The concept of eReadiness and its application in developing countries Methodological problems and results for the eReadiness of Nicaragua

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Abstract

Originated by the intent to provide a unified framework to evaluate breadth and depth of the so called Digital Divide between more and less developed or developing countries, different evaluation guides made their appearance, claiming each to be a useful tool both to diagnose current situation and to orient steps to narrow and shallow the Divide.

The Harvard Guide *Readiness for the Networked World* for instance defines a framework of five interrelated categories with 19 sub-topics, where a grading of each sub-topic into one of 4 stages supposedly results in inter-country comparable eReadiness indicators and strategies to improve eReadiness.

The presented paper claims that –though well intended- many of these approaches fail in the attempt as they ignore internal divides within less developed countries and their nature. Moreover they don't pay sufficient attention to the different cost of opportunity structure in developing countries compared to more developed countries.

As a result the recommendations derived from these approaches may turn counterproductive, as they don't differentiate actions between those segments of society and economy that have to go digital to at least maintain their level of competitiveness in a globalized economy and others segments, where not always the direct digital option will be the most cost-effective. Worse, focused on end users, they deviate attention from possible indirect solutions, which using intermediates might bridge instead of narrow the Digital Divide.

Background

In March 2002, the Nicaraguan National Chamber of Industries (Cámara de las Industrias de Nicaragua, CADIN) commissioned an eReadiness-evaluation of Nicaragua based on the Harvard Guide**.** The evaluation should serve as background and founding material for the implementation of a National Development Gateway as part of World Bank's initiative for Global Development Gateway. The authors decided to extent the scope of the evaluation into a general, geographically and by sectors disaggregated survey about the use of Information- and Communication Technologies in almost all segments of social activities in Nicaragua.

Right from the start the framework proposed by Harvard proved insufficient as it limits itself to gather some facts about penetration and usage of ICT –mostly in the form global averages - neglecting completely the socio-economic context and historical and cultural background, which obviously condition penetration and usage. As result many indirect suggestions for improvement fail in their effectiveness as they either point too low –for already more advanced segments of society- or too high, when the most elementary preconditions for effective ICT usage are missing.

The authors therefore decided to include additional data –mostly socio-economical- in the study, data that permits to appreciate the raw indicators based on the Harvard-guide in their respective context. The assessment includes the resumed experiences of about a dozen in-depth studies by the authors related to the usage of ICT in private and public institutions, that facilitated the interpretation of the indicators. It is also based on an analysis of the reasons for success or failure in the 13 years passed since **.ni** was created in 1989 as forth ccTLD of whole Latin-America, on the initiative of one of the authors (Mr. Hopmann), who has followed the development of ICT in Nicaragua closely, since then.

The following text presents some parts of the findings of the evaluation.

network Access

Information Infrastructure

Basic Data	
Main lines / 100 inhabitants	3.00
Fixed lines / 100 inhabitants	3.00
Installed lines / lines in use	227.098 installed / 158.928 in use
Cellular	174.998, Prepaid 144,649 Postp: 30,349
Cellular / 100 inhabitants	3.3
Public Telephones / 100 inhabitants	0.053
Percentage of digitalization	99,3% served by Digital Exchanges
Cable Clients TV / 100 inhabitants	1.42
Tariffs	
Tariff Local Call – 3 Minutes	0.08 $US
Tariff Large Distance National – 3 Minutes	0.30 $US
Tariff Large Distance US – 3 Minutes	3.10 $US

The telephone-infrastructure of Nicaragua was almost completely modernized from 1992 to 1996: the switch-technology went digital, in Managua and another densely populated area fiber optic rings were installed as principal backbone, major parts of the distribution network were upgraded to comply with ISDN-B requirements. Started 1996 the bidding procedures to pass the telephone service from state to private ownership, the process of expansion and renovation was stopped and has yet to be reassumed by the new private operator, who finally took over in 2001.

The infrastructure of telecommunications is geographically concentrated in the Pacific region, leaving a larger part of the national territory without any service. More than 60% of the service capacity is installed in the capital, Managua, though Managua represents only 22% of total population and 34% of those with sufficient economic capacity to pay for the service.

An analysis of economic data for urban-like places revealed an unsatisfied demand of some 166,000 main lines at least –more than doubling those in use. There is an additional rural demand with sufficient purchase power of at least 66,000 main lines. However 88% of possible demand and 94% of already installed capacity concentrate in only 40% of the territory and 28% of municipalities, such that most likely –economy of scale- expansion of traditional services will concentrate first on these areas. However, for about 65% of the population, those living below poverty line, a private telephone is and will not be feasible.

In order to reach out to rural areas and totally unconnected municipalities including some with sparely populated vast areas, novel solutions will be necessary, which combine digital and classical services using different technical options from medium-range wireless networks or latest Cellular technologies like GPRS or UMTS. Satellite-links or fiber optics as part of high voltage energy transmission lines may serve to feed central hubs. In some currently unconnected villages, local cable TV may be upgraded to cover locally last mile both for digital and classical services.

Summary: there is a huge unsatisfied demand –compared to existing services-, which can be covered by traditional technology. There is an additional but smaller unsatisfied demand in rural areas and more remote areas, which however will need the use of unconventional technologies for telephone services. Without these types of extension about 60% of the population will have no technical means to connect to Internet. Yet even if the technical problems are solved, individual access to communication-services is beyond reach for about 65% of the population, who can't afford it.

Internet Availability

Basic Data		
Internet Service Providers (II. Tier, resellers)	17	(8, 9)
ISP with presence outside Managua	5	
Points of presence outside Managua	11	(of 152 municipalities)
Individual accounts (Managua)	~ 14,000	(11,000)
Clients with dedicated line (Managua)	~ 300	(280)
Clients by TV-Cable (Managua)	~ 2500	(2400)
Capacity of external connection to Internet	17 Mb/s up- & 32 Mb/s downstream	
Dial-In Lines available	~ 1,319	
Numbers of domains in .ni (with national service)	~ 1921	(1385)
Tariffs		
International Circuit equivalent to E1 (2,4 Mb/s)	12 – 18,000	$US monthly
Bi-directional VSAT link 64Kb/s	580 – 800	$US monthly
National circuit 256Kb/s with reserved 1:1	2,400 – 2,900	$US monthly
Local circuit 256Kb/s with reserved 1:1	1,100 – 1,800	$US monthly
Local TV-Cable 64Kb/s without reserve	58 – 64	$US monthly
Local Dial-In	19 – 28	$US monthly

As shown above, Internet is at this moment in first place used by customers and clients in the capital Managua. Moreover, the extremely high international connection-costs –12 times at least for similar bandwidth in the US-, oblige local 2nd tier ISP to oversell their external capacities. As ratio for services without reserved bandwidth 1:16 is standard, a ratio of 1:32 is no exception. Due to this policy, an average dial-in user receives on average only 4Kb/s as service, even if for instance a local TV-cable connection would permit much more.

External connections are additionally expensive, as they cannot use the national landing-points for the ARCOS fiber-optic-link in the Caribbean and hence have to use first a regional Micro-Wave-link to Costa Rica before getting onto a fiber connection. Mostly for political reasons –both national and imposed by the international agencies involved in the privatizing process of national Telephone-Company-, there exists until now no backhaul, which would link the Caribbean landing points with the pacific zone. Another cost-driving factor stems from the fact that each 2nd tier ISP maintains a specific relation with his 1st tier provider in the US. A joined lease of bandwidth with better economy of scale would require multiple party arrangements.

National circuits too are extremely costly, as there is no national data-transport backbone. Either this obliges ISP to setup their own private Microwave-links or to use individually leased point-to-point data-circuits from the national telephone-company. Again, these solutions violate most simple principles of economy of scale. The extension of TV-cable services with bi-directional use reduces some of the problems, though only in a very limited area. Individual usage by means of dial-in outside the metropolitan area or where a there is no local PoP, results in prohibitive monthly phone-bills of 98 $US or more.

Beyond the reach of Telco-services, the only options are currently VSAT connections, which due to their very nature –burst-service, latency, limited bandwidth and costs- are not very attractive.

Summary: under current circumstances priorities for a national policy should be:

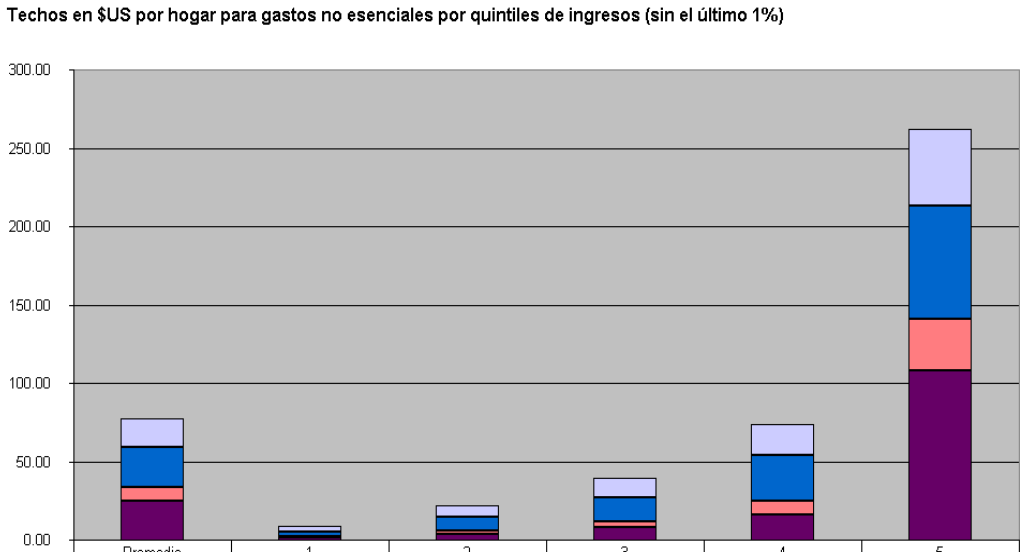
(1) A national data-transport network connected to the ARCOS fiber-network
(2) Local points of presence of Internet wherever technically possible
(3) Unconventional integrated digital solutions for the last mile in remote or rural areas as mentioned already in the previous chapter
(4) Where VSAT solutions remain as only option, they should be scaled and implemented as possible roots for wireless (or TV-cable) municipality-networks.

Internet Affordability

	Place	Hours monthly	Price per hour	Monthly Costs
1	School Telecenter with subsidies	20	0.30 $US	6 $US
2	Public Telecenter with subsidies	20	1.20 $US	24 $US
3	Commercial Telecenter	20	2.20 $US	44 $US
4	Home, by local dial-in	20	2.70 $US	54 $US
5	Home, long distance call	20	6.15 $US	123 $US
6	Home, by TV-cable	-		58 $US

The above costs are based on the average of current offerings in Nicaragua. They include telephone costs. A detailed cost-calculation for Telecenters resulted in minimal costs of 0.50 $US per computer and hour, due to high connection and energy costs. Including personnel and rent of space, they reach 0.80 $US to 1.40 $US per hour. With depreciation and a small profit, 1.50 $US to 2.20 $US are necessary. It is therefore very unlikely that more competition will reduce current averages.

Let's have a look on current thresholds (or ceilings) for Nicaragua family budgets. Each group shows the average of assigned budget for a group of 20% ordered by total family income:



	Promedio	1	2	3	4	5
Otros bienes y servicios	18.43	3.58	7.42	11.99	20.19	49.25
Enseñanza	25.24	3.35	8.95	15.67	28.71	72.46
Esparcimiento, equipo y servicios recreativos	8.93	0.60	1.88	4.00	8.72	32.69
Transporte y comunicaciones	24.93	1.51	3.84	7.67	16.37	107.84

The combination of both tables shows, the 20 hours Internet at home exceed for 80% of the families all other related budget positions, namely for education (enseñanza), Transport and Communication or other household necessities (Otros bienes y servicios). Still 60% would have to spend more than their complete family budget for education if using a subsidized public telecenter. Finally, even usage at a low-cost subsidized school-telecenter would be beyond what is affordable for 40% of all families. It is noteworthy that Nicaragua government currently spends about 6 $US total per student-month for public primary or secondary education, which rules out massive public subsidies.

Summary: as bitter but inevitable consequence, there is absolutely no way by which direct access to Internet for the large majorities can be made affordable, not even –we will touch this point later again- by school based telecenters. Other ways of bridging the Digital Divide instead of narrowing it have to be found. Yet the same comparison reveals also, that there is still an untapped high potential of family users, between 130,000 to 170,000 families, which have the necessary resources for an individual email-account, compared to current 14,000 in existence.

networked Learning

Kids access to schools in 2001

Population aged 7-12 (Primary)	**~ 809,793**	**16% of total population**
Attending Primary Education	~ 838,437	104% of to age-group
Average Grade leaving	4th grade	52% leave with this grade
Students completing Primary	6th grade	29%
Population aged 13-18 (Secondary)	**~ 735,953**	**15% of total population**
Attending Secondary Education (Technical)	~ 321,649 (77,020)	54% of age-group
Students entering Secondary		28% (80% completed Primary)
Students completing Secondary (relative)		11% (48%)
Population aged 19-24 (Tertiary)	**~ 595,002**	**12% of total population**
Students attending Tertiary	~ 85,000	14% respect to age-group
Students entering Tertiary		7% (60% completed Secondary)
Students completing Tertiary (relative)		2.5% (37%)

For developing countries it is not obvious, that all children and youth do have access to a complete school education. Actually the situation is by far more dramatic. In Nicaragua, and not only in Nicaragua, a larger percentage of children does not attend let alone complete school for many reasons. Among these reasons are that there is simply no school to attend at reasonable distance, say 3 hours of walking, or because family economics prevent children from assisting.

Functional illiteracy, meaning the inability to understand and execute simple written instructions or to write a simple story about a daily life event, scores high in many of these countries; in the Nicaraguan case for at least 50% of adult population. We will return to this issue later on, when analyzing networked Society.

The above statistics shows that this will not change in the near future: 31% of whole population corresponds to ages for primary and secondary education, 43% are aged less than 24 years. However, currently 52% leave school before acquiring most basic literacy skills. The over-percentage of 104% with respect to the age group underlines this fact, as a large number of students continue assisting primary education well beyond the normal school age due to many interruptions of a normal assistance program.

It has been estimated that fewer than 75% of the corresponding ages attends basic education (6 years primary, 3 years secondary or technical education) and less than 20% completes this cycle. Comparing rural areas or remote areas with Managua, the gap widens: average completing grade is equivalent to 2.5 and 2.7 years, whereas Managua 'excels' with 6.6 years.

The coverage of curriculum content by classical printed materials like textbooks, readers etc. is still insufficient. In many cases the prevailing teaching and learning model –from primary and unfortunately up to the university-level – therefore belongs at most to the early XIX century, before industrial printing made books affordable: the teacher literally dictates his lesson or lecture and students are copying the most basic information about the subject into their notebooks. These prehistoric learning-models were reinforced by the period of revolutionary unrest from 1978 to 1990, where there were almost no books available at all.

Summary: Under the presented conditions the most effective global promotion of eReadiness consists in extending coverage of the school-system, increasing the percentage of regular students and the percentage of students, who complete at least primary education in rural or remote areas or the basic education in the more developed urbanized areas. Otherwise, as shown, Nicaragua will continue indefinitely as illiterate society. Therefore, the impact of any use of ICT in schools should be evaluated against these fundamental targets.

Schools' Access to Information and Communication Technologies

Primary Schools (Private)	**~ 5,545 (1,112)**	
Enrollment	~ 727,731 (138,785)	
Graduates 2001	~ 81,411	
Teachers in public schools	~ 22,096	
Average Salary Public Teacher	~ 87.3 $US monthly	0.52 $US per hour
Average Spending per student	~ 44 US$ yearly	
Secondary Schools (Private)	**~ 429 (502)**	
Enrollment	~ 228,169 (108,817)	
Graduates 2001	~ 38,695	
Teachers in public schools	~ 5,149	
Average Salary Public Teacher	~ 110.00 $US monthly	0.57 $US per hour
Average Spending per student	~ 68 US$ yearly	
Technical Education (Private)	**~ 37 (~251)**	
Enrollment in year programs	~ 12,373 (4,244)	
Enrollment Training Courses	~ 58,542	
Monthly Costs Computer-Lab	**Min. 1,323 incl. Internet**	**0.52 $US per hour**
N. Labs in Primary (private)	*18* (~ 50) *projected*	3 - 4 with Internet
N. Labs in Secondary (private)	8 + *45* (~ 200)	~ (70) with Internet
N. Labs of in Technical (private)	26 (~ 100)	3 (~ 10) with Internet

The table shows that only an insignificant portion of all public schools has computer-labs, though about 84% of private secondary schools, yet even most of these do not have Internet-connectivity. In primary education computers labs exist only in a very few, most expensive elite-schools. The student per computer relations ranges from 34.8 as average in private secondary to planned 75 at least in public secondary. 70% of public and about 80% of private technical educations centers have a computer-lab but most of them without Internet connectivity.

The above figures about annual spending in public primary and secondary education and the per-hour costs of a class-lesson compared with a single computer-hour should make it self-evident that it is neither cost-effective nor feasible to equip all public schools or even a significant fraction of them with their own computer-labs. It would mean at least doubling the current public education budget only to sustain computers. At least within primary education it would be moreover counterproductive to ask parents to wholly o partially assume the costs of these labs. Looking at the respective thresholds for family spending, it is beyond their capacity and would decrease instead of increase the percentages of retention and graduation.

Again other alternatives to bridge instead of narrowing the Digital Divide are needed. For instance public education could concentrate first on teachers and their qualification instead of trying to leap-frog with insufficient resources. Covering a substantial part of faculty with computer-usage and access to increase quality and relevance of lecture-content appears both feasible and cost-effective. Likewise multipurpose centers, which serve as school-labs and community-labs and are operated inside campus but with participation of other public or private entities, might reduce the fixed-costs of school-telecenters to sustainable levels.

Summary: currently only an insignificant number of public institutions for primary and secondary education have access to Internet. For public primary or secondary education, rapid expansion appears neither feasible nor cost-effective. Other ways to bridge the Digital Divide therefore have to be found. In case of new or existing Labs for private secondary and technical education rapid expansion of Internet-connectivity seems however achievable. Internet would not change substantially operation-costs, at least within the capital Managua or places with local PoP.

Enhancing Education with ICT

Unfortunately ICT in education in many cases is reduced just to basic skill-training in manipulating standard packages, sometimes complemented by computer-delivery of old contents without changing much the forms and methods of learning, e.g. the cycle of passive reading and then answering feed-back questionnaires. The off-place delivery using Internet does not improve these misconceptions. This old fashioned pedagogic approach –though promoted by some of the biggest players in software-market- does not explore the rich facilities a computer offers as a device to help in problem-solving: from finding the appropriate materials in the internet, passing through modeling situations and answering by simulation what-if questions, putting thereby mathematics to practical use, up to the almost unlimited possibilities to allow inter-person and inter-group collaboration at distance in time and space.

According to some US-surveys, this way of using computers turns out to be a problem even in many if not most US-high schools. It is no surprise that the eReadiness-study found the same approach in almost all educational establishments in Nicaragua. It's however alarming that the only official Government-project –the aforementioned project of installing computer labs in public schools- only claims to have more advanced objectives. However its concrete implementation does not go beyond elementary computer skill training, despite the fact that the neighboring Costa Rica started already 14 years ago a systematic project to introduce computational education starting in primary education. The project took the work of Pappert and his colleagues at MIT as methodology framework and covers meanwhile all public primary and secondary schools in Costa Rica. Developed in a very similar cultural context, the Costa Rican experience could have served as very-close-by model for the Nicaragua project.

In technical education, the computer laboratories are almost exclusively used for technician-level careers and courses, definitively not as supporting element for other training-tracks. Moreover and despite of its name, Technical Education means 67% courses in Commerce and Services subjects, only 21% in technical subjects and 12% in different types of agriculture or related subjects. None of these 2 to 3 year programs includes the usage of a computer as a problem solving device in their classes, not even in classes of accounting or financial analysis.

With rare exceptions the same pattern is repeated at university level; computer-labs serve in first place for computer-related programs and otherwise only for homework, using Word and EXCEL. This usage pattern does not vary between public and semi-public universities, where, additionally, there is a substantial shortage in computers - and private universities with close to sufficient resources.

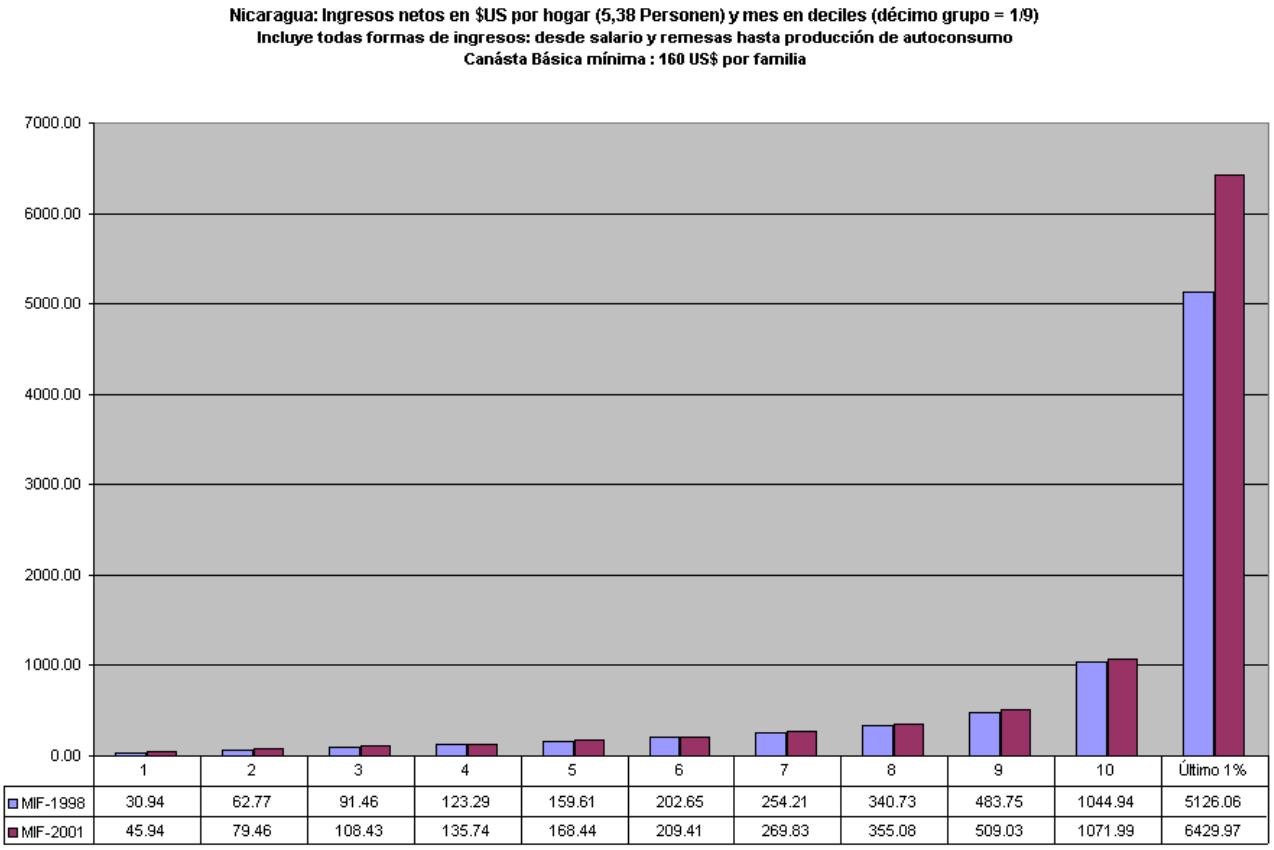
Summary: Besides shortage in computing-resources and lack of access to Internet, the Nicaraguan education system on all levels faces a deeper challenge, the challenge to change the focus from memorizing facts and simple deduction rules in school education to a more constructive approach, where specifically in primary education learning to learn should be a central point. With respect to technical education and tertiary (university) education, one may simply state that the average Nicaraguan professional or technician still receives an formation as if the computer did not exist beyond typewriting and pocket-calculations, a preparation that makes him a misfit for XXI century even before graduating.

Nicaraguan Society

Demographic and Income distributions

Distribution of population according to age, gender and area

~ 5,071,649	TOTAL			URBAN			RURAL		
Age	**Both**	**Male**	**Female**	**Both**	**Male**	**Female**	**Both**	**Male**	**Female**
00-09	30.2%	15.4%	14.8%	16.0%	8.1%	7.8%	14.3%	7.2%	7.0%
10-19	24.3%	12.3%	12.0%	13.6%	6.8%	6.8%	10.7%	5.5%	5.1%
20-29	17.4%	8.6%	8.8%	10.3%	4.9%	5.4%	7.1%	3.7%	3.4%
30-39	11.6%	5.6%	6.0%	7.3%	3.4%	3.9%	4.2%	2.2%	2.1%
40-49	7.7%	3.7%	4.0%	4.7%	2.2%	2.5%	3.0%	1.5%	1.5%
50-59	4.3%	2.1%	2.2%	2.6%	1.1%	1.4%	1.8%	0.9%	0.8%
60-69	2.7%	1.3%	1.4%	1.6%	0.7%	0.9%	1.1%	0.6%	0.5%
70+	0.4%	0.2%	0.2%	0.2%	0.1%	0.2%	0.2%	0.1%	0.1%
TOTAL		**49.8%**	**50.2%**	**57.1%**	**27.7%**	**29.5%**	**42.9%**	**22.1%**	**20.8%**



It does not make much sense to talk about *networked Society* without talking about society first. The above table shows that purely due to demographics, 30.2% of the population is not a possible candidate since hardly kids under the age of 10 will be considered as regular Internet users. Harvard like global averages therefore have a bias for 'older countries', as already different demographics produce different results in the indicators.

Second, rural areas have –as we explained before- no access at all even to basic communication services, as they do not have access to grid-electricity either. This implies that at most 41.1% (urban and older than 10 years) are potential clients for Internet-usage. The distribution between rural and urban is significantly different in industrialized countries. Using a base adjusted to urban population above 10 years, –the only comparable to industrialized countries-, the Per population indices of Harvard would have to be doubled to be comparable.

The second graphic shows clearly, that about 50% of Nicaraguan families live below misery level (1 $US per person and day), which means actually they cannot even afford the daily diet for adequate survival. Another 35% live on less than 2 US$ per person and day, which means that basic needs like health, education etc. can not be completely covered. Please note that all types of income –including crops from the backyard- were considered as income for this statistics. As a result, at most 15% of all families have an income that could make Internet an affordable and reasonable choice.

Applying the 15% to the 41.1% of potential users limited by age and geography, we end up in about 6%, to whom Internet is useful, technically possible and reasonably affordable. It might be a little bit higher, say 10%, as poverty-distributions differs between rural and urban areas.

Law, Law-Enforcement and Social Organization

With respect to social structure, the Harvard methodology grossly underestimates the impact of functional illiteracy. Internet has as background not only individual literacy but a literate society, a society in which – possible due to a very low rate of functional analphabets - social organization can be based on written, formal rules and communication.

Where written information is not 'real', communication and communication-structures have to be based on personal relations. To guarantee minimal social coherence at large, illiterate societies have to use complex, informal chains of intermediates, linked by personal loyalty. Under these conditions formal written rules and institutions play secondary roles. Where and when the transition between oral and written is needed, professions like scribes still exist. In legal matters, a functionally illiterate person never will interact directly with public administrators but will always contract the services of a legal agent. Likewise, the most simple commercial transaction like buying a car needs intervention of a lawyer to find the adequate formal expression. Even at the executive level, the processes of decision making rarely involve facts and fact-finding. They are mostly based on hearsay, other people verbally transmitted experiences and recommendations.

A US-American child assimilates human and other rights in primary school; that the Declaration of Independence, Constitution and Amendments and ´The Law´ in general define real rights and obligations, sustained by a framework of institutions and formal procedures. A Nicaraguan child, based on parents' and own experience, will always assume that enforceable rights and obligations depend primarily on the intervening persons' power, not on law or (to him) abstract institutions.

The literate society is a rather recent achievement of the north, as it goes far beyond individual literacy and at least 2 generations of individual literacy are needed before a complete transition may take place. In most industrialized countries, the transition was completed in the first half of the 20thcentury, long before the computer arrived. Countries like Costa Rica are just entering into the process with two generations of individual literacy completed right now. Countries like Nicaragua have yet to achieve their first generation, which means that the transition will be possible at best at 40 years from now.

Summary: to be at comparable, eReadiness assessments have to reflect different demographic, geographic and economic distributions of the base population. Moreover eReadiness development in an illiterate society has to follow a different path than that followed by literate societies, as it takes several generations to achieve a literate society and not only a few years or decades.

People and Organizations Online

Basic Data		
Individual accounts (Managua)	~ 14,000	(11,000)
Clients with dedicated line (Managua)	~ 300	(280)
Clients by TV-Cable (Managua)	~ 2500	(2400)
Dial-in lines available	~ 1,319	
Domains in .ni (with national service)	~ 1921	(1385)
Cybercafes or Telecenter in existence	~ 80 (59 confirmed by 07/01)	
Estimated Computers in existence	~ 80,000	
Estimated Internet Users	~ 60,000	
Indicators		
Phones per 1000 Inhabitants (Dial-in lines)	~ 30	(0.3)
Computer per 1000 Inhabitants	~ 16	
Internet user per 1000 Inhabitants	~ 12	
Cybercafe or Telecenter per 1000 users	~ 0.01	
National Domains per 1000 Inhabitants	~ 0.3	

In the above table, we separated domains within .ni into those that simply link to some site outside Nicaragua and others that are locally served. The estimate for computers is based on annual imports of computing equipment as reported by customs. The amount is doubled for all types of grey imports and an average lifetime of 3 years is assumed for pc-like computing equipment in Nicaragua environment conditions. The estimated amount of users was calculated assuming two users per individual account, 50 users per dedicated line, 3 users per TV-cable connections and 100 users per cyber café.

In the previous chapter, the percentage of potential Internet-users was reduced to about 10% of the population. The next question might be whether these 10% have an internet-participation at comparable rates to more developed countries. The surprising result: assuming about 60,000 Internet-users in Nicaragua, we have with Harvard-bias only about 1.2% Internet-users. However, adjusting the base to the real universe, we have 12% of Internet-users in the reduced universe, which would boost Nicaragua to a position close to Spain or Portugal.

Jiggling with statistics is not the point. However, within the group of truly potential Internet users we have preferences and behaviors similar to a country like Spain, yet on very small scale. 10% of 5,071,649 of total population result in some 507,169 people, a population comparable to the region of León (Spain!). The leverage of Internet-usage, networked Education, networked Society, and networked Economy etc. would have to be compared with this region in Spain to be comparable. On this level the principal problem is hence a problem of economy of scale, that makes usage more costly, less demanded and hence less profitable or effective compared to larger scales, and obviously the problem are necessary promotion strategies. Internet usage patterns and strategies for its development for the local majorities, those locally on the other side of the Digital Divide, can not be compared nor copied from more developed countries, simply because the whole context is completely different.

Summary: promoting of Internet in a country like Nicaragua means targeting two very different segments of society: potential direct users, a minority, and the majority. The minority sector still has a substantial growth potential. For the majority however the internal literate to illiterate frontier has to be an explicit part of the development design. Combinations with local Radio or local TV are not just less costly alternatives; they are ideal elements to bridge between both worlds. Similar there are others –like local technicians, local health- and education-personal, lawyers or law-agents, more advanced merchants, who may act -as they do already in the pre-internet world– as bridging agents. Secondary students, properly trained and supported, may also act on behalf of whole families. Using these types of bridges and bridging agents, a by far larger population may benefit from Internet.

Locally Relevant Content

Local websites	**~ 361**
.com.ni	~ 183
.org.ni	~ 98
.gob.ni	~ 43
.edu.ni	~ 29
.net.ni	~ 5
Estimated number of local web-pages	**~ 150,000**
La Prensa, El Nuevo Diario, Bolsa de Noticias and OPS	70% of content
Estimated domains in .com and .org	**~ 1790**
Google results:	
Nicaragua	**~ 2.7 million**
Nicaragua and (index or default)	~ 37,000
.com	~ 16,200
.org	~ 5,800
.edu	~ 2,480
.net	~ 2,090
Nicaragua + Project + Development	~ 165,000

Xolo Sistemas in Nicaragua provided the data about local websites. They developed and operate a local web-grabber. Matthew Zook, who operates a site for global internet-statistics, provided the data for estimates of Nicaraguan domains in .com and .org.

The term *Locally Relevant Content* the has many different possible readings. It may refer to locally available or locally produced content, to content related to local subjects or to content relevant for local people and organizations. None of these readings implies the other.

Content may be locally available by caching or mirror services without being locally produced, yet due to the limitations of external bandwidth, not being locally available it might be in fact inaccessible. Indicators suggest that more websites with locally produced content are located at web-hosting services in the generic domains outside Nicaragua than there exist websites inside Nicaragua. It is very likely that there are, by far, more web pages related to local subjects but produced and available outside Nicaragua, than there are inside Nicaragua. Just as an example, the web sites of international development agencies contain more information about or originating in development projects in Nicaragua, than offered within.

Which content is relevant for local people, depends entirely on their economic position and what they are doing. As an example, for exporting/importing businesses, information about US-markets and the respective access conditions is by far more important than local information about indigenous agriculture in some parts of Nicaragua. The importance of local content for local people locks with economic capabilities almost in stalemate: for those, who can afford direct access, easy access to non-local content might be more important than local content; but most of those, who would need local content, don't have the resources to pay.

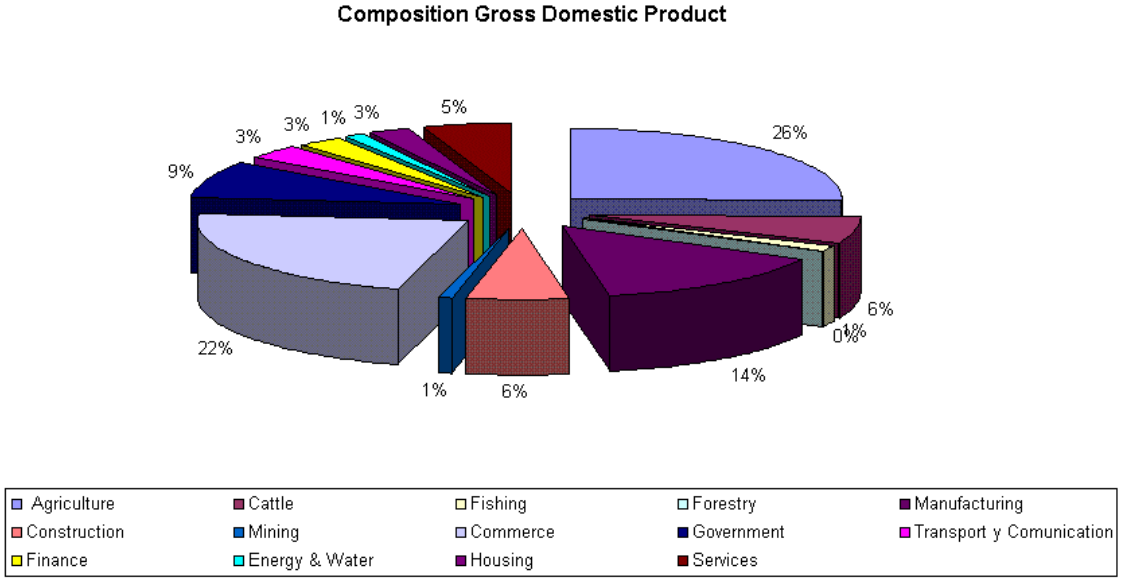
The intersection, local people and local organizations interested in locally produced content about local subjects, appears too small to provide in general a base for economically self-sustainable local content development. No local ISP offers a mouse-click interface to register a domain including simple portal-services like email and a small and unsophisticated web site. This type of service would require an initial investment of some 60,000 US$. As consequence, it is for Nicaraguan users easier and cheaper to register and operate such type of a portal at some web-hosting provider in the US, even if its principal audience is located in Nicaragua.

Summary: locally relevant content does not equal to locally available content or content about local subjects. Economically supported local demand for local content locally hosted seems to low to sustain at this moment large-scale local content development, unless it is setup as externally sponsored activity. There might be however, sustainable niches for local content brokering or portal-services.

networked Economy

Nicaraguan Economy

Before talking about *networked Economy*, we have to talk about economy. Nicaragua has a total GDP of 2,239 Million $US, which converts into a per capita of 460 $US, at distance one of the lowest in whole Latin America. Only Haiti scores lower.



32% of GDP correspond to activities of the primary sector, in first place agriculture and cattle rising. Except the cotton-production, collapsed at the beginning of the 90ties, and some rice and sorghum production, in general production has very low levels of mechanization. In addition, post-harvest handling is mostly manual. In addition, in very recent years, coffee production, a very important -export item, almost collapsed in 2001 as a consequence of the dramatic price-drop on international coffee-markets and has had a dramatic impact on the rural economy.

Agro-producers rarely apply agro-engineering methods themselves and only when advised by the few technical advisors of the ministry of agriculture. However, Nicaragua has rich soils and groundwater supplies for irrigation but productivity and efficiency are very low, when compared even with neighboring Central American countries, for all sizes of production, from the extremely small family-farm up to very large farms. Yet, unprocessed agriculture products represent, with 55%, the most important and significant part of exports

The next large segment corresponds to commerce with 22%, which comprises a small set of larger retail- and mini-supermarket chains, same larger central markets, another 200 of medium size sites, but literally tens of thousands of 4 square-meter sales points –pulperias-.

The next segment is manufacturing with 14%, with few larger installations but at least 1,926 handcrafting establishments with 4 to 10 employees.

It should be noted that our survey did not include the maquila-industry, increasingly important, as their technological needs are determined by the respective HQs outside Nicaragua. Manufacturing excluding Zonas francas represents 24% of exports.

After Government with 8%, -we will see more details on its ICT-usage in eGovernment, comes construction, where some eight national constructing firms dominate the scene, which subcontracted labour-brigades for construction. It should be noted that in most cases foreign construction companies act as general manager for larger construction projects.

From the remaining segments, only Finance and Services may need further considerations.

After Government with 8%, -we will see more details on its ICT-usage in eGovernment, comes the Construction Industry, where some eight national constructing firms dominate the scene, subcontracting labour-brigades for construction. It should be noted that in most cases, foreign construction companies act as general manager for larger construction projects.

From the remaining segments, only Finance and Services may need further considerations.

The finance sector comprises all-services financial groups, which cover from banking and small-scale investment-management to credit cards, loans and mortgages all types of financial services. Normally they also operate in association with insurance-companies, even though the still state-owned INSER has the largest market share. As this business is more or less internationally standardized, their internal ICT usage and the services offered via ICT to clients are close to international standards. However, inter-bank-transactions both nationally and internationally are time taking and clumsy, mostly because there is still no fully automatated inter-bank-clearing.

Apart from the classical finance-sector, a new segment, non- profit micro-financing institutions has developed in the past ten years. They have taken over partially the functions of the collapsed public banking-segment, which attended small agro production, small manufacturing and small commerce. Additionally to lend own funds –mostly originating in some seed-donation- they channel credit from the standard banking-system. They have by far more clients than the standard system, but very low individual credit amounts. Their ICT usage limits normally to most basic credit-accounting.

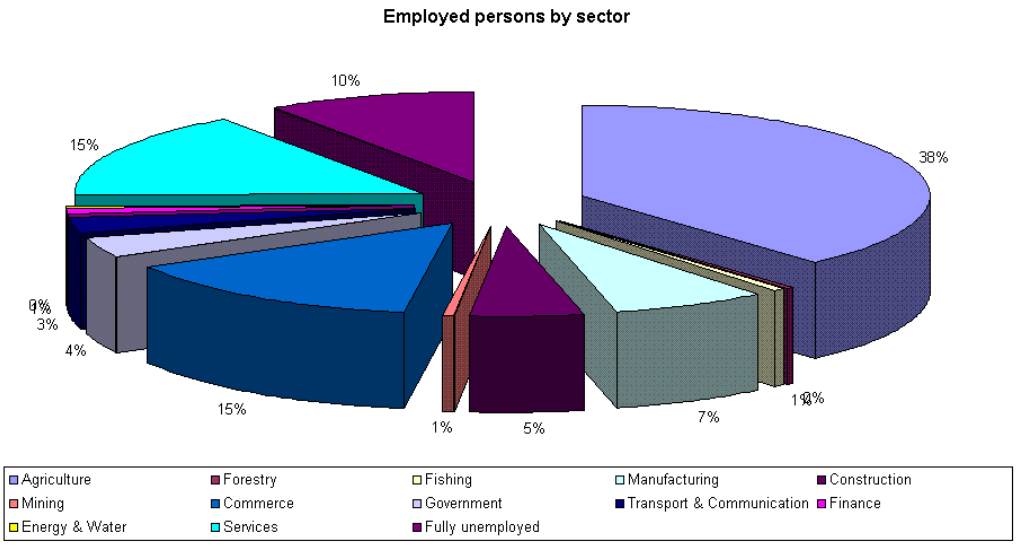
The service-segment comprises statistically all personal services, from large hotels and tourist resorts to restaurants and comiderías. Also home-services like housemaids, cooks, gardeners etc. appear in this category. Yet with tourism and tourism related services it includes one of the most promising elements for further economic development.

The commercial balance of Nicaragua is chronically negative, reaching with a ratio of 1:3 between exports (592.4 Million $US) and imports (1,628.8 Million $US), a deficit already in very short terms completely unsustainable. In the global balance of Nicaragua, external money and capital transfers helped to reduce the effects of the commercial deficit. Transfers are twice as important in the balance sheet as all exports together. None the less, for its high external debt –5 times GDP-, Nicaragua 'qualified' for the highly indebted poor country (HIPC) initiative. As inflows originating in development-projects are decreasing, other, more active means are urgently needed to reduce in a rather short time the commercial deficit.

Summary: Nicaragua belongs to the group of the highly indebted poor countries. It has one of the lowest GDP per capita in the western hemisphere. There was no substantial increase in exports over last decade and, which is worse, the traditional principal export-production –coffee- has almost collapsed since 2001. The commercial deficit hence is soaring. Internal efficiency and productivity are low. Quality of production and timeliness are constant problems.

The principal challenge for ICT usage is therefore not networking as such but rather how in general ICT usage concretely may help to increase exports, while reducing the impact of the aforementioned principal problems of quality, timeliness, productivity and efficiency. ICT-policies, initiatives and projects for economic development should be matched and evaluated against this challenge.

ICT Employment Opportunities



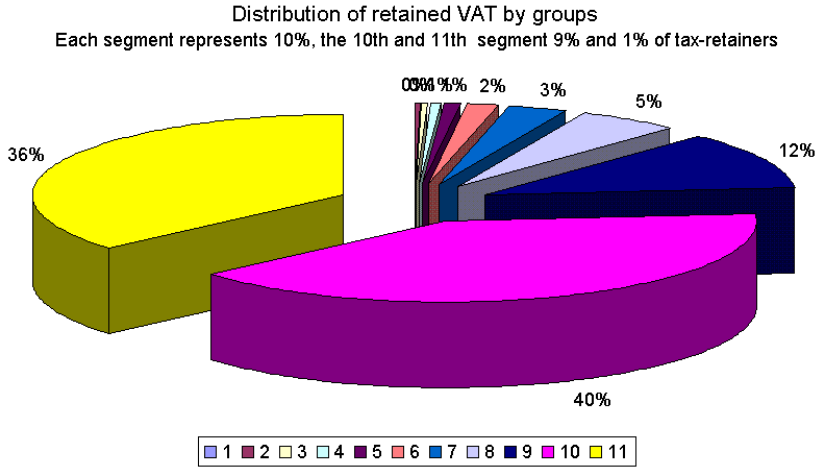
The above Graphic shows employment in all sectors of economy. Employed in Nicaraguan statistics includes all types of activities, not only paid labor. Actually, some 1.6 million have some occupation, but only 19%, some 314,000, are formally contracted, including formally self-employed. Percentages are very low for the complete primary sector (0.1%) and still low for Commerce (14%) and Construction (14%). In between are Manufacturing (55%) and Services (48%). Top formal employers (100%) are Energy, Finance and the Government.

To find a ceiling for ICT employment opportunities in Nicaragua, we use the –certainly far to high – percentage of ICT with respect to total employment of Canada from 1993, which was 2.9%. For Nicaragua, this figure would result at most in some 9,000 jobs or self-jobs related to ICT. In Canada 60% of these were ICT-services, 25% Hardware-Manufacturing, the remaining 15% sales. The Canadian breakdown of ICT-services gives 56% for communications and 44% for Software and Computer Services. For Nicaragua, this would result at most in 3,024 jobs in communications and 2,376 jobs for Software and Computer-services. Another way to define a ceiling might be on the base of the estimated 80,000 computer in existence. Assuming 1 professional or technician for every 30 pieces of equipment, we would have 2,660 directly computer-service related jobs.

Universities and Technical education graduated or qualified, since 1997, at least 600 ICT technicians and professionals per year, such that –even assuming Canadian percentages- the ICT-job-market is over saturated. Still it might be difficult to find in some situations specifically trained personnel that master specific tools and methodologies. However, these cases might account for possibly less than hundred job opportunities. Most intents to establish ICT-services, independent from equipment sales, or other non-computing activities but with little success, since demand is scarce and unstable. The few large projects, public and private, are contracted normally by foreign companies, which subcontract temporarily but as individual local professionals and technicians. The standard bidding conditions of international lenders favor this form of contracts. What remains are small –4 to 8 weeks-programming-jobs, which do not require nor sustain formal companies.

Summary: ICT in Nicaragua as such does not offer significant employment opportunities, compared with other activities. Worse, currently professionals and technician with general ICT-qualifications have saturated the job-market. Remaining niches require more intensive and specific training. Yet ICT as complementary qualification may improve competitive chances for opportunities in other, not directly ICT related jobs. The profiles of university and technical education do not reflect adequately this situation.

E-Commerce B2C



In Nicaragua, all commercial transactions by formally established business include a 15% sales tax. Few products are exempted, like basic food, medical drugs. The above graphic showing retained tax grouped by amount of retention reflects hence truly the structure of commercial relations in Nicaragua, based data of about 8,200 formally constituted, private and corporate businesses in Nicaragua, resumed by the tax-office.

As result, 88% of Sales tax is retained by only 20% of formal businesses. These include in first place importers, wholesalers and producers, who distribute directly to tens of thousands of small shops, which themselves are not constituted as formal business. Next, are the providers of energy, water and telephone services, which include the sale tax in their monthly bills, then the 2 national retail-chains, the 2 national supermarket-chains, finally the large construction firms, and the car sales.

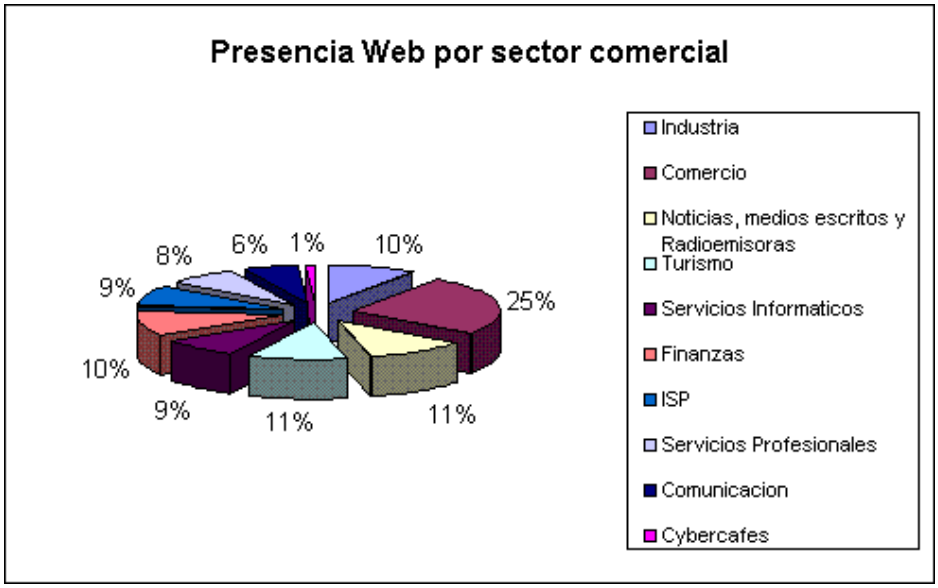
The structure of the commerce reflects the structure of income and consumption: only 15% of families have some money left after very basic needs are satisfied. As for the majority, income is irregular on a day-by-day basis and not by weekly or monthly paychecks, the nearby pulperia or the classical market is at walking distances are more attractive, especially as the pulperia offers on spot 0-interest short term credit, the day no money is available to buy the daily food, which gives it a clear advantage over any shopping-center or supermarket,.

It should be noted, that the pulperias themselves as the walking services offered by plumbers, electricians, mechanics, scissor grinders, shoemakers, gardeners and many others, stem from risk-reducing social strategies in the absence of stable employment opportunities, not in entrepreneurship as people from the north usually tend to misinterpret.

No surprise hence, that the local example of B2C-eCommerce in Nicaragua cover about 2 general stores, 5 computer-retailers and some specialties like a flower shop, a French bakery and one pizza-chain. All banks offer their services also by ATM-machines and by Internet as anywhere. B2C-eCommerce with the foreign countries, specifically the US, is however –for the top 10% of incomes- extremely important as it cuts drastically transaction times and costs, eliminating the otherwise necessary local intermediates.

Summary: due to the structure of income and consumption, local B2C-eCommerce does not fit into local commerce structure. Changes in a short time are very unlikely. For the highest-income group B2C-eCommerce with outside Nicaragua plays an important role. If however the tens of thousands of resellers themselves were taken as final consumers, then using Internet might allow reduction of distribution-costs for distributors and resellers, particularly if the Internet became locally available in more places outside Managua.

E-Commerce B2B



The above graphic shows the distribution of the approximate 361 web sites in the .com.ni domain. Only 35% or 126 correspond to industry and commerce. Both the total number as the web-presence of industry and commerce contrast sharply with a total of approximately 8,200 formally established businesses, even if we reduce our focus to only the 1320 larger businesses[1] with annual cash flow above $US 200,000 or annual profit before taxes above 20,000 $US. No agribusiness except the sugar mill, San Antonio, presents itself on the web.

By looking on the websites themselves, we found that less than 8% of the last group has got its own website in Nicaragua and even fewer are connected online, though some may count with web- or even virtual-domain presence in the generic .com domain. Based on data from the different sector-organizations, like chambers, associations etc., some 68% have at least a representative with an email-address, but in many cases it is his private email or the email doesn't work at all, as resulted for a 20% tested by a representative sample of 300. To complete the external part, only one chamber out of 20, CADIN, manages its own website and operates a local network in its HQ connected to Internet, for another one, American Chamber of Commerce in Nicaragua, a Website is hosted and operated in the US.

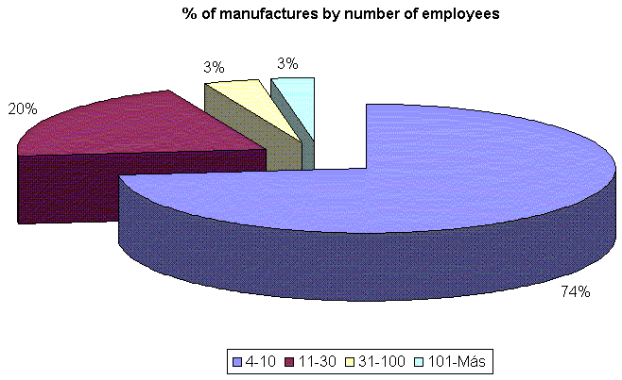
On the internal side, very few use internal email or more sophisticated task-management tools for internal organization beyond classical systems with shared online access like accounting, internal purchase and sales order processing or inventory, even if operating a local network. There are at most 10 examples of integrated sales-point operations. We have however no knowledge of any example of integrated client- or provider-relation management.

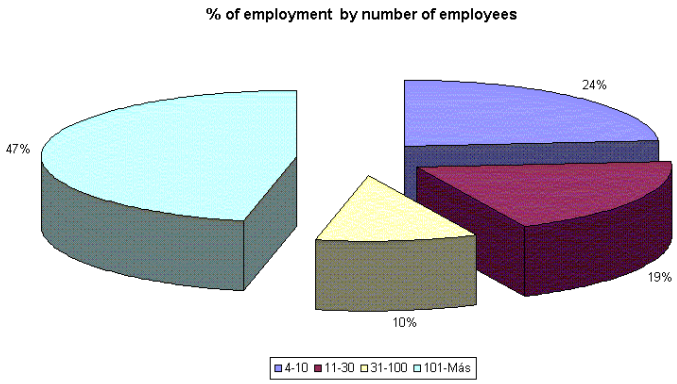
Summary: Besides mentioned limitations for B2C-eCommerce, most of even the largest Nicaraguan businesses are internally not prepared to interface with external B2B-eCommerce, not to mention midsize or small businesses. Existing networks are used as a platform for mainframe-style applications of the late 80. Despite of partially existing resources, no Business Process Re-engineering (BPR) has taken place yet, such that opportunities and necessities for improved supply- and distribution-chain management are neither internally nor externally

[1] Excluded from analysis are local branches of transnational companies, like Bayer, Nabisco or Shell to name some

exploited. This situation jeopardizes any attempt for competitiveness of national businesses. Improvement should be –but is not- a top priority for joint efforts by public and private sector.

E-Commerce P2B





The above 2 Graphics show the composition of the Nicaraguan manufacturing sector, grouped by the number of employees. Similar as in the case of commerce, we have a large number of very small units, compared to a small number of larger units. It should however be noted that the 3% of largest units[2] respond for about 47% of employment. Due to economy of scale, the 7.1% largest units –including a few of the second group- contribute 82.4% of total production value and 79.4% of added value. They pay on average a yearly wage of 3585 $US (298 $US monthly), whereas the smaller ones pay only 1362 $US yearly (113 $US monthly).

Fixed costs per commercial transaction affect smaller enterprises more than larger ones. Additionally variable costs-to-market have a tendency to become lower per unit if there are more units shipped than if there are less. To illustrate: a computer-equipment with basic software and accounting for a small shop is equivalent to one year of salary of 1 worker, which in turn represents at least 25% of workforce, whereas for a large one it represents less than half a worker and less than 0.5% of workforce.

It is the same problem as in distribution, yet inverse. As B2C-eCommerce didn't make economic sense, direct P2C-eCommerce –producer to consumer- will not result economically, except in very special cases, jewelry or other high-luxury goods. Internet as such has only marginal cost-reducing effects, as the bulk of costs-to-consumer arise from handling and shipping a sold product, not from selling it.

The historical known concept for the reverse distribution-problem are production-cluster, which include different stages and units for production, pre- and postproduction, distributing input-materials and recollecting finished or half finished products. Cluster normally comprise additional services, like financing, product-standardization and quality-control, tools-supply, storage, marketing and shipping of finished products. The English and French furniture-industry of the XVI century had already elaborated schemes for handicraft-based cluster. Nicaragua has had its own experience –though in agriculture- by the coffee-cluster, that already by 1928 included Banks, Stores and Exporters, and up to small electric power-plants.

Summary: P2B –Producer to Business- eCommerce may help production-cluster to operate more smoothly and with lower transactions-costs, if they already exist. ICT may even help in their formation, if properly integrated, planned and executed. But it would be dot-com virtual reality, if the net brings into existence a non existing real cluster, simply by giving many, most or even each handicraftsman or handicraft shop access to Internet,. An integral approach transcending pure ICT is needed, where again bridging and not narrowing the Digital Divide would be a central point. Unfortunately, very well financed official projects try instead to put as many crockery-, leather- or furniture-handicraftsmen as possible directly on the net. The same reasoning about successful ICT usage applies in principle for agro-cluster.

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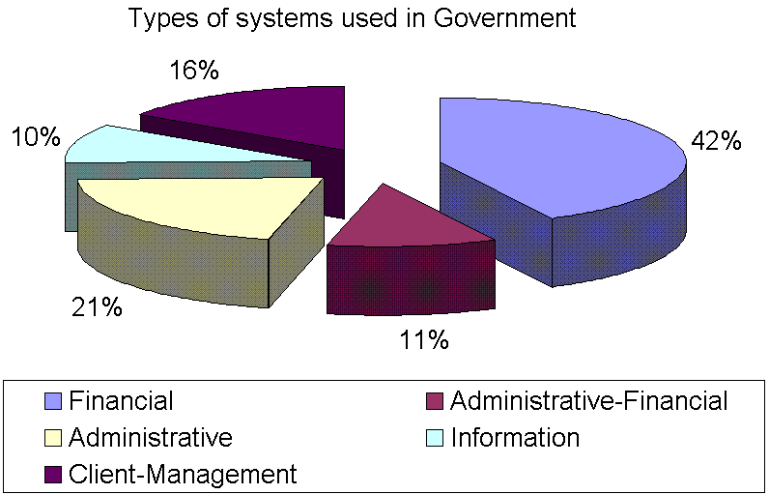
[2] Again without maquila–industry, if included large manufacturers would count for at least 70% of employment.

E-Government



Total Institutions	37	Email usages	Never	At times	Frequent	Always
investigated	73%	Internally	26%	30%	22%	22%
Of these have		Externally	15%	15%	52%	19%
LAN	93%					
Internet Connection	73%					
Internal Email	81%					
External Email	70%					
Both types Email	52%					
Internal Web	26%					
External Web	70%					

The initial graphic shows the types of systems, government agencies use currently. The table shows that most of central government institutions count with the elementary infrastructure for eGovernment, that is LAN, Internet-connection and email and external Web-presence. The internal low usage at the same time indicates the there has been no re-engineering of internal procedures to use this infrastructure in any adequate way. Only one agency, Nicaraguan Customs, offers web-based services to importing and exporting custom agents.

Yet not even the costly communication-infrastructure for this project, an ATM based fiber-optic network connecting almost all agencies, can be used for other purposes than budget, for instance a global intranet or high speed Internet-access for all agencies. The reason: project mechanics and -bureaucracy exclude any usage not contained in the initial World Bank credit for this project. Similar 'arguments' preclude joint usage and synergetic effects between projects financed by WB or IADB and the corresponding hosting Nicaraguan government agencies. Under these circumstances the efforts of a small office at the vice-presidency, to streamline client services of state-agencies on a by-institution voluntary base have had little effect, as they lack any systematic support by ICT.

Summary: despite available resources, the Nicaraguan government agencies in general are not ready, and as it stands, will not be ready for eGovernment. Just as in the private sector, a systematic effort of government-re-engineering is missing. Top priority should be –but it isn't- to coordinate a dozen ICT relevant projects, using a common set of objectives, goals, methods and means to achieve effective and efficient use of scare resources. Neither government itself nor financing external agencies have set up if only a complete descriptive inventory of all projects in planning or execution, less a effectively coordinating central office.

E-NGO

According to the registry of the Ministry of Government, there are 1.900 formally registered National Non-governmental Organizations. Another 200 are nationally registered as International NGOs. There might be another 1000 or so still in the clumsy process of registration, which needs the formal approval by the National Assembly.

Among these, the about 1200 NGOs dedicated to development and social assistance operate 168 web sites, including two portals, which represent some 300 and 120 affiliates respectively. External websites in .org or .com and websites operated by foreign NGO partners on behalf of a local NGO are not included in this count. Compared with the traditional private sector, NGO take by far more advantage of being connected.

Under current legislation, a NGO is simply a non-profit organization with some social benefit. Both terms are to be understood in a very broad sense, non-profit only means that the NGO cannot transfer surpluses to members as members, but they can develop any type of economic activity that even remotely connects to their objectives; as example all the micro-financing institutions are legally constituted as NGO. In addition, social benefit does not limit operation to pure charity. For instance the country clubs of the high-society are formally constituted as NGOs. In summary, an NGO can operate as any other business accumulating capital and transferring income to its members under the concept of payments for professional services or in the form of non-monetary benefits. NGO import tax-free and do not pay any type of local tax either. Development-NGO are the favorite channel or instrument to implement external cooperation, private and official, as the most cost-effective option: they don't pay local taxes and hire their local personal and even foreign volunteers at local conditions without compromising the external funding institution.

Besides acting as catalytic element for the emerging Civil Society as such, NGOs assume many functions that otherwise or previously were attended by public central or local authorities and agencies. As an economic element, they respond for at least 5% of the GDP and provide some 10% of the employment, mostly professionals and technicians. Without NGOs, many poor and the rural areas as such would have no attention at all, since they act also as channel between local people and public agencies at the central and municipal level.

Finally, NGO constitute a channel of extreme importance for communication, promotion and fundraising outside Nicaragua. It is assumed that they by themselves raise about $US 140 Millions in donations yearly, an impressive sum compared to the $US 480 Millions, mainly credits, of the official cooperation. In this aspect, they depend for economic survival crucially and very short term on selling their missions and their results, inserting them into the international agendas of actual trends in development policies. In many cases, the Internet presence is already the media of choice.

The Constitution and the Government have recognized the role of NGO, assigning them representatives in the constitutional advisory Council for Social and Economic Planning (CONPES) and the presidential advisory Council for Sustainable Development (CONADES) on equal footing with traditional private sector.

Summary: NGO play a crucial role in any concept of development for Nicaragua. As doubly rooted organizations, right on the spot in Nicaragua but with vital ties to foreign partners and partner networks around the globe and nationally, they seem ideal agents to bridge the Digital Divide. Additionally with their local offices almost anywhere, they might be better suited intermediates for any type of eGovernment of central government or municipalities, better than the classical for-profit legal agent. As ICT as such does not and should not constitute the core of their activities, they do need some support, namely in general Internet connectivity throughout the country and for initial investment in ICT. On the other side, ICT-reduced operation-costs will benefit their clients and might even partially serve to subsidize fixed-costs for telecenters and similar installations.

Conclusions

I. Using the Harvard-evaluation, Nicaragua will score low in most of the 19 categories, means in the 1st or 2nd level in most of them.

II. However, eliminating the demographic, geographic and economic bias and focusing on those to whom Internet is useful, technically accessible and affordable, scores raise substantially.

III. The Harvard methodology does not take into account insurmountable obstacles, like misery or more general the effects of an illiterate society, obstacles that, according to the last summit on sustainable development in Johannesburg, will take decades if not generations to eliminate..

IV. Nor does it consider local cost-of-opportunity structures, by which definitively in Nicaragua neither in basic public education nor in eCommerce 'going internet' is an all-around adequate option.

V. Biased in favor of the typical upper-middle-class consumer of developed countries, Harvard does not identify and evaluate bridging solutions, which benefit many people, especially the poor and the illiterate. According to Harvard you are either connected or you are not, alternatives which is mostly wrong for developing countries

VI. Harvard ignores willfully that the Internet-boom in developed countries has had a solid background by a sustained development of in-house applied ICT accompanied by systematic re-engineering of Business-Processes both in public and private sector, long before public Internet appeared.

VII. eCommerce and eGovernment in most cases therefore did not imply much else but using Internet-technology to facilitate cross-enterprise and external access to already streamlined processes with existing internal ICT-support. The Nicaraguan case shows that without these ICT-supported and streamlined back-offices, pure front-office possibilities produce no effect at all.

VIII. Networked Society in a developing country, ePeople, eCommerce and eGovernment alike, needs appropriate local strategies, which don't presuppose the existence of a non-existing context. In many cases the corresponding real structures have to be created side-by-side with supporting virtual structures. In many situations bridging instead of narrowing should be the strategy of choice.

IX. In developing countries NGOs are not simple nonprofit charity, welfare or public benefit institutions. They assume roles that in other parts of the world are assumed by public agencies as such or by for-profit private enterprises. Yet NGO with their multiple ties inside and outside might offer a competitive alternative for developing countries to bridge internally the Digital Divide. They have operated already globally, when others were still learning meaning and impact of Globalization.

X. The Nicaragua case shows moreover that without a National Development Policy for ICT, consented by all participants but enacted by public agencies as leaders, valuable and scare resources are wasted. As in the US, that has with ANSI, DoC, NIST, and NSF leading public agencies, in developing countries this type of `technological intervention' should be likewise fostered and not inhibited for the sake of free-market-economy.

Appendix

Historical Remarks: how Internet started in Nicaragua

Used Sources of information