0.506
	Weighted Score	0.047	0.044	0.037	0.048	0.031	0.033	0.047	0.035	0.037	0.018	0.031

Table 4. Scores of European countries for National Renewal Capital

		Germany	Austria	France	Netherlands	Turkey	Bulgaria	Belgium	Italy	UK	Greece	Spain
National Renewal Capital (w=0.341)	NRC1 (w=0.151)	0.151	0.147	0.12	0.098	0.045	0.032	0.106	0.067	0.094	0.031	0.074
	NRC2 (w=0.508)	0.472	0.508	0.444	0.371	0.106	0.173	0.422	0.207	0.489	0.043	0.299
	NRC3 (w=0.075)	0.057	0.063	0.075	0.062	0.008	0.02	0.06	0.052	0.035	0.035	0.038
	NRC4 (w=0.265)	0.265	0.26	0.244	0.265	0.143	0.159	0.229	0.156	0.125	0.129	0.179
	Total	0.945	0.978	0.883	0.796	0.302	0.384	0.817	0.482	0.743	0.238	0.59
	Weighted Score	0.322	0.333	0.301	0.271	0.103	0.131	0.279	0.164	0.253	0.081	0.201

Table 5. Scores of European countries for National Financial Capital

		Germany	Austria	France	Netherlands	Turkey	Bulgaria	Belgium	Italy	UK	Greece	Spain
N. Financial C. (w=0.171)	NFC1 (w=1)	0.922	0.985	0.823	1	0.4	0.352	0.905	0.763	0.832	0.604	0.75
	Total	0.922	0.985	0.823	1	0.4	0.352	0.905	0.763	0.832	0.604	0.75
	Weighted Score	0.158	0.168	0.141	0.171	0.068	0.060	0.155	0.130	0.142	0.103	0.128

3. CONCLUSION

Being the first step of a more comprehensive study, this study proposes a model to measure the national intellectual capital. The model applied to 11 European countries. These countries were selected according to data availability. In Table 6, the national intellectual capital scores of these countries are summarized.

Table 6. Overall Scores of the European Countries for National Intellectual Capital

		Germany	Austria	France	Netherlands	Turkey	Bulgaria	Belgium	Italy	UK	Greece	Spain
National Intellectual Capital	Nat. Human Cptl.	0.2309	0.2569	0.2627	0.2264	0.2201	0.1991	0.2449	0.3164	0.2325	0.1857	0.2315
	Nat. Process Cptl.	0.0954	0.0928	0.0846	0.1003	0.0363	0.0519	0.0735	0.0652	0.0960	0.0468	0.0622
	Nat. Market Cptl.	0.0473	0.0443	0.0370	0.0485	0.0306	0.0333	0.0467	0.0346	0.0374	0.0182	0.0314
	Nat. Renewal Cptl.	0.3222	0.3335	0.3011	0.2714	0.1030	0.1309	0.2786	0.1644	0.2534	0.0812	0.2012
	Nat. Financial Cptl.	0.1577	0.1684	0.1407	0.1710	0.0684	0.0602	0.1548	0.1305	0.1423	0.1033	0.1283
	TOTAL	0.8534	0.8960	0.8260	0.8177	0.4583	0.4754	0.7984	0.7111	0.7616	0.4351	0.6545

As can be seen from the table, Austria and Germany have the highest scores. They are followed by France and Netherlands.

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