

Knowledge Management, ITC and Spillover Effects in Mexico

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This paper presents a perspective on Information Technology and Communications (ITC) and spillover effects in Mexico competitiveness and generation of wealth. We have reviewed some of the basic aspects regarding IT and Computer Technology, innovation and the effect that these have into competitiveness, productivity and overall creation of wealth. In advanced organizations and economies, leading edge practices of knowledge management together with the proper implementation of innovations and ITC are promising sources of productivity growth. The use of knowledge in a broader perspective using tacit and explicit knowledge and ingraining that knowledge into the ideas and ideals of the organization generating a vision and mission of the organization makes a complete new level of development. This, together with the usage of technology generates productivity growth. We have also sketched a process for ITC development and drew conclusions on the practices and culture that should go hand in hand with technology development to make a more significant impact. It is important to notice that some organizations and economies have adopted a new cluster of information work practices and culture by itself that we need to learn and generate in Mexico.

KNOWLEDGE, TECHNOLOGY, INNOVATION AND COMPETITIVENES

At the time that we are writing the present paper, which is at the beginning of 2010, we are seeing a slow recovery from a major global and Mexican economy recession. Global stock markets have plummeted. National banks have implemented a series of measures to revive economies. We saw a great number of failing financial institutions and weak companies globally and in Mexico. In the judgment of many of us, what we are seeing corresponds to an economic cycle of major downturn after a series of past growth cycles. However, and going into deeper inherent questions of wealth and development, many of us wanders what is the basic source of wealth and competitiveness for companies to remain strong, and specially in times of major economic changes. Companies need smarter ways to be managed in order to survive economic downturns and become major generators of wealth. In the present paper we offer an explanation which is not precisely unknown but far valuable to revisit and reinforce more evidence: major wealth is created in the maximized knowledge together with technology development leading into more technology, innovations and competitiveness.

Major successful companies within these industries are, actually, creating a major wealth into the global and regional economies. We could see many examples in other industries in many other advanced

economies, such as the case of Korea, United States, some European countries and others where major developments have taken place. Most of these companies reside in the developed world creating wealth for the countries where they reside.

But then, our next question is: what do we understand as knowledge in an organization enabling this kind of development? – Traditional theories from Frederik Taylor, Herbert Simon, and many others have viewed the organization as machine for information processing. In this view, the useful information is the one that is formally and systematically developed as hard data, codified procedures, and universal principles. With this, the key metrics for measuring new knowledge is hard and quantifiable – increased efficiency, lower costs, and improved return on investment. However, as some of the key authors in knowledge management have expressed, there are highly successful companies in countries like in the United States, Japan, Korea and Europe, with companies like Honda, Canon, Toyota, Apple, Google, Skype, Samsung, Nokia, among others. These companies have developed new knowledge in products and services, responded quickly to customers, created new markets, rapidly developed new products and services, and dominated emerging technologies.

There seems to be different angles in the ways that these highly innovative firms approach to knowledge management. This made them highly successful in implementing innovations and technologies. For instance, Honda has innovated and incorporated new technologies in Honda's innovative urban cars, notably the Honda hybrid cars. Canon tested new concepts that created the personal copier breakthrough in the design of Canon's revolutionary mini-copier. Also, Canon has integrated in different manners innovations and new technologies successfully in creating the now more mature market of digital cameras. Sharp has developed a reputation for creating "first products" that defined new technologies and markets, making Sharp a major player in businesses including liquid crystal displays to customized integrated circuits. Apple created a whole new market together with a complete vertical system with the iPod and iTunes. Google emerged as a whole new concept of searching information and profiting with a redefinition of marketing based on web tools and technology. Skype created a new way of communicating with the use of the web. Samsung has created a range of electronic products with innovative designs, quality and well executed processes. During the 1990s and even today, Nokia has achieved the leading position in mobile communication devices and kept innovating with novel designs and devices. In each of these cases, the angles that these companies took by innovating and incorporating new technologies were not that plain, systematic, and hard as some of their rivals. Innovation and technology incorporated through a different view of knowledge. In these cases, a different approach of knowledge management played a highly effective tool for creating success.

Many people recognize the quality of technology and innovation. But, as explained by many authors, executives at these companies are managing that approach of knowledge management leading to innovation and technology development to the benefit of the company, its employees, and its customers. The key to this approach is the recognition that creating new knowledge is not simply a matter of "processing" objective information. Rather, it depends on developing the "tacit" and often highly subjective insights, intuitions, and hunches of individual employees and making those insights available for testing and use by the company. In this process it is of utmost value the personal commitment of the employees and their sense of identity with the enterprise and its mission. Mobilizing that commitment and embodying tacit knowledge in actual technologies, products and services require managers to feel comfortable managing highly tacit knowledge and plan strategically to implement it.

The essence of innovation is to re-create the world according to a particular vision or ideal. To create new knowledge means quite literally to re-create the company. This is a continuous process of personal and organizational self-renewal. In this type of company, creating new knowledge is not a specialized activity but it is a way of behaving normally in which everyone is a knowledge worker – that is to say, an entrepreneur.

The creation of more wealth, development and productivity in a country, industry, or firm depends on many factors. There are a number of fundamental issues regarding education, power and wealth

distribution, development of science and technology and the industry development. This also includes fundamental developments of creating a culture of investment, entrepreneurship, university-industry links, basic and higher education in science and technology. But in this paper we will focus more at the knowledge management, technology, innovation and productivity development issues occurring in organizations.

In this paper, we have the ideal and ideas that Mexican companies can replicate some of the leading edge practices from highly successful countries in the developed world like in Japan, Korea, European countries and in the United States of America. In Mexico, we need more knowledge in the broader way of seeing it. We need a new breed of companies to behave differently: companies that are able to gather and develop new tacit and explicit knowledge, innovate, and implement and even develop more and new technologies to create wealth and economic development. A fundamental component is a major cultural change ingrained in a new breed of Mexican executives. This new generation must learn more quickly new ideas and accept learning to occur in the organization by allowing people to experiment ideas on their own. This new breed of managers must let go micro-management control to let ideas to flow and strengthen the organization in that open way. This new breed of managers must mobilize the organization by creating an enormous energy letting ideas to be nurtured, tested and to flow around the organization. They should understand changes and make the best out of the opportunities around them as opposed to closed systems, like in monopolies. We need a major cultural change in Mexico towards knowledge management, innovation and management of technology. The paper is organized as follows: Section 2 discusses the traditional acquisition. Section 3 introduces the improved acquisition. Section 4 is fine frequency estimation. Section 5 introduces signal tracking. Section 6 presents results and discussions. Section 7 gives conclusions. Section 8 presents future work.

PRODUCTIVITY AND WEALTH GENERATED BY INNOVATION AND TECHNOLOGY

We have seen so far how knowledge, in a broader respect, including tacit and explicit knowledge, with a broader meaning to mission and vision can impact the organization in generating innovations, new technologies, and reaching a great success. In the present section we will discuss and argue the enormous impact that innovation and technology has in productivity. In the present paper we define productivity as the amount of output per unit input. It encompasses just about everything in the economic activity of the organizations. Ultimately, productivity growth determines living standards, the competitive advantage of companies, and wealth. It is arguably, perhaps the single most-important economic statistic. This was first understood in the Cobb-Douglas formula in 1928¹ and further understood as explanations for “why are some countries richer than others?” which traces back to Nobel award winner Solow’s classic work in 1956.² Solow’s seminal paper suggested that differences in the rates at which capital is accumulated could account for differences in output per capita. Cobb-Douglas productivity formula is the following:

$$Y = f(K,L) = \bar{K}(K,L)K + \bar{\lambda}(K,L)L$$

Where:

$f(.,.)$ = total production

$\bar{K}(.,.)$ = participation of capital in total production expressed as percentage of participation

$\bar{\lambda}(.,.)$ = participation of work in total production expressed as percentage of participation

A significant driver for productivity per employee comes from the implementation and usage of technology and innovations. In a great extent, technology and innovations improve processes, products and services improving significantly and strategically the companies. In the United States of America, while there is a major crisis currently, there is an increased budget deficit, trade deficit, unemployment, and overall economic growth. The only good news is that productivity growth per employee has remained remarkably strong. In fact, according to the U.S. Bureau of Labor Statistics, the annual rate of output per worker in the United States of America has been growing significantly as we could see in the table below.

But also, referring to the development of productivity in other developed nations, it is very revealing to notice growth of productivity in the table below.

As we could see from the table above, there has been a significant increase of productivity in Ireland and Finland. The explanation behind the great increase of productivity in these countries is based on the significant usage of knowledge management practices in their companies and development of technology and innovations. There were a number of outstanding competitors in the telecommunications industry, like Nokia in Finland and some others, and a great number of Information Technology (IT) companies in both of these countries. This discussion leads us to another aspect to evaluate, which is the flow of technologies and innovations coming not only from the large corporations, but from the entrepreneurial arena. Major developed countries have implemented a number of measures to foment entrepreneurship, innovation, higher education, science and research which leads to overall development.

TABLE 1
MAJOR SECTOR MULTIFACTOR PRODUCTIVITY INDEX IN THE US³

Year	Real Value-Added Output div by combined inputs
1997	96.226
1998	97.479
1999	98.737
2000	100.000
2001	100.108
2002	101.764
2003	104.444
2004	107.039
2005	108.782
2006	109.368
2007	110.082

Series Id: MPU490007 Measure:

Multifactor Productivity (Indexes, 2000 = 100.000); Sector: Private Business Sector (NAICS 11-81)

TABLE 2
DEVELOPMENT OF PRODUCTIVITY IN EUROPE AND THE US^{4 &5}

	1975- 1985	1985- 1990	1990- 1995	1995- 2002
Ireland	1,8	2,9	2,6	4,0
Finland	1,5	2,0	1,8	3,3
Greece	-0,2	-0,1	0,1	1,9
Sweden	0,5	-0,8	1,7	1,9

TABLE 3
DEGREE OF APPLICATION OF DIFFERENT EDUCATION, ENTREPRENEURIAL, INNOVATION, AND TECHNOLOGY DEVELOPMENT POLICY MEASURES PER COUNTRY⁶

	1975-1985	1985-1990	1990-1995	1995-2002
Portugal	1,8	3,6	1,3	1,8
Luxembourg	1,6	3,1	1,9	1,6
Austria	1,3	1,9	1,5	1,5
Belgium	1,3	1,6	0,8	1,2
United Kingdom	1,6	1,3	1,7	1,2
Denmark	1,2	0,5	2,0	1,2
France	1,4	1,7	0,6	1,1
Netherlands	1,1	1,1	1,0	1,1
Italy	1,3	1,5	1,2	0,7
Germany	1,2	1,7	1,1	0,7
Spain	1,6	1,0	0,6	0,5
European Union	1,4	1,5	1,1	1,0
United States of America	1,0	0,9	0,9	1,5

TABLE 4
INVESTMENT IN RESEARCH AND DEVELOPMENT AS A PERCENTAGE OF GDP IN SOME OECD COUNTRIES ⁷

	Finland	Spain	Canada	Brazil	Korea	US
Venture capital	***	*	***	*	*	***
Tax incentives	-	**	***	**	**	***
Support for innovation in SMEs	***	**	*	**	**	***
Promotion of University & industry links	**	**	**	**	***	***
R&D grants	**	***	***	**	**	**
Support for higher ed. in Science	**	**	***	*	***	**
Support for Basic science	**	**	**	**	**	**

It is of no surprise that there has been a notable development and application of such measures in some of the major developed economies as opposed to developing countries, and in a great extent, Mexico. These measures lead to higher investment in science and technology. Science and technology investments as a percentage of GDP are expressed in the figure below.

TABLE 5
GLOBAL COMPETITIVENESS RANKING OF SOME OECD COUNTRIES⁸

U.S.A.	1	Chile	28
Sweden	4	Spain	29
Finland	6	Portugal	43
Germany	7	Italy	49
Japan	9	Mexico	60
Canada	10	Turkey	63
United Kingdom	12	Brazil	64
Korea	13	Argentina	88
France	16		

Data from WEF Global Ranking of Competitiveness

Developed countries such as Sweden, Finland, Japan, Korea and USA have invested a major share of the country GDP in science and technology. Interestingly, these countries have consistently scored high in productivity, competitiveness, and also we could see great knowledge management, innovation, and technology implementation and development practices in many of the company examples discussed previously. The World Economic Forum produces a global ranking of competitiveness of countries. The table below has some of the countries discussed in the present paper.

TABLE 6
CONFORMATION OF INFORMATION TECHNOLOGY AND COMMUNICATIONS INDEX

Hardware	Software	IT Services	Comms
Computer equipment	Apps and computer programs	Business Process Outsourcing	Fixed and mobile telephones
Specialized circuits (semicond.)	Operating systems	Integrated comms services	Fixed and mobile services
Motherboards	Middleware	Privacy and security	Satellites
Information storage components	Database software	Storage services	Transmission antennas
Media components	Multimedia	Data Centers	Optic fiber
Other components	ERP's	Mainten. and tech. support	Modems
	CRM's	Strategy and IT architect.	
	Manag. Info. Systems		
	Dec. Supp. Systems		

THE RELATIONSHIP BETWEEN INFORMATION AND COMMUNICATIONS TECHNOLOGY (ICT) AND WEALTH CREATION

The present section covers an analysis of the relationship between Information and communications technology with overall wealth generation in the different countries. In our research, we have applied various methodologies to try to find relationships using logic, empiric, intuitive and statistical methodologies. We have collected data in the following categories.

We have experimented with a regression exercise using the “stepwise” methodology. This methodology is based on the procedure of eliminating variables of which Project is a list that effectively have an influence over the model based on the Fisher’s “F.” The elimination of variables is made through the adjustment of the model (Fisher’s F) for every variable.

We have found based on the variable elimination procedure “stepwise” the following:

- In Brazil the four subsectors influence heavily GDP
- In Russia Communications
- In China Communications
- In India IT services
- For Mexico and the United States of America there was a study based on the correlations of all of the subsectors of IT with competitiveness
- In United States of America the four subsectors are highly correlated with productivity and GDP

TABLE 7
CORRELATIONS MATRIX OF USA WITH ITC AND WEALTH CREATION

	Product- tivity	Hardware	IT Serv. Software	Comms
Productivity	1	-0.6836	-0.6799	-0.6255
Hardware	-0.6836	1	-0.0121	0.7326
IT Serv. & Software	-0.6799	-0.0121	1	-0.0633
Comms	-0.6255	0.7326	-0.0633	1

Data source: OECD, World Bank databanks

In Mexico we have found that the ITC sector is not as linked with productivity as in other countries. Therefore, it was not related in the same way with GDP either. This result has led us to think that there is not an adequate absorption or adoption and usage of technology.

TABLE 8
CORRELATIONS MATRIX OF MEXICO WITH ITC AND WEALTH CREATION

	Investment in ITC	Sector Size	Productivity
Investment in ITC	1	-0.7477	-0.1653
Sector Size	-0.7477	1	-0.0625
Productivity	-0.1653	-0.0625	1

Data source: OECD, World Bank databanks

We also have formed another index, which we call “Technology Competitiveness”, which covers the following data found in Table 9. In this index, it is notorious to have 2 important blocks again. The first block corresponds to highly development countries such as USA, Japan, Taiwan, Hong Kong with an index higher than 5 points. The second block corresponds to developing economies. Its index is on the proximity of 3.5 points. These countries have again the challenge to make deep structural changes into their economies and close the gap with the developed countries.

Based on data from Brynjolfsson from more than 1,167 large U.S. companies, there is a statistically significant correlation between the intensity of IT used in a company—IT capital per worker—and the company's overall productivity. There is an emerging consensus among economists that IT has been the biggest single factor driving the productivity resurgence, although debate continues about the exact magnitude of its contribution.

From the study, it is easy to appreciate the relationship between IT and productivity. It is also important to notice the significant variation of performance between companies. In Brynjolfsson and Hitt research, they have visited some of the companies sponsoring the MIT Center for eBusiness to review their practices and understand with more in-depth how IT drives productivity.

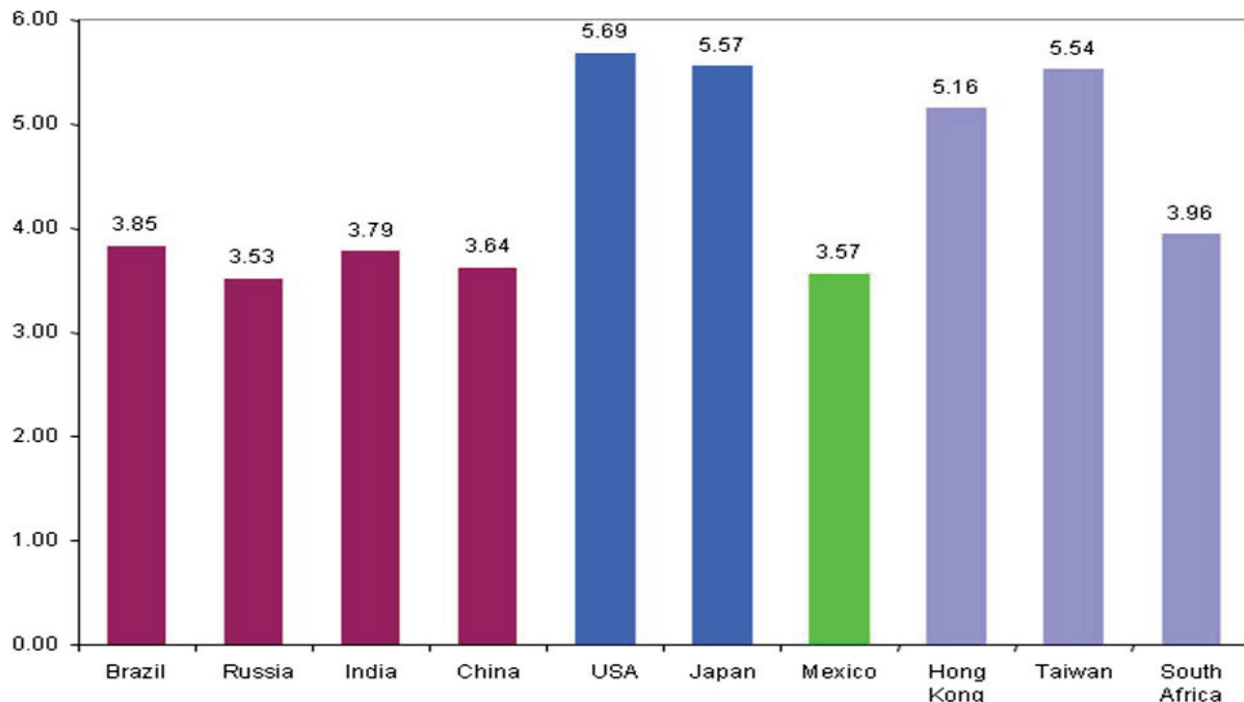
Among these companies, at Cisco Systems, they have observed an emerging "Internet culture" of distributed information flow, worker empowerment, and ubiquitous access to Web-based data for employees, suppliers, and customers. At United Parcel Service of America, they saw the importance of end-to-end integration of systems and a focus on execution. At Dell Computer, they witnessed the transformation of the factory floor using new production-planning systems and a dramatic reduction in work-in-process inventories. Wal-Mart uses data from its point-of-sale system to decide which products to stock and passes this information on to suppliers so they can improve their production planning. All of these practices drive productivity forward.

TABLE 9
TECHNOLOGY COMPETITIVENESS INDEX

Teledensity (15%)	Higher Education and Training (15%)	Business Sophistica tion (35%)	Business Innovation (35%)
Connections	Educational programs quality	Quality of suppliers and distributor	Intensity and quality of research and development in businesses
Usage intensity	Knowledge sophistication	Supply chain integration	Leading edge technology usage
Infrastructure saturation of ITC	High value- added jobs	Usage of technology in business processes	Change practices due to business innovation
Mobile Penetration			
Internet penetration			

Source: ITU, WEF (Global Competitiveness Index)

FIGURE 1
TECHNOLOGY COMPETITIVENESS INDEX DEVELOPED IN
THE PRESENT PAPER



As a preliminary conclusion and from reviewing basic data from the USA, mainly from established companies, one could see that there is indeed an important relationship between productivity and IT development. There is a correlation of -8.21 between investment in science and technology as a percentage of GDP in 2005 and competitiveness in the OECD countries with 2007 data. The following figure plots the relationship between the ranking of global competitiveness and R&D investments as a percentage of GDP together as a linear function.

The countries that have been mentioned with companies having outstanding practices of knowledge management, innovation, and technology score high on competitiveness like the cases of Finland, Japan, USA, Sweden, Germany, Canada, UK and France.

A particular example of a country where there has been a great development in terms of wealth, competitiveness and technology is South Korea, which used to be considered among the “developing” countries a couple of decades ago and currently is very close to other developed countries as we could see from the graph. On the other hand, there is a major gap between these developed countries and the rest of the countries. It is notable to see the difference between Argentina, Mexico, Turkey, Brazil and to some extend another block of countries with Italy, Portugal, Chile and Spain, but most of all to see the difference between the least developed countries and the first block of the more developed countries. There seems to be a consistency in terms of investment in R&D and competitiveness. Competitiveness, investment in R&D and innovation seems to go hand in hand.

A BRIEF EVALUATION OF THE CURRENT STATE OF MEXICO IN KNOWLEDGE MANAGEMENT, INNOVATION AND TECHNOLOGY

As one could see from some of the data earlier presented, the current situation with knowledge management practices, innovation, technology and therefore productivity is not encouraging in Mexico when compared to other countries. Mexico as an economy and Mexican companies do not seem to adopt

practices from developed economies, engage actively in innovation, invest in developing and adopting technology. As a result, it is notorious the development of competitiveness in Mexico has been dropping significantly during the years at it could be seen in the chart.

It is notorious that even facing an increase in investments, Mexican organizations have not increased productivity accordingly. The explanation behind the inability of increasing productivity could be explained partly for the lack of investment in technology and R&D.

We believe that education plays a fundamental factor in the country development. According to the United Nations, literacy rate in Mexico is 92% in 2002. It scores lower than in developed economies were in average this percentage is higher than 97-98%. Countries with high levels of education, and mostly by using technology there could be more productivity. There is more ability in people to learn and actually practice leading edge practices, understand more productivity fundamentals and be more comfortable with the use of technology. The pillar of the country's education starts with elementary school and thereafter the rest of the education system.

Most recently, the Mexican government has been reaching and implementing agreements with the nation-wide public schools teachers union to improve basic education. There was an evaluation in Mexico of the status of elementary education, where a great majority of public school teachers of elementary school failed an exam to monitor the level of basic teaching knowledge. Thereafter there were a number of measures taken to improve the system. However, these measures have been difficult to implement due to significant riots in some states, significantly in Morelos, where the local unions have been blocking highways and streets in Morelos state but also in Mexico City. There is a great road ahead in Mexico to improve basic education, and thereafter improve the rest of the system. However, the government is progressing to some extent in what we consider the right direction.

FIGURE 2
DEVELOPMENT OF MEXICO COMPETITIVENESS INDEX

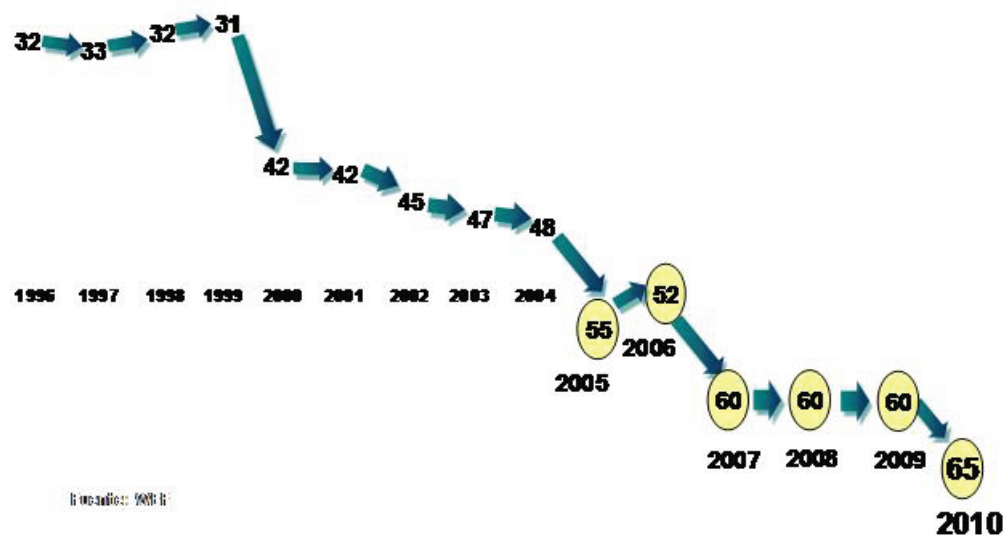
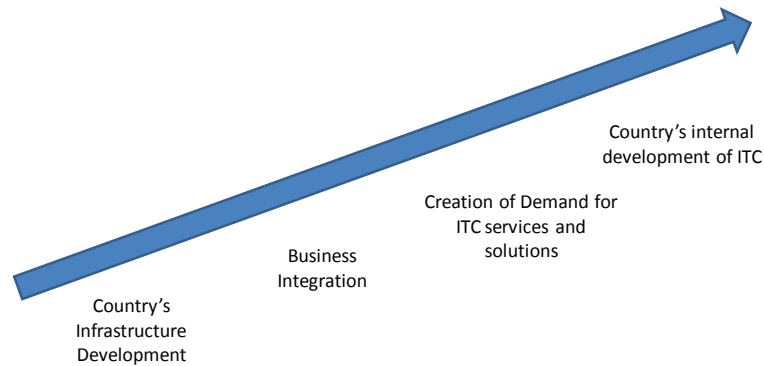


FIGURE 3
4-STAGE PROCESS OF ITC SECTOR DEVELOPMENT IN MEXICO



After our brief revision of education we need to take a look at the productive environment in companies. In Mexico there is a history of domination of few companies in quasi-monopoly from various industries, preventing innovation, integration and development of new technologies and also well documented in the literature. Also, power and wealth is distributed in an uneven manner in comparison to developed countries. The reason why innovations, more technology usage, and investments are prevented in large companies in Mexico has been explained by a low culture of company development. There has been a minority group controlling a great number of the large Mexican companies. This also brings over-control from managers, the prevention of creativity, domination of top-down processes, lack of knowledge management practices in the organizations and lack of overall managerial practices from leading edge organizations globally.

We believe that the current situation in Mexico is a result of factors including education, power in large and high impact private and public organizations, culture of innovation and technology development, and overall culture that affected into under-development in the country.

As mentioned earlier, there is currently a global economic crisis and significantly affecting the United States of America. Earlier studies have proven that Mexican GDP, its components and even real money balances has a robust long-run relationship with the US economic activity and the bilateral real exchange. Therefore, we can expect a significant effect from the current crisis to take place in Mexico. In Mexico, we are at a real risk of more poverty and crisis.

Considering the country's under-development gap with developed countries and their developed organizations, the hope is that there is a great room for improvement in our organizations with in turns has repercussions in developing competitiveness, productivity and overall development. But improving technology usage and overall development together with innovation might alleviate somewhat the problem as discussed in the section below.

HOW TO DEVELOP MEXICO TOWARDS MORE KNOWLEDGE, TECHNOLOGY, INNOVATION AND PRODUCTIVITY?

As we have been expressing in the present paper, an organization is an information organism generating wealth and development. It gathers, processes and develops information from the market, suppliers, and employees. It takes decisions, implicitly and explicitly. It then communicates and acts on those decisions. Many times, the flow of information speeds up dramatically the value chain increasing

performance of a highly automated operation. But the real gain is when this information moves from the operational to the strategic level to create a whole new range of opportunities for the company. In order to make this information meaningful, information must be abstracted in very relevant and action-oriented manners to not overflow managers with a bucket of data. In the information economy, the scarce resource is not information, but the capacity of humans to understand and process that information. Therefore, it must be effectively implemented with leading knowledge management practices.

The Information Technology and Communications (ITC) sector in Mexico is fundamental in creating this new environment and culture. We believe that this particular sector needs to be nurtured and developed. We see the process of strengthening the ITC sector in Mexico in a 4-stage process as illustrated below.

The 4-stage process starts with the country's infrastructure. There is a basic need for infrastructure equipment allowing for instance a variety of fixed and mobile voice and data communications. This is currently the stage in countries like China and India where the communications sector has the highest growth at the moment. This is also the situation in certain scattered rural areas and poor communities in Mexico where basic infrastructure is not present. Together with the information networks infrastructure there needs to be higher investments in hardware. This is in order to compete with the great changes in value chains, processes, products, services and a range of business transactions and interactions. Therefore, there is a need to acquire more hardware to offer the required integral technology infrastructure that supports the new business models based in knowledge, collaboration and innovation.

After covering the basic infrastructure needs of the basic communication networks and hardware, services of information technologies accelerate and grow significantly, becoming a major development drive for the country. The development of information technologies is fueled when processes are transformed and technological tools add more value. The transformed processes include virtualization of relationships between customers, suppliers, and many other business relations. The automation of transactions generates higher usage of Internet as a communications channel and it is a source of new business models and accessibility to new markets. Technological tools such as Enterprise Resource Planning (ERP) software, Internet, mobile telephony, mobile computing, Customer Relationship Management (CRM), Business Intelligence, financial analysis tools, electronic payment systems, new business models based on Internet among others drive this business integration development.

Information Technology and Communications (ITC) services can grow in a more accelerated manner once the economy has covered basic infrastructure and business integration needs. This integration, as we have seen in the United States in the IT sector, indicates that the country is achieving higher degrees of technological development and higher value added. As a consequence, there is a much higher demand and development of Information Technology and Communications (ITC) services. ITC services is a sector with a high degree of sophistication and develops advanced business models. This in turn generates more wealth and development in the country.

New customer-centric business models using intense collaboration, innovation and communications result in higher degrees of value-added. The sophistication of business and governments networks with the higher complexity of processes, transactions and interactions demand more complexity and value-added. Value chains, distribution, competition for the customer satisfaction drive this cycle significantly. This develops in an important manner the technological infrastructure and its usage.

Also, we recommend more investment in R&D, including funding research at university together with strengthening the links with industries. Venture capital and risk management models should be adopted in Mexico. A major investment in R&D, technology development, and entrepreneurial activities create wealth. The government can play a major role in providing funds for these activities and promoting mechanisms where the ITC development phases takes places, motivating infrastructure development, business integration, creation of demand for ITC services, and overall development of ITC. The government has also a great capacity to support scientists, investors and new entrepreneurs to benefit

significantly from this setting. The country needs to invest more than 1-2% or more of GDP in R&D development like industrialized countries.

Existing companies in Mexico need an integral transformation towards more added-value. To increase a company's information metabolism, it is not enough to simply adopt technology to automate parts of business processes or even automate whole processes without a strategic knowledge management technique. Firms must consider how the rest of the organization will be affected in a comprehensive manner. Business processes and decision-making systems are inevitably linked. Most business processes have evolved during a time when information-processing costs were there is a radically higher use of technology. But most importantly, there are a number of other high value-adding assets that are developed together with ITC, innovation and knowledge management as shown in the figure above.

Given the unprecedented development over the past 20 years, it is not surprising that the decision-making structures that were optimal in the 1970s and 1980s are not optimal today in the global competitive arena. Therefore, we need to look not for the best practices of the past, but for the next practices in the future of developed organizations. There is more research needed in order to better understand how Mexican companies could learn from leading edge practices and culture from abroad.

CONCLUSIONS

The main conclusion is that in advanced economies, leading edge practices of knowledge Management together with the proper implementation of innovations and technology have lead into productivity growth. It makes a much higher direct contribution to the overall performance of a company or the economy when all of these aspects are combined. We found evidence of a substantial relationship between leading edge practices of advanced countries and advanced companies produced significant benefits and wealth. The use of knowledge in a broader perspective using tacit and explicit knowledge and ingraining that knowledge into the ideas and ideals of the organization generating a vision and mission of the organization makes a complete new level of development. Organizations that are unusually productive have overcome the adjustment costs associated with organizational innovation. They have adopted a new cluster of information work practices and culture by itself that we need to learn and generate in Mexico.

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