National Intellectual Capital (NIC) – New Metrics*

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Abstract. National Intellectual Capital (NIC), the measurement of intellectual capital (IC) at national level, is a fairly novel approach to IC research as a whole. Thus far, NIC quantification has predominantly relied on well-established and increasingly obsolete benchmarks within the subsets of: national human capital (NHC), national market capital (NMC), national process capital (NPC), and national renewal capital (NRC).

Аннотация. Национальный интеллектуальный капитал (НИК) и измерение интеллектуального капитала (ИК) на национальном уровне представляют собой достаточно новый подход к исследованию ИК в целом. Ранее количественное изменение НИК в основном базировалось на критериях национального человеческого капитала и ряде других критериев, которые хорошо зарекомендовали себя в прошлом, но в последнее время оказались все более устаревающими.

Key words: National Intellectual Capital (NIC), intellectual capital (IC) measurement, macroeconomics, socioeconomic development.

The overall philosophy of the revised NIC measurement proposed herein is aimed at tilting the center of gravity from quantifying IC means (effort, expenditure, time) towards quantifying IC ends (efficiency, value and quality).

The proposed study helps revise the nascent methodology of NIC quantification. It is also expected to encourage a complex discussion on new socioeconomic policy goals to be formulated by nations and humanity as a whole in the IC domain.

1. REVIEW AND CRITIQUE OF NIC MEASUREMENT

Over the past few decades, intangible resources (as drivers of wealth, prosperity and socioeconomic progress), have attracted widespread attention, not only from academic researchers, but also from national policymakers. Because of the widening chasm between the book and market values of enterprises, largely attributable to intangibles, the concept of IC has also been the focus of keen interest. It is thus helpful to put the NIC concept in (however limited) historical perspective. The initial stage of IC research, which traces its origins to the late 1980s and the 1990s, focused on recognizing and understanding the potential for IC at the firm level to render "the invisible more visible" (Petty, Guthrie, 2000). Pioneering research in this scope was inaugurated by practitioners, e.g. Edvinsson (1996), Sullivan (1996), Brooking (1996), Stewart (1997), Roos (1997). IC interpretations began to abound in the relevant literature, although the best known definition, coined by Edvinsson and Malone, was presented in the Skandia Value Scheme in 1997, on which basis two major subsets of IC, such as human and structural capital were added.

As a result, at the second stage of IC research (aimed to refine, expand and measure its basic elements), a number of frameworks for classifying measuring and reporting the concept emerged. It is worth stressing that when the world economy entered the era of the knowledge-based economy (in which the new wealth of nations began to be tied directly to the creation, transformation, and capitalization of knowledge), numerous theoreti-

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Table 1. The selected models of measuring NIC.

Country/ researcher	General basic model	Dimensions	Nature of indicators
Models developed by individual researchers (academic models)			
Sweden (Rembe, 1999)	Skandia Navigator	Human capital, market capital, process, renewal capital	financial indicators, descriptive indicators
Malaysa (Bontis, 2000)	Skandia Navigator	Financial wealth, human capital, market capital, process capital, renewal capital	financial indicators, intangible indicators, descriptive indicators
Sweden (Spring Project 2002)	Skandia Navigator	Business recipe, human capital, structural capital, relational capital	innovative indicators, competence indicators, industrial indicators, company-universities indicators
Spain (Pomeda et. al., 2002)	Skandia Navigator	Human capital, organizational capital, technological capital, relay capital, social capital	descriptive indicators, intangible indicators, innovation indicators
EU Countries (Bounfour, 2003)	IC-dVAL Approach	resources, processes, outputs	financial indicators, descriptive indicators, innovation indicators
Arab Region (Bontis, 2004)	Skandia Navigator	Financial wealth, human capital, market capital, process capital, renewal capital	descriptive indicators, intangible indicators, financial indicators
Finland (Ståhle and Pöyhönene, 2004)	Skandia Navigator	Human focus, market focus, process focus, renewal & development focus	industrial indicators, national indicators, financial indicators
Andriessen and Stam, 2005	Skandia Navigator	Human capital, structural capital, relational capital	financial indicators, descriptive indicators
Israel (Pasher and Shachar, 2007)	Skandia Navigator	Financial capital, human capital, market capital, process capital, renewal & development capital	financial indicators
EU Countries (Weziak, 2007)	Skandia Navigator	Human capital, relational capital, structural capital, renewal capital	financial indicators, descriptive indicators
Lin and Malone, 2011	Skandia Navigator	Human capital, market capital, process capital, renewal capital, financial capital	financial Indicators, descriptive indicators
Models developed by international organization			
United Nations Development Programme (UNDP, 1990)	Human Development Index (HDI)	Education, health, standard of living	financial indicators, quantitative indicators
Organization for Economic Co-operation and Development (OECD, 1998)	Science, Technology and Industry Outlook (ST I)	R&D, patents, researchers and other innovative performance	financial indicators, quantitative indicators
World Bank, 2002	Knowledge Assessment Methodology (KAM)	Economic and institutional regime, education and skilled human resources, dynamic information infrastructure, efficient innovation system, performance indicators	financial indicators, qualitative indicators
World Economic Forum (WEF, 2004)	Global Competitiveness Index (GCI)	Institutions, infrastructure, macroeconomy, health and primary education, higher education and training, market efficiency	financial indicators, quantitative indicators, qualitative indicators
European Union (EU, 2006)	Innovation Union Scoreboard (IUS)	Enablers: human resources, research systems, finance and support; firm activities: firm investments, linkages & entrepreneurship, intellectual assets; outputs: innovators, economic effects	financial indicators, quantitative indicators, qualitative indicators

Source: Own elaboration based on Lin, Edvinsson (2011b) and Labra, Paloma Sánchez (2013).

cians set out to simultaneously explore the concept of national intellectual capital (NIC).

From the societal perspective, IC is construed as a collection of various socioeconomic phenomena: education, training, work experience, know-how, science, technology, patents and social relations. NIC can thus be defined as "the intrinsic value of human talent, enterprises, institutions, communities and regions, which are current and potential sources of wealth" (cf. Bontis, 2004). These hidden values are key to dynamic and sustainable macroeconomic growth and social welfare. They also underscored the need for measuring NIC, as such quantification can facilitate the implementation of good policies and practices for a more balanced national development (Lin, Edvinsson, 2011a).

Macro-level research on IC came to the fore at the beginning of the 2000s (along with the third stage of IC studies), refuting grand theories in favor of the analysis of praxis (Marr and Chatzkel, 2004). Apart from the critical and performative approach (dominant at the third stage) and "what really happens within the firm", there was an urgent need to examine an ostensive fourth stage of IC research based on IC eco-systems of cities and nations (Dumay, 2014).

NIC research has the potential to make an important contribution to understanding the sources of a country's competitiveness and can act as a catalyst for national foresight and strategy. Nonetheless, it requires a reliable methodology for identifying, assessing and measuring NIC, which seems to be a daunting challenge at the fourth stage of IC research. However, it is worth noting that — beyond purely academic studies — comparative socioeconomic analyses and rankings of nations have also been conducted, compiled and published by international institutions, such as the UN, World Bank, European Union Commission or OECD.

In sum, contemporary socioeconomic literature contains at least, two clear-cut conceptual approaches towards NIC (cf. Labra, Paloma Sánchez, 2013):

- Firm-level: represented by academic models of measurement and management of IC derived from companies on the basis of the IC taxonomy championed by Edvinsson and Malone (1997). The relevant academics have contended that there is no need for a specific NIC model since the IC concept is relatively universal and easily transferable from the micro level upwards;
- Country-level: developed by international organizations, business schools and think tanks, seeking to study competitiveness, innovativeness and development specifically at the country level (*de facto* assuming that socio- and macroeconomic IC drivers are unique enough to validate such a distinctive treatment).

In technical terms, the principal differences between both methods have revolved around general objectives, ways of measuring and analyzed components (see Table 1). The academic models have tended to focus directly on IC, whereas models derived from business organizations have zeroed in on competitiveness, innovation or development (without identifying IC itself, or IC components). Furthermore, in academic models intangibles have been evaluated individually, using non-financial proxies. Additionally, NIC oriented researchers have considered the necessity to separate the economic effects of NIC from the effects of other (more traditional) factors of production. As a result, the NIC dynamics have been measured either using numerous separate indicators (Ståhle and Bounfour, 2008) or with a composite single index constructed on their basis (Andriessen and Stam, 2005; Węziak, 2007).

In contrast, under the country-level models, tangibles and intangibles have been evaluated in aggregate, mainly via financial indicators. Under this approach, researchers have not referred to themselves as the IC community, but have applied the concept of *intangible capital*.

Despite the varying approaches discussed as part of the aforementioned models, the results obtained, if limited to country rankings, are usually convergent because they share the evaluation of intangible assets. However, if intangibles are the subject of specific analysis in the context of their contribution to GDP output, result can be inconsistent. For example, Andriessen and Stam (2004) found no interdependence between GDP and the stock of intangibles, whereas Lin and Edvinsson (2011), in a study conducted across 40 economies, found a significant average correlation (0,88) between the proposed composite indices of NIC and GDP *per capita*. These contradictory findings might be attributable to discrepancies existing within the models and might relate to incongruous and obsolete methodologies for IC measuring and scaling.

Undoubtedly, a simple replication of the well-known micro-measurement models, such as INC, IC-dVAL and VAIC, can be problematic in a macroeconomic setting (Labra, Paloma Sánchez, 2013). Firstly, research on IC at the macro level involves a vast quantity of information (whose collection seems cumbersome because plenty of data concerning intangibles do not figure in routine in-

formation disclosure produced under national accounts). The systematic collection of such data without a prior, comprehensive and commonly accepted framework is a considerable practical impediment. Secondly, these models mainly use indicators of intangibles and report NIC through composite indices that enable cross-country comparisons. Comparisons among countries are usually based on disparate qualitative criteria and different regional/national statistic systems, and these differences may result in inconsistencies contained in final results.

Many authors raise the question whether the translation of models from the domain of business management to the national or regional levels is appropriate. In the case of the application of the Edvinsson and Malone model, there is a problem with defining structural, organizational and process capital. This can result in double-counting. It means that the same indicators characterizing various components of IC can appear twice, like in the case of the Węziak model (2007) where patents USPTO *per capita* are used jointly in process and market capital. The Edvinsson and Malone model does not offer clear underlying metrics or straightforward guidelines for conducting reliable and comparable analyses. The indicators for this model and the procedures of normalization used have been selected arbitrarily. The same caveat applies to the Andriessen and Stam model (2004), in which the statistical indicators selected for three categories — assets, investments and effects — were posited. In order to appreciate the difference between past, present and future development, each of the three classes of IC can be monitored from three different perspectives. As a result, we have, first of all, assets providing an indication of the present power of a nation, secondly investments (forward looking), which determine the future power of a nation, and finally effects that show the extent to which the nation has made its intangibles productive during the past period. However, the combination of disparate indicators into a composite is still based on speculative weightings and the model does not show inter-relational dependencies amongst IC components. The core problems of index formulation were not avoided by Bontis (2004), but his study is an important contribution to IC research on inter-related connections and dependences among IC components and their influence on overall economic performance (Ståhle, 2008).

The issue of identifying the most critical drivers for each IC metric has not yet been resolved definitely. To apply appropriate indicators, the fundamental criteria must be fulfilled, such as: comparability, reliability, objectivity or verifiability. With respect to macroeconomic qualitative indicators (used for estimating specific elements of IC like values, motivation, satisfaction or loyalty), it seems rather difficult because they usually suffer strongly from subjective biases, and are overly influenced by recent economic performance. Evidently, most national intellectual capital measurement models analyze existing data at the input and output levels, although some academics prioritize the effects of IC. Pulic (2005) was the first who focused explicitly on the connection between IC and economic performance operating solely via financial indicators. In spite of such an operational approach, findings from Pulic's VAIC model have been contradictory concerning the impact of IC on economic growth. The author presented rather straightforward formulae for calculating the VAIC index, but the implementation of some assumptions for the purpose of economic analysis, e.g. substituting the concept of human capital for *Personnel Expenses* or identifying the structural capital with the difference between *Value Added* and *Personnel Expenses*, seems to raise doubts as to its technical correctness. The explicit concentration on economic effects of intangibles also figured prominently in the model developed by Lev (2001), although, unlike Pulic, the author analyzes the economic effects of intangibles without using detailed indicators or definitions (Ståhle, 2008).

Basing on the literature reviewed, it can be asserted that the IC global community has not yet managed to reach a consensus on the methodology of measuring NIC. Further studies are needed to harmonize and standardize such models originally derived from the IC taxonomy of Edvinsson and Malone. Apart from the necessity for a multi-dimensional conceptualization of the NIC paradigm, it appears to be particularly difficult to demonstrate the effect of IC on the national economy, since empirical findings on NIC's relevance to economic growth are fragmentary and contradictory. Due to the IC's intangible nature, interrelational dependencies between IC indicators and GDP, or the different tempos of IC effects at different economic levels, the analysis should include the time context and the economic environment. What is more, one of the prerequisites for reliable such analysis is adjusting GDP by isolating the effect of non-IC drivers within the economy. It is noteworthy that neither academic nor international organizational models are able to identify

and measure the hidden value of NIC comprehensively. The World Bank (2002) proposed a knowledge assessment methodology (KAM) consisting of 69 structural and qualitative variables classified into five dimensions: economic and institutional regime, dynamic information infrastructure, performance indicators, education and skilled human resources as well as efficient innovation system, to assess a country's preparedness for developing a knowledge-based economy (Lin, Edvinsson, 2011b). Despite many variables on the scorecard, some components of IC, such as social and environmental aspects, quality of life, social well-being, values, attitudes and competences attributable to human capital, were not considered (Navarro, Lopez Ruiz, Nevado Peňa, 2011). An analysis of NIC in the context of inputs (rather than outputs) also seems to be an important weakness of models proposed by international organizations, such as the OECD, but even academic models are not free from such shortcomings, offering a rather limited perspective (e.g. inputs or intellectual property rights) or containing too many disjointed variables to enable trend analysis (Lin, Edvinsson, 2008).

2. RATIONALE FOR NEW METRICS

Despite the undisputed appeal of the original NIC methodologies, continued insights into their structure are necessary to render them maximally representative of the new, IC relevant "wealth of nations".

The essence of a revised system of NIC metrics proposed here, as aforementioned, is shifting the center of gravity from quantifying IC means to quantifying IC ends. In this vein, the following vital notions should be incorporated to better account for:

- *Functional literacy* vs. passive schooling participation (enrollment) or education expenditure (budgets): it is by far more representative to measure educational progress through the skills and knowledge transferred rather than by the sheer amount of time and money allocated to the process (various contemporary yardsticks of empirical educational and training achievement can be used to this end);
- *Social media* vs. information technology subscriber statistics: as the nascent and progressively popular form of global interconnectedness, social media intensity has been taken into account here (and will eventually replace the most passive and increasingly outdated drivers of information technology use);
- *Socioeconomic progress* vs. output of products or services (notably via gross domestic product, GDP and human development index, HDI): both aggregates, have been major components of NIC and prevalent measures of socioeconomic progress, and are increasingly considered obsolete and detached from quality-of-life factors empirically measured on a global scale. The proposed research is tilting the scale towards ends-driven (and perceptible) indicators of human development;
- *Commercialism* vs. formalism: particular emphasis has to be placed on commercialism and usage data (rather basing on traditional macroeconomic reporting or isolated elements of intellectual property registration);
- *Ecological footprint* vs. ecological ignorance: the study incorporates the human demand on the Earth's ecosystems — a factor widely acknowledged as a major macroeconomic concern, yet oftentimes ignored in the measurement of socioeconomic progress (at national or supranational levels).

3. A CRITIQUE OF THE NIC MEASUREMENT FRAMEWORK

To illustrate proposed amendments to the NIC model, it is worth pointing out the weaknesses of indicators being used to value the individual NIC subsets as well as the rationale for changes. Table 2 encapsulates these criteria basing upon the online database maintained by P. Stahle, and S. Stahle (Bimac, 2014).

4. NEW METRICS

Alternations to the NIC measurement methodology should supplement it with variables that refine the existing NIC concepts so as to better reflect the socioeconomic priorities laid out at the outset of this paper. Table 3 demonstrates amendments to the aforementioned NIC indicators, the recommended metrics and sources.

5. CONCLUSIONS

National Intellectual Capital (NIC) is a groundbreaking research approach to intellectual capital (IC), whose socioeconomic and political significance is rising and warrants further scientific elaboration. The need to continuously examine NIC is dictated by the pivotal role played by intangible assets at macroeconomic level — a factor largely ignored in mainstream strategic and national policymaking.

Table 2. A critique of indicators making up NIC subsets.

NIC Subset	NIC Indicator used	Need for alternation	Reasons
NHC	Skilled labor	no	Skilled labor is a pivotal element of NHC and the availability of a skilled workforce determines macroeconomic competitiveness
	Employee training	no	In view of rising work complexity and more frequent labor mobility, ongoing employee training is key to long-run workforce competitiveness
	Secondary education up enrollment	yes	Most global economies are now saturated with secondary graduates, therefore further progress in this respect can be limited, whereas school participation at this level per se does not guarantee competitiveness growth (remote relevance to IC creation)
	Pupil-teacher ratio	yes	No theoretical or practical studies support the claim that the lowest pupil-teacher ratios benefit all aspects of educational performance (e.g. achievements involving teamwork — requisite in numerous complex research and development projects)
	Public expenditure on education	yes	Public expenditure on education is a typical means-oriented measure ignoring the efficiency of money being spent (in certain circumstances diverting capital from private business through higher fiscal levies can be downright counterproductive to IC growth)
	15–64 years old population	yes	Not only are most countries currently extending the working lives of their populations beyond the age of 64 (or will be forced to do it in the not-too-distant future) but an efficient use of human talent is required over an entire lifetime
	Qualified engineers	yes	Granted — IC intensive technologies require a stable inflow of qualified engineers, however, it is over- simplistic to assume that innovation is the exclusive product of engineers: other qualified professionals should be included as well
	Students PISA performance	no	Despite numerous constraints of the Program for International Student Assessment (PISA) methodology, this metric is a typical ends-oriented variable demonstrating empirical educational quality
	Human Development Index	yes	Although partially an ends-oriented measure, HDI overlaps other, more specific yardsticks of the quality of life are thus recommended
	Gender equality	no	The sex ratio for the entire world population is equally balanced between females and males, any gender inequality attests to inefficiencies in the use of NHC
	Years of education	yes	The length of education by itself is not a direct proxy for education quality, hence the need for alternation (a more specific measure of education intensity)
	R&D researchers	no	The number of individuals involved in research and development (R&D) activity, although not directly relevant to the output of NHC, determines the knowledge base for current and future innovation
NMC	Corporate tax encouragement	yes	The corporate tax environments of many economies are undergoing substantial reforms (some countries have decided to discontinue levying and collecting corporate income taxes altogether), hence the need for a broader measure of fiscal friendliness to business
	Cross border venture	no	Cross border venturing epitomizes the international marketability of businesses, therefore its incorporation in NMC should be preserved
	Openness of culture	no	The openness of national culture to foreign investment reduces information asymmetries faced by parties involved in IC exchanges
	Transparency of government policies	no	The transparency of government policies ensures the smooth running of market efficiencies (mitigating regulatory risks)
	Image of your country	no	A country's image is a natural macroeconomic intangible (an equivalent of intellectual property held by companies), its inclusion into NMC is thus uncontroversial
	Capital availability	yes	A more representative benchmark of financial market flexibility (that would quantify the competitiveness of an entire financial market) is needed
	Trade to GDP ratio (exports + imports)	no	The proportion of foreign trade in Gross Domestic Product (GDP) demonstrates how globalized GDP is, which is an efficiency factor
	Current account balance	yes	The current account balance relates to the structural nature of a given economy and has no direct bearing on IC marketability
	Investment flows	no	Investment inflows show how attractive a given economy is to foreign capital and international commitments to that economy
	Country credit rating	yes	The information relevance of sovereign credit ratings tends to be inferior to more dynamic (market oriented and timely) measures of sovereign debt quality
	Investment risk	yes	No universal definition or measure of investment risk has yet been worked out internationally, however, modern perceptions of risk related to investment incorporate political hazards
	Globalization index	no	Globalization determines the openness of a socioeconomic system to the exchange of IC (their current and future marketability) and should be preserved

NIC Subset	NIC Indicator used	Need for alternation	Reasons
NPC	Business competition environment	no	The business competition environment of a given economy drives the efficiency of its processes, therefore the necessity for this factor in NPC
	Government efficiency	no	Government efficiency enables efficiencies in all other sectors, which warrants the inclusion of this metric
	Computer per capita + Mobile subscribers	yes	Given the rapid sophistication and hybridization of consumer electronics, personal computer/mobile telephone penetration does not fully account for high-technology uptake and should be broadened by other, modern applications
	Internet subscribers + Broadband subscribers	yes	In an era of omnipresent social media use, personal computer/mobile telephone penetration largely ignores numerous aspects of online interconnectedness and should be expanded by Internet based social interaction
	Convenience in establishing new firms + start up days	yes	Convenience in establishing new firms is only a fraction of standards related to initiating, maintaining and closing business activity – a more comprehensive measure would thus be advisable
	Goods & services distribution efficiency	no	The distribution efficiency of goods and services determines the final stages of marketing, so its inclusion is necessary
	Overall productivity	no	Economic productivity is essential to the quality of processes, therefore it should preserved
	Unemployment% + Youth unemployment%	yes	Unemployment rates (including youth unemployment) do not adequately capture the number of active jobseekers and are being increasingly criticized
	Consumer price inflation	no	The Consumer Price Index (CPI) is related to macroeconomic stability and directly relates to the efficiency of macroeconomic policy
	Health & environment	yes	Human health and environmental standards (especially if measured on the expenditure side) are difficult to quantify; an ends-oriented alternative appears to be advisable
	Corruption	no	Corruption is a challenge to IC processing, as it distorts free competition and interferes with the efficient allocation of scarce resources (including IC)
	Freedom of speech	no	Free speech is a sine qua non for minimizing information asymmetries – in consequence it can be interpreted as an efficiency factor
NRC	Business R&D spending	yes	The sheer amount of spending on research & development (R&D) does not always translate into economic effectiveness, so a more sophisticated measure is needed in this regard
	Basic research	no	If an exception should be made to the overriding desire to shift the philosophy of NIC measurement from means to ends, it is in funding for basic research (its applications – while usually not assumed at the outset and deferred – can be highly cross-disciplinary and IC relevant)
	R&D spending/GDP	no	With considerable reservations to Gross Domestic Product (GDP) as a proxy for macroeconomic progress, the proportion of research & development (R&D) in GDP shows the commitment of an economy to innovation
	R&D US$ per capita	no	A measure of research and development (R&D) intensity related to population puts the R&D expenditure in a human relevant perspective
	IP right protection	no	The protection of intellectual property (IP) – if overaggressive – can occasionally hamper future IC creation, yet the lack of it undermines the propensity to innovate
	Utility Patents/ R&D expenditure	no	This particular measure aims to quantify the effectiveness of research and development (R&D) via patenting, which a proxy for R&D
	Cooperation between corporations and university	no	Academic research commercialization is a sine qua non for synergies in tertiary education and a prerequisite for academic renewal (inter alia in access to sustainable funding)
	Scientific articles	yes	The sheer number of scientific articles does not guarantee their quality, hence the need for a more elaborate quantification of scientific output quality
	Patents per capita (USTPO+EPO)	yes	The intellectual property (IP) concept extends far beyond patenting, therefore diverse forms of IP registration should be accounted for
	Entrepreneurship	no	Entrepreneurship emblematizes the propensity of an economy to initiate new business ventures, which is closely related to IC creation
	Development & application of technology	No	The development and application of new technologies helps renew IC micro- and macroeconomically,
	Venture capital	No	Venture capital (private equity invested into young, entrepreneur-led, high-potential companies – typically driven by technological innovation) is a natural form of IC renewal based on commercial premises

Source: own elaboration based on the NIC model (BIMAC, 2014).

Table 3. New metrics proposed for selected NIC indicators, their reasoning and sources.

NIC Subset	NIC Indicator used	Proposed metric (reasoning) /Source
NHC	Secondary education up enrollment	Tertiary education enrollment (this metric would quantify participation in academic education: at under- and graduate levels). For professionals without this standard of formal education, their skills would be measured through other indicators (e.g. evidence of certification) /World Bank
	Pupil-teacher ratio	Teacher quality (a combination of formal education levels, experience, certification, periodical assessment and awards) /Education Ministries, national statistical offices
	Public expenditure on education	School quality (availability of technical infrastructure in public schools: educational resources, audiovisual equipment and Inter-/Intranet based applications) /Education Ministries, national statistical offices
	15–64 years old population	Employment-to-population (such a ratio highlights how effective a given economy is in job creation in relation to this economy's working-age population) /World Bank
	Qualified engineers	Qualified professionals (the percentage of professionals holding certifications widely recognized in a given industry) /Professional bodies authorized to award industry certifications
	Human Development Index	The where-to-be-born (quality-of-life) index based on life-satisfaction surveys and objective life-quality determinants/Economic Intelligence Index
	Years of education	The lifelong learning index combining the different learning environments of school, community, work and home life within four educational pillars ("learning to know", "learning to do", "learning to live together" and "learning to be") /UNESCO, Bertelsmann Stiftung
NMC	Corporate tax encouragement	The ease of paying taxes (the total tax rate, time needed to comply with major taxes and number of tax payments required under a given fiscal system) /PricewaterhouseCoopers
	Capital availability	The Global Financial Centres Index (this index demonstrates the competitiveness of global financial centers in three critical dimensions: "breadth" (diversity), "depth" (specialty), and "interconnectedness" (connectivity) /Qatar Financial Centre Authority
	Current account balance	The Gini coefficient (a measure of statistical dispersion intended to represent the income distribution of a nation's residents, most commonly used to gauge economic inequality, which IC marketability) /The World Bank
	Country credit rating	Sovereign default probabilities (based on currently tradable credit default swaps, CDS) / Deutsche Bank Research
	Investment risk	Such a yardstick ought to incorporate broad concepts of financial loss, including political uncertainty (i.e. World Investment and Political Risk reports) /MIGA, World Bank Group
NPC	Computers per capita + Mobile subscribers	To account for mobile connectivity, such a measure might be broadened by smartphone and tablet penetration (smartphones and tablets per capita) /Our Mobile Planet, Google
	Internet subscribers + Broadband subscribers	Besides Internet and broadband subscribers, this category should be broadened by the numbers of Facebook and LinkedIn users, i.e., respectively, "Facebookization" and "LinkedInization"
	Convenience in establishing new firms + start up days	Instead of the measure of convenience in establishing new firms (+startup days), a broad indicator of doing business standards (a function of the regulatory) should be applied, i.e. the Ease of Doing Business Index/International Finance Corporation, The World Bank Group; The World Bank
	Unemployment% + Youth unemployment%	Labor force participation rate (the percentage of working-age persons in an economy who are employed or are unemployed but looking for a job) /UBS, World Bank
	Health & environment	Longevity (life expectancy) and the ecological footprint (human demand on the Earth's ecosystems): on the one hand demonstrating the effectiveness of health care systems and, on the other hand, helping quantify environmental costs related to macroeconomic growth/World Health Organization, Global Footprint Network
NRC	Business R&D spending	The Global Innovation Index (ranking economies by their ability to create an environment propitious to innovation outputs) / Johnson Cornell University, INSEAD, World Intellectual Property Organization (WIPO)
	Scientific articles	Despite significant theoretical and practical limitations, the country h-index (attempting to measure both the productivity and impact of the published work of a the country's scientists or scholars) /SCImago Journal & Country Rank
	Patents per capita (USTPO+EPO)	The intellectual property (IP) concept extends far beyond patenting, therefore various forms of IP registration should be accounted for on a per country basis (i.e. patents, trademarks, industrial designs, copyrights and utility models/WIPO

Source: own elaboration.

The recently emergent models of NIC research require further insights and enhancement. Given the constant evolution of concepts related to socioeconomic progress, some of the metrics making up the original NIC subsets should be revised to better account for contemporary socioeconomic priorities. Among the recommended alternations are: an overall about-face towards quantifying socioeconomic ends (efficiency, value and quality) rather than means (effort, expenditure, time), a functional (achievement-based) approach to schooling at all levels (with particular emphasis on tertiary education), more emphasis on quality-of-life (individually perceptible) aspects of socioeconomic progress, commercialism (market orientation) in reporting macroeconomic phenomena and the need to factor in the ecological impact of civilization (sustainability).

The amended NIC methodology endeavors to address these concerns and is intended as a stepping-stone in the process of advancing NIC measurement.

Future research into NIC is expected to bear on the following specific concepts related to assessing the intellectual wealth of entire nations:

Active participation in the debate on socioeconomic development: to a large extent, the IC community involved in the discussion on NIC has thus far been a passive adopter of methodologies conceived and developed by macroeconomists — it must now become an active force in transforming the theory and practice of measuring socioeconomic progress;

Exploring IC in social media: social media have recently been a prominent feature of human interaction via modern technologies, yet its intuitive liaisons with IC have stayed out of the limelight and have neither been sufficiently studied by IC scholars — more scientific scrutiny should thus be applied to IC related aspects of online interconnectedness;

IC vs. globalization and sustainability: a principal constraint on NIC measurement is the rising interrelatedness of individual economies (especially in the intangible context) — prospectively, the research into NIC should expand into measuring IC of the entire planet (incorporating its social liabilities).

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