

Intellectual Capital and National competitiveness: Conceptual and methodological challenges

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Introduction

Intellectual capital on national level has recently emerged as a new area of research, where the focus is on understanding and measuring the intangible factors influencing national wealth creation. Knowledge based economy is widely based on intangible factors, and to understand the role of these as economic drivers and competitive edge for a nation is getting more and more strategic importance. For example, Bounfour and Edvinsson (2005a; Edvinsson 2005, also Amidon 2001) cite many examples of practical and strategic assessment and development projects concerning national IC being conducted all over the world. In addition to IC studies also various competitiveness reports, like those by IMD, WEF and EU, have gained increasingly attention during the past few years.

In this paper we challenge both national intellectual capital (NIC) and national economical competitiveness reports (NEC) from methodological perspective. The approaches overlap each other both by the definitions and the utilized indicators, and neither of the approaches are able to track the dynamics of economic drivers or anticipate future performance. In this study we demonstrate how NIC and NEC indicators are connected with economic performance and how these interdependences vary in different conditions. We also show that trend analysis can be implemented for identifying national competitiveness or intellectual capital as well as anticipating their influence on future economic growth. Our study is experimental and methodological by nature and it is based on the data from World Competitiveness Yearbook by IMD including 51 countries, 331 basic indicators with 27

upper level rankings, and 4 Competitiveness Factors: Economic performance, Government efficiency, Business efficiency and Infrastructure.

National Intellectual Capital as an emerging area of research

Various kinds of classifications and approaches of intellectual capital have been developed during the last ten years, but as a scientific approach the field of national IC is in its infancy. Its beginning can be traced back to the year 1996, when the Swedish government produced a report called “Welfare and Security” where the hidden wealth of the country was examined based on the Skandia Navigator model by Leif Edvinsson. In this model intellectual capital is divided to four main foci:

- Human focus: citizens’ knowledge, skills and capabilities, education, creativity.
- Market focus: attractiveness from viewpoint of external markets, international relations.
- Process focus: infrastructural support for knowledge processes, ICT.
- Renewal and development focus: investments in knowledge, innovation.

Each of these is assessed with multiple quantitative indicators in order to produce a holistic representation of the system’s intellectual capital. Since Sweden’s pioneering attempt, the Navigator model has been applied and modified for assessing the IC of f. ex. Israel (Pasher 1998), the Arab region (Bontis 2004), Canada and United States. Other methods for measuring national IC include Ante Pulic’s (2005) VAIC™ approach, Ahmed Bounfour’s (2005b) IC-dVAL® and Andriessen and Stam’s (2005) Intellectual Capital Monitor©. In the beginning of 2005, a book edited by Ahmed Bounfour and Leif Edvinsson came out that represents the first collection of seminal articles on macro-level IC.

For the time being there are many open questions concerning NIC both from academic and practical perspectives. First, as Bounfour (2005a) notes, examination of intangible factors of production has a long history in macroeconomic literature, and second, several well-established systems for reporting and valuating national competitiveness already exist, such as those by WEF and IMD.

Overlaps of National Intellectual Capital and National Competitiveness

National Competitiveness (NEC) and National Intellectual Capital (NIC) as used today have several overlapping definitions and components. Although NIC has been defined in many ways and from different perspectives, the definitions seem to have one common feature: they all emphasize how value can be extracted from knowledge, both at present and in the future. For instance Bontis (2004) defines IC as *"hidden values of individuals, enterprises, institutions, communities and regions that are the current and potential sources of value creation"* and Andriessen and Stam (2005) as *"all intangible resources available to a country or a region, that give relative advantage, and which in combination are able to produce future benefits"* .

The concept of NEC concentrates also on economic capability to win the competitors: *"A nation's prosperity depends on its competitiveness, which is based on the productivity with which it produces goods and services."* In this definition of WEF¹ (Global competitiveness report 2004) the emphasis is on the economical and business perspective. *"Competitiveness analyses how nations and enterprises manage the totality of their competencies to achieve prosperity or profit"* . The point of departure in this definition of IMD² seems to be intellectual and its influence on competitiveness. European Commission³ defines NEC as *"... a sustained rise in the standards of living of a nation and as low a level of involuntary unemployment possible"* with emphasis on economical and social dimensions. The different definitions of national competitiveness are not necessary contradictory, but instead they show the multidimensional dependencies of competitiveness with various economical, societal and cultural issues.

Conceptually NIC and NEC overlap each other to a wide extent. The future of a nation is dependent on the national competitiveness, which on the other hand is based on national intellectual capital and the capability to extract value from it. On the other hand, the development of global economy defines the factors that bring competitive advantage for the

¹ The World Economic Forum is an independent international organization committed to improving the state of the world by engaging leaders in partnerships to shape global, regional and industry agendas from 1971

² International Institute for Management Development IMD, one of the world's leading business schools with over 50 years' experience, publishes the World Competitiveness Yearbook.

³ Competitiveness and benchmarking European competitiveness report 2004. Commission staff working document SEC(2004)1397. Office for Official Publications of the European Communities, 2004.

nations in different circumstances. Competitive advantage is based on material and immaterial resources and their combinations; in developed countries it is assumed to be based furthermore on national intellectual capital (e.g. Teece 2000, Castells & Himanen 2002, Stähle & Grönroos 2000).

When we compare NIC indicators (defined by the most common IC models or used in previous mentioned NIC applications) with indicators used by the reports of WEF, IMD or EU, it is obvious that basically all the IC indicators are included in these global competition reports. E.g. IMD calculates and evaluates its national economical competitiveness index (Over All Ranking, OAR) based on 331 different basic indexes, which form four Competitiveness Factors: Economic performance, Government efficiency, Business efficiency and Infrastructure. Both IMD and WEF use a combination of publicly available hard data as well as information provided by the Forum's Executive Opinion Survey, which provides more textured qualitative information on difficult-to-measure concepts. When calculating its Growth Competitiveness Index (GCI) WEF uses indicators from three main areas: macro- and microeconomic environment, public and social environment, and technology. So far the same indicators and elements have been approximately used in NIC studies except for a few areas of indexes.⁴ This is fully logical, since the basics of IC thinking are that a) it maps the elements that form the intellectual capital of a company or a nation, b) these elements are the source of value in knowledge based economy and c) these elements are the source of competitiveness. Thus already the point of departure for NIC and NEC is initiated from the same factors, functions and capabilities that are supposed to be drivers for knowledge based economy.

Open questions

The problems concerning both NIC and NEC are pretty much the same. Even if various categories, factors and indicators have been mapped, we do not for instance know

- how the different indicators are factually connected with economic performance, (e.g. which indicators are real drivers and which are to be understood as mere results)

⁴ For instance Government efficiency (among some other minor areas) – are not included in IC reports. This means that indicators like public finance, fiscal policy, institutional framework, business legislation, societal framework, corruption, contract and law are left out. This is not fully understandable, because all of these indicators can be counted as societal structures or processes – and thus they could be part of the IC category of Internal structures.

- what weight or importance each indicator or their combinations have on overall competitiveness
- which kind of dynamics between the indicators or how high levels are needed for overall competitiveness, (e.g. how far urbanisation can be conceived as a driver till it turns into ecological hazard jeopardizing sustained growth.)

We can assume that the recognized factors and indicators reveal the competitiveness of a nation on general level to a certain point. The countries on the top of WEF and IMD rankings are competitive by definition of GNP. And here there is a strong correlation between knowledge economy and GDP per capita (Aubert 2005, 64)⁵. However, the more equal the countries become by their conditions for knowledge economy, such as technology and level of education, the more the sources of competitive edge must be found from other factors.⁶ The overall rankings factually correlate rather weakly with the national economic performance: they correlate strongly with the present and past few years, rather weakly for the longer period of past development, and not necessarily at all with the future success. The high ranking of a country can by no means be treated as a sign for positive future performance (Rouvinen 2005,40). This observation can easily be made also by following up radical changes of both over all rankings and lower level ranking indexes. Thus we have a strong argument for questioning whether the right elements (indicators) are being emphasized – or processed in a right manner – when assessing the competitiveness of the nations.

The problem of IC focuses on the fact that knowledge is always embedded in various functions, structures and technologies in any level of a system (organization, region, and nation). Thus it is difficult to report on IC perspective alone without dealing with the other elements of overall competitiveness. One way to solve this problem is to narrow the perspective of IC. For instance Khan (2005) has applied this with interesting results to the estimation of investment in knowledge across the OECD countries. The starting point in the study is that the investment in knowledge consists of three components: Expenditures of R&D and innovation, Education and training, and Software. From IC point of view this definition is hardly extensive enough, but meaningful and acceptable from the perspective of

⁵See also Stelios, 2005.

⁶ Or as the New Growth Theory shows, the ultimate competitiveness comes from knowledge accumulation and innovativeness, e.g., continuous renewal (Romer, 1986). From this perspective the whole society with its functional and cultural dimensions that support growth and innovativeness is basically the enabler for national innovativeness.

knowledge focus in the case. Another kind of national IC approach has been made by Pasher and Shachar (2005) in the study of the intellectual capital of Israel. Instead of the measuring perspective on IC they choose a more strategic framework. The four IC perspectives of Process, Market, Human, and Renewal and development capital were used, and the key success factors were chosen for each. After this procedure the relevant indicators and measures were picked up from the World Competitiveness Yearbook and other statistic sources. By this methodology NIC report shows strategically relevant information for a country. However, it still remains open the question, should we call the result NIC report or strategically emphasised NEC report. Practically this does not matter, but theoretically it has meaning – and challenges us for a more thorough definition of the NIC as a concept in general.

Both NIC and NEC approaches have some severe weaknesses. Neither of them can reliably show the influence of different indicators or categories on national economical development, and their results are still too much based on theoretical assumptions or unverified statistic analyses. The capability of both approaches to demonstrate the underlying dynamics of the phenomenon is very limited, as well as their ability to anticipate future development. In practical analyses it seems to be assumed that the complex and dynamic system of global economy basically functions in a linear input – output or feedback manner.

A new approach towards understanding economic growth and the underlying dynamics has been recently presented by Deutsche Bank Research⁷. Whereas IMD and WEF mostly concentrate on indicators that are presumed to induce or sustain growth, DBR focuses on economical growth *drivers* and their linkage to *global trends* that fuel the drivers. The 21 global trends identified by DBR influence on four main drivers: volume and growth of 1) GNP/capita, 2) labour force, 4) human capital and 4) openness of trade. On one hand the drivers as such are seemingly obvious by laying the foundation for maximum potential growth of GNP. On the other hand the linkage to global trends opens up a new perspective by showing that national economical competitiveness is the outcome of a) national potentials and resources, and b) strategies that recognize global changes and respond to them (e.g. by utilizing these as new opportunities or by tackling emerging and inevitable problems with foresight). When global trends are used as a point of departure, it is possible to make

⁷ DBR at www.dbresearch.com / megatrends.

long term forecasting. As a result DBR produces forecasts for GNP growth rates up to 2020, and this ranking changes heavily the order of the countries from those by IMD or WEF. For instance USA in the new ranking is 11th (1st by IMD, 2nd by WEF) and Finland 28th (6th by IMD, 1st by WEF). However, when measuring the reached *level* of GNP/capita in 2020, USA is 1st on the ranking list and Finland 16th. This example of DBR shows how radically our insight and foresight of national competitiveness vary dependent on whether we deal with dynamics or levels of the used indicators.

Capturing dynamics behind economic performance

The goal of this study is to demonstrate how NIC and NEC indicators are connected with economic performance and how these interdependences vary in different conditions. We use trend analysis for a) identifying national competitiveness or intellectual capital and b) for anticipating their influence on future economic growth. This study is a methodological experiment on how the dynamic features of trend relations (in form of influence and interdependency) of different indicators are related with national economic growth.

The analysis is experimental by nature and it has two major limitations:

1. The study is based solely on the statistic data from The Competitiveness Yearbook 2005 by IMD (containing 331 basic data variables, 27 upper level ranking indexes, and composite indexes in 4 economic categories of indicators and 51 countries).
2. As a bench marking line for economic performance we chose GNP annual growth rate, which means that all the indicators in this experiment are analysed from the perspective of their correlation with the annual growth rate of GNP over the period 2000 - 2004. Annual growth rate of GNP instead of GNP/capita was selected to stress the growth perspective in contrast to mere levels of GNP or GNP/capita.

We started by analyzing how the trend of an individual indicator⁸ correlates with the annual growth rate of GNP from different trend relational perspectives.⁹ The correlation with GNP was calculated for each indicator from seven perspectives:

1. Does the high level of the indicator correlate with the high level of GNP annual growth? (LBL in Table 1, 2, 3 and 4)

⁸ A span of 5 years, 2000-20004 and 1999-2003, based on the available information.

⁹ Trends were calculated by linear regression analysis, which produces one numeric value for next year in each span.

2. Does the time span of the indicator correlate with the corresponding time span of GNP annual growth rates? (CTsB)
3. Does the high level of the indicator correlate with the positive trend of the indicator itself? (PLT)
4. Does the level of the indicator correlate with the trend of GNP annual growth? (LBT)
5. Does the trend of the indicator correlate with the level of GNP annual growth? (TBL)
6. Does the trend of the indicator correlate with the trend of GNP annual growth? (TBT)
7. Does the country/time span matrix of the indicator correlate with the comparable matrix of GNP annual growth? (CCB)

All seven relations focus on economic growth, and points 2 and 6 particularly refer to exponential growth (growth of initial annual growth). The view point of growth is relevant for our purpose, since economic growth can be seen as a key element of competitiveness. Contrary to the levels, *the trends demonstrate dynamic influences and dependencies, through which the functions of NIC and NEC could hopefully be tracked and identified.* The correlations were calculated from seven different aspects because we wanted to explore a) whether the trend of the variable accounts for more than the level of the variable and b) what differences the different trend relations account for, if any.

Example of correlation combinations and variations Indicator	Correlation type and value					
	PLT	LBL	LBT	TBL	TBT	CTsB
1 1 Pno 16__ Gross domestic savings / Percentage of GDP	-0,09	0,13	-0,04	0,23	-0,11	-0,24
1 3 Pno 65__ Direct investment flows inward / US\$ billions	-0,25	-0,07	-0,03	0,30	-0,30	-0,12
2 2 Pno 115_ Effective personal income tax rate / Percentage of an income equal to GDP per capita	-0,14	-0,37	-0,20	-0,11	0,32	-0,11
3 3 Pno 226_ Value traded on stock markets / US\$ per capita	-0,20	-0,17	0,23	0,23	-0,46	-0,09
4 2 Pno 280_ Fixed telephone lines / Number of main lines per 1000 inhabitants	-0,41	-0,37	-0,10	0,23	-0,05	0,00
4 2 Pno 319_ Intellectual property rights / Intellectual property rights are adequately enforced in your economy	-0,17	-0,26	-0,21	-0,05	0,39	-0,15

Table 1. Examples of different trend correlations with GNP annual growth rate

As a result of the analysis the indicators showed considerable variations in trend relational behaviour. As an example Table 1 shows that the indicator 2.2.115 correlates with GNP

growth solely by trends, and all the other correlations are negative. The indicator 1.3.65 correlates instead solely by trend to level of GNP growth. In addition it is interesting, that

- both indicators (2.2.115 and 1.3.65) are linked to dynamics that affect GNP growth *irrespective of the level of the indicator* (high or low level of the indicator has no bearing on the linkage to GNP growth rate) but instead the *trend* of the indicator correlates with GNP growth
- that parameter 2.2.115 is linked to dynamics with *booming* effects on GNP growth rates, e.g. the trend of the indicator affects the *trend* of GNP annual growth rate
- the trend of the indicators is linked to GNP growth through dynamics which *sustain* present growth rates of GNP, e.g. the trend of the indicator only upholds present GNP annual growth rates.

It is obvious that we cannot speak about trends and their correlations just in general or by speaking only about one kind of trend relation. It is always a question of which kind of trend relation and correlation we refer to. The connections are nonlinear and tediously complex, and every simple approach and formula is therefore doomed to fail. If we neglect the diversity of trend relations and extreme dynamic interrelatedness, we cannot get any reliable results, since no simple regularities can be found. However, the example above also demonstrates how trend analysis of each indicator can give us reliable information on the dynamics of the indicators. From a strategic point of view it is important to identify those indicators that are strongest linked with economic (or otherwise desired) growth. Concerning investments the analysis gives guide lines according to the purpose, either for reaching a higher growth level or to uphold an ascending growth trend as such.

As the result of the analyses we found significant differences between the *level* and *trend* analyses. The correlations were clearly divided into four groups:

1. The indicators that correlate with the GNP annual growth by the level of the indicator and indicators which are linked to GNP growth by the indicators trend.
2. The indicators that correlate with the GNP annual growth both by the level and the trend of the indicator
3. The indicators whose trend correlates with the GNP annual growth rate, but has no bearing on the trend of annual growth rate, e.g. indicators sustaining present growth rates, and indicators whose trend correlates with the GNP annual growth rate trends, e.g. indicators boosting present growth rates towards higher levels.

4. The indicators whose trend correlates with the GNP annual growth irrespective of the level of the indicator.

Classification of indicators by correlation to GNP growth		
Correlation to	Level of present GNP annual growth rate	Trend of GNP annual growth rate
Function	Sustaining	Boosting driver
Linkage		
Level of indicator	0	0
Trend of indicator	1	0
Example Indicator 1.3.65	Direct investment flows inward / US\$ billions	
Function	Sustaining GNP annual present growth rate	
Linkage	Trend of indicator irrespectively of level	

Table 2. An example of classification of indicators by function and linkage with GNP growth

In conclusion we argue that when incorporating indexes as parts of NIC and NEC their *function* and *linkage* must be acknowledged and adequately taken into account. *This experimental analysis in Table 2 shows that only the trend of the indicator is linked to dynamics to boom GNP growth. The level of the indicator is a vital part of NIC or NEC, but the level of the indicator has instead a minor function.*

To understand more of the underlying dynamics we wanted to find out the behavioural similarities and differences between different trend relations. The question was, whether the relations support each other or do they work independently. Table 3 shows the simple correlations between the seven trend relations taken over all 331 indicators.

Over all performance 51							
	PLT	LBL	LBT	TBL	TBT	CTsB	CCB
PLT		0,16	0,03	-0,19	0,04	-0,26	0,17
LBL			0,07	-0,18	0,37	-0,09	0,98
LBT				-0,09	0,07	0,04	0,09
TBL					-0,29	0,11	-0,13
TBT						0,11	0,29
CTsB							-0,09
CCB							
PLT	Indicators level to indicators trend value						
LBL	Indicators level to GNP annual growth level						
LBT	Indicators level to GNP annual growth trend						
TBL	Indicators trend to GNP annual growth level						
TBT	Indicators trend to GNP annual growth trend						
CTsB	Indicators time series to corresponding GNP annual growth series						
CCB	Indicatorsmatrix to corresponding GNP annual growth matrix						

Table 3. An example of correlations between different trend relations

Table 3 shows the first result of this relational dynamics. The matrix shows a) how the different trend classes support each other, and b) which comparatively sustained groups of indicators are connected with the GNP annual growth rate. For instance $-0,18$ in the cross-section Row LBL/Column TBL shows, that when LBL (level to level of growth correlation) for an indicator is positive, it is slightly expectable that TBL (trend to level of growth correlation) for an indicator is negative, and vice versa. This means that the two trend relations do not support each other. In contrast to this the following results must also be taken in account:

1. *Level to level co-works with trend to trend (LBL/TBT, correlation 0,37)* e.g. when the level of the indicator correlates positively to the growth rate of GNP, the trend of the indicator is likely to correlate positively also to the trend of GNP annual growth rate. This is a credible result, since levels and volumes usually are antecedents for growth (e.g. results of previous growth). In this sense, accumulated volume (in the form of level) and growth are intertwined.
2. *As level to level co-works with trend to trend, one would expect it to co-work in the same way with level to trend, LBT.* However this is not the case (correlation only 0,07). The differences between levels and trends are visibly emphasised.

We can conclude that *trends precede levels* and *mere levels do not induce or strengthen growth*. Concerning both NIC and NEC we can conclude: Competitive advantage cannot be identified only by monitoring current *levels* (e.g. levels of GNP or ICT) but by focusing on the *dynamic forces* behind the levels.

The analyses showed significant variations in trend relations, their function and linkages dependent on the sector under scrutiny, e.g. within the sector of Business and efficiency the indicators trend relations were interconnected differently than for instance within the sector of Infrastructure. Levels dominate only in the sector of Economical performance. This can be seen from the fact that the level of indicators and GNP growth rate (LBL) correlate with each other over time periods (CTsB). Economical performance is de facto the only sector where this relation is positive, and in all the other sectors it is negative. Thus high levels of indicators are strongly linked with GNP growth only in the realm of Economical performance (e.g. domestic market size is a real economical driver).

The result brought forth a hypothetic idea that the dynamics could vary also according to the developmental or economical phase of a nation. We proceeded by repeating the same analysis as before, but instead of the different sectors we now focused on the general development levels, e.g. *growth environment* of the countries. We divided the 51 countries into groups of TOP 17, MID 17 and MIN 17 simply using the over all ranking by IMD as the grouping criterion. The result confirmed the hypothesis, that similar variations of trend relations appear in the three growth environments than within the four sectors discussed in the previous analyses. This means in practice, that different growth environments are unique and the economic drivers behind them are different.

Infrastructure TOP 17							
	PLT	LBL	LBT	TBL	TBT	CTsB	CCB
PLT		-0,01	-0,07	-0,21	0,14	-0,09	-0,05
LBL		0,16	0,16	-0,23	-0,16	-0,26	0,95
LBT		0,16	0,08	0,08	-0,03	0,04	0,21
TBL		-0,23	0,08		0,05	0,20	-0,21
TBT		-0,16	-0,03	0,05		0,20	-0,21
CTsB		-0,26	0,04	0,20	0,20		-0,10
Infrastructure MID 17							
	PLT	LBL	LBT	TBL	TBT	CTsB	CCB
PLT		0,25	-0,24	-0,37	0,11	-0,27	0,25
LBL		-0,27	-0,27	-0,13	0,18	-0,30	1,00
LBT		-0,27	0,12	0,12	0,07	0,15	-0,27
TBL		-0,13	0,12		-0,33	0,21	-0,11
TBT		0,18	0,07	-0,33		0,20	0,17
CTsB		-0,30	0,15	0,21	0,20		-0,28
Infrastructure MIN 17							
	PLT	LBL	LBT	TBL	TBT	CTsB	CCB
PLT		0,01	-0,03	0,03	-0,22	-0,23	-0,03
LBL		0,48	0,48	-0,19	0,17	-0,21	0,96
LBT		0,48	0,22	-0,22	0,16	-0,24	0,38
TBL		-0,19	0,22		0,12	0,16	-0,17
TBT		0,17	0,16	0,12		0,44	0,15
CTsB		-0,21	-0,24	0,16	0,44		-0,11
Saturation							
Legend							
PLT	Indicators level to indicators trend value						
LBL	Indicators level to GNP annual growth level						
LBT	Indicators level to GNP annual growth trend						
TBL	Indicators trend to GNP annual growth level						
TBT	Indicators trend to GNP annual growth trend						
CTsB	Indicators time series to corresponding GNP annual growth series						
CCB	Indicators matrix to corresponding GNP annual growth matrix						

Table 4. An example of how growth environments affect trend relations within the sector of Infrastructure.

In Table 4 we can see, that when following along MIN 17 to TOP 17, a strong and almost systematic tendency towards a decline of the initial trend of relational strengths can be observed, e.g. whereas there is a strong co-operation between LBT and LBL in group MIN 17 (correlation 0,48), it turns out to negative in group TOP 17 (correlation $-0,23$). We can understand this tendency only as a saturation effect, which actually can be seen in every parameter: each of them has a level where investments begin to decline by paybacks. Continuous growth can therefore be reached only by being able to exploit genuinely new growth potentials. Such a potential can be identified in the relation between PLT and TBT: the relation rises steadily from negative to positive when moving towards TOP 17. The underlying dynamics that are revealed by these relations give apparently TOP 17 its competitive advantage. The practical implications of these relations and their dynamics rise interesting questions for later research.

To understand these dynamics better and avoid confusion, we must notice that *level* and *trend* as the units of analyses are categorically and functionally different. The developed countries of TOP 17 show high levels of most of the indicators, which however is a result of an accumulation process of growth over a long period of time. Annual growth inevitably mounts up to high volumes (e.g. levels of indicators that measure the volumes), but it is not originally the volume that induces growth. Though the high level of TOP 17 gives superiority over MIN 17, it gives little or no competitive advantage over the other countries of TOP 17. The only key for their competitiveness is the speed of the growth, which can be measured by trends.

We finish this exposition of our experiment by demonstrating an interesting and unexpected finding. Even if TOP 17 and MIN 17 operate on totally different levels they utilize astonishingly similar trend relational dynamics. This can be seen in Table 4 when focusing simply on positive and negative relations. Astonishing also is the finding that MID 17 by no means acts as an average between TOP 17 and MIN 17, but on the contrary MID 17 possesses a totally unique dynamics with only weak resemblance with TOP 17 and MIN 17. Moving upwards on the ranking ladder is therefore not a linear process, but a development through phases including even radical changes. Table 5 highlights this finding.

Trend behavioral resemblance between groups			
	TOP17	MID17	MIN17
Over all performance			
ALL51	0,51	0,67	0,70
TOP17		0,02	0,58
MID17			0,07
Economical performance			
ALL51	0,67	0,77	0,63
TOP17		0,66	0,29
MID17			0,18
Government efficiency			
ALL51	0,73	0,31	0,56
TOP17		-0,13	0,24
MID17			0,20
Business efficiency			
ALL51	-0,05	0,73	0,82
TOP17		-0,45	0,24
MID17			0,31
Infrastrucure			
ALL51	0,65	0,67	0,68
TOP17		0,33	0,58
MID17			0,04

Table 5. An example that demonstrates the similarities and dissimilarities of the three groups of countries from different growth environments

We believe this to be a sign of the transitional stage of MID 17, where old and new economical and societal dynamics are mixed and intertwined. Based on this we have a reason to suppose that *transitional* growth environments (MID 17) function on different premises as *developed* and *emerging* (TOP 17 and MIN 17).

Conclusions

Our experimental study shows that the trend analyses can act as a promising tool for capturing the dynamic interdependence of intellectual capital, factors for competitiveness and economic performance of a nation. However, the dynamics is nonlinear and tediously complex. To get reliable results the diversity of trend relations and extreme dynamic interrelatedness must be taken into account. We cannot speak about trends and their correlations just in general or by speaking only about one kind of trend relation, but instead it is always a question of which kind of trend relation and correlation we refer to. The bases of our analyses consisted of seven different trend correlations within four separate sectors (of societal and economical structures defined by IMD) and three different developmental phases of the countries. As a result we found that the dynamics and the drivers behind the annual growth of GNP vary dependent on which sector or growth environment we deal with.

When using indexes and indicators as parts of NIC and NEC analyses their *function* and *linkage* must be acknowledged and adequately accounted for, and in addition their variations in different growth environment and (societal/economical) sectors must be taken in consideration. Concerning both NIC and NEC the conclusion of the analyses can be stated: *Competitive advantage cannot be identified only by current levels (e.g. levels of GNP or ICT) but by the dynamic forces behind the levels.* These dynamic influences can be captured by using multidimensional trend analyses as experimented in this study.

When 51 countries were divided into three different categories according to their general developmental level, the dynamics within each group of countries differed from each other.

This means, that the influencing factors vary according to the phases of development. From this perspective, to rank the countries regardless of their growth environment (as IMD and WEF do) is misleading and without any grounds. Likewise misleading and questionable is a simple weighted averages as the only method when producing rankings.

As a result of the experiment we can conclude, that *the trends of the indicators correlate sufficiently strongly with the present annual growth rate of GNP and its trend*. If the trends are neglected in the analyses – as in IMD and others – the rankings are not able to anticipate the future success of nations. In this case the concept of competitiveness loses its actual meaning.

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