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NJIT e-Business Laboratory

**Universities as Partners in Measuring
e-Business and ICT for Development**

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Introduction

This paper offers an overview of the possible contributions that universities can provide in building an organizational and technology infrastructure to measure the impact of ICT and e-business (which includes e-commerce) for development. It assumes that a consensus exists on the need for action in a wide diversity of developing countries. Our vision of such an infrastructure is also focused on building new capabilities to make, implement, manage, and control policies on ICT and e-business for development.

We first discuss the present international trends in ICT policy, and the importance of measuring progress in this area. We then address the evolving roles that universities can play in the measurement process. This leads us to outline the present state of e-measurement, especially the challenges of both the end-users (mostly policy makers) and producers (mainly National Statistical Organizations or NSO's) of such data and information. We try to identify the main challenges in devising a new implementation environment for an e-measurement infrastructure.

Based on this assessment, we then discuss a number of possible areas for action. Among others we focus on the 4 areas raised in the recent UNCTAD Background Paper on e-measurements, namely: (1) developing an international database; (2) building new policy capabilities; (3) creating forums for exchange; and (4) providing training to transfer best practices. We conclude with some ideas for a multilateral effort in building an international infrastructure to measure ICT and e-business, and ensure policy efforts in this area remain focused on development priorities.

Background of ICT and e-business for Development

As many success stories have confirmed, it is clear that the diffusion of ICT, the Internet, e-business and (more specifically) e-commerce hold unprecedented promises for developing countries. With the upcoming World Summit on the Information Society (WSIS), a new sense of urgency is emerging, one that shall lead governments to take a wide range of policy decisions and actions in the years to come.

While such dynamism will certainly prove positive to help narrow the Digital Divide, we must keep in mind the risks inherent to this trend. Indeed, a "mushrooming" of government and business actions in ICT can easily lead to dispersion of efforts, uncoordinated/contradictory policies, disappointing/slow results, waste of scarce public funds, failed investments, and (worse of all) wider disparities between high and low income groups within developing economies.

As well, one must bear in mind that, in most developing countries, we still find the prevailing perception (and too often unfortunate reality) that getting access to ICT and adopting new e-business practices is primarily a concern for high-income citizens and sophisticated, internationally oriented companies.

Yet, the follow up to the WSIS shall demonstrate that we can, indeed, bring ICT and e-business to enrich the lives of the majority in developing countries. The priority areas for

action are well known: e-learning, e-government, fairer trade intermediaries, rapid market and business development, consolidation of small buyer and seller power, access to capital, and local technology entrepreneurship (e.g., offshore development, open source products, IT-intensive business process outsourcing, etc.). Yet, all these areas have their own challenges, and require policy makers to forge collaborative networks with a wide range of technical and industry experts. They also involve numerous coordination points, some of which are completely new to most countries, as governments in other advanced economies have discovered in the past few years.

It is therefore imperative that we build reliable mechanisms to ensure that such buoyant activity around ICT and e-business will prove positive. We may, effectively, have only one chance to prove this right, as we are talking about massive one-time investments that tend to lose value much faster (and in much more unpredictable ways) than other assets. Our window of opportunity is exceedingly narrow compared to previous development efforts of similar scale.

Given this context, it is crucial to get a more accurate and regular measurement of the impact of ICT and e-business on development. Such data will allow all parties involved to manage risk and coordinate highly complex policy actions on several fronts. Measurements also play a key role in carefully identifying threshold and saturation points in various areas, and therefore keeping policy makers' attention focused on what really counts. As well, the use of flexible measurement processes and data analysis tools shall prove determinant in leveraging this resource and delivering the most accurate, highest quality information to the right decision makers at the right time.

Evolving Role of Universities in e-measurement

In building an international infrastructure for measuring ICT and e-business for development, it is interesting to consider the role of universities as exemplifying a full range of interest and expertise in e-measurement, whether as users or producers of data. Academic researchers are one of the primary groups to tap on large statistical databases to build policy models and perform thorough analyses. Universities have also been major contributors of accurate measurements of the impact of ICT and e-business on development.

However, universities are going beyond their traditional roles in this field. As several researchers have found, the issue is not simply one of "how much" ICT and e-business impact development, but primarily "how to" bring these resources to enrich the lives of the majority. The previous question depends heavily on understanding economic development per se (i.e., the output). Yet, the latter requires a more detailed (technical expert) knowledge of how various e-business technologies and practices (the inputs) are diffused, adopted, and implemented. It also requires a clear understanding of the interplay of government, business, and users around each technology (or clusters thereof).

Consequently, a major research issue that is emerging is, in essence, the ICT and e-business policy-making infrastructure itself. Measurements are the centerpiece of this system, allowing for an accurate targeting of policy efforts in several coordinated directions. As such, the research challenge becomes one of identifying new, more

innovative measurement processes, tools, and methodologies, properly customized to the context of making and implementing policies related to such complex areas as ICT and e-business.

Interestingly, universities are well equipped to tackle this challenge. Indeed, they have most of the resources to required by this new research focus, as they can blend and leverage key skills/assets such as:

- ?? A hands-on knowledge of e-business technologies in various sectors
- ?? A closely knit network of collaborative research with (especially ICT) industry
- ?? A first-hand understanding of the needs of data (especially policy) end-users
- ?? A proven ability to develop innovative data mining tools for policy analysis
- ?? A capacity to train both data producers and users in best practices and tools

Implementation Environment for e-measurement

Creating such a complex, fully integrated information infrastructure requires an accurate understanding of the implementation environment within which ICT and e-business policies are developed. There are 3 issues we must consider before designing these new tools for e-measurement, which are: (1) to get a sense of how metrics are used for policy making; (2) to understand the overall goals of policy makers; and (3) to identify the operational concerns of data producers.

1.1. Using Metrics for ICT Policy

Government decisions and actions in ICT and e-business have often suffered from lack of accuracy in many ways. Whether it is the definitions of policy targets, or the proper implementation of policies and programs, public and private organizations face tremendous challenges in adopting a data-driven approach to decision making.

To help overcome this major deficiency, policy makers at all levels can rely on metrics in many ways, in order to:

- ?? Accurately identify the right groups of people to help, so as to pinpoint the actual digital divide, and ensure ICT policies remained focused on development priorities (i.e., narrowing the gap between high and low income groups).
- ?? Properly determine the required size of policy projects, especially in right proportions to the actual (not simply estimated) needs, so as to carefully allocate large ICT budgets, and guarantee the most efficient and effective use of public funds and private sector investments.
- ?? Clearly delineate the boundaries and conditions of national interests in developing indigenous ICT capabilities and resources, especially when it is necessary to resolve key debates about international dependence and sovereignty, such as those related to privatizations and FDI.

- ?? Carefully building investor confidence by using neutral data, and provide for an accurate and regular control of joint public-private projects, so as to ensure returns to all parties involved (especially those stakeholders with least representation capacity, such as lower income groups).
- ?? Conscientiously reporting to donors and/or field auditors, especially by controlling and holding actors accountable, and enforcing data-driven decision rules and thorough investment analyses.

1.2. End-User Perspective

We have identified so far only some of the numerous ways in which policy makers can use metrics to make better policies. To maximize its impact, it is therefore crucial to focus this information infrastructure on the overall goals that drive the demand and use of metrics. Indeed, this infrastructure must ensure that it helps policy makers accomplish the following end-results:

- ?? **Reset Priorities:** e-business and ICT policies must be refocused, and therefore require the use of metrics to renegotiate efforts across the board. Among other priorities, it involves refocusing existing efforts on citizens with the most pressing needs, and on supporting local entrepreneurship.
- ?? **Build Vision:** A new vision of policy analysis and decision-making processes must emerge, and be deployed at all levels of government, industry, and society. Policy-making must be reengineered to leverage new databases, make comparative analyses, and promote a culture of accuracy at all levels.
- ?? **Coordinate Policies:** There is a constant risk of rapid exhaustion of resources and efforts, and therefore policy coordination is crucial in ensuring continued success in implementing ICT policies. Such coordination requires the establishment of key processes to leverage policy interdependencies, and especially to detect potential savings, efficiencies, and multiplier effects, with reliable estimates justifying the close coordination and in some instances the full integration of various efforts (e.g., linking such diverse policy efforts as promoting ICT entrepreneurship, providing local training in ICT to the workforce, and building e-government tools for local institutions, etc.).

1.3. Data Producer Perspective

However wide-ranging, policy makers (or end-user) interests must be matched with actually producing the ICT and e-business metrics. This requires due consideration to the operational concerns of data producers (who are mainly NSO's). Among other issues, the following stand out in developing metrics:

- ?? **Measurable Goals:** The e-business technologies and practices targeted must have clear inputs and outputs. Data producers can resolve this challenge by properly compiling, classifying, interrelating, and (possibly) integrating a number of models that help gauge the implementation, evolution, and impact of policies on ICT and e-business for development. This approach can help producers make sense of metrics in their context.
- ?? **Value of Data:** The relative (and widely varying) benefit/cost ratios of the data must be shared by many end-users, and be properly correlated to strategic initiatives. It is unthinkable that metrics can be collected on all decision items at all levels. Yet, data producers can devise innovative approaches to help push forward the “statistical possibility frontier” (e.g., by combining advanced technologies and field-level common sense).
- ?? **Analytical Tools:** Policy analysts, at all levels in within a diversity of organizations (whether government, business, NGO’s, or universities) need access to advanced tools to manage this data. For example, a centralized data warehouse, On-Line Analytical Processing (OLAP), Data Mining (DM), and complex simulation engines can be used to help produce real-time reports, estimates, and scenarios at varying units of aggregation, time, geography, etc.

Areas of Possible Contribution

The implementation environment for e-measurements will require substantial investment from international institutions. This is effectively a public infrastructure that benefits all countries equally, and therefore requires a multilateral effort.

As we compare, on one hand, the concerns of end-users and data producers, and on the other hand, the interests and capabilities of universities, we find several areas for possible contributions to this effort. Among others, universities can provide:

- ?? **New Processes:** To help improve and deploy new policy processes built to exploit international measurement guidelines and metrics databases.
- ?? **New Metrics/Tools:** To leverage existing and new industry relationships to customize and adapt metrics for complex e-business technologies.
- ?? **New Forums:** To stimulate international cooperation to transfer capabilities to countries ready to join a multilateral effort.
- ?? **New Graduate Degree:** To build a new graduate program to train policy and statistical analysts, and ensure international comparability through common standards.

1.4. Providing New Processes

The creation of a new e-measurement infrastructure requires the proper reengineering of policy making processes, especially around data-driven decision making practices. This has always been a major challenge of all organizations, and most noticeably in the public sector.

Therefore, by leveraging their expertise in process reengineering and the proper application of analytical methods, universities can help in overcoming the obstacles to such changes. In particular, they can actively managing the necessary “process innovation” effort through wide-ranging international networks. To this end, a number of possible actions can be envisioned:

- ?? To actively research and identify the best practices recently developed by a number of leading (more experienced, or better equipped) NSO’s, governments, agencies, etc.
- ?? To carefully document their processes into standards, and build deployable guidelines with workflows and roles, tasks and deliverables, staffing/positions, analytical models and tools, information systems and technologies, etc.
- ?? To build an international database of local experts to help in this research and standard development exercise, and to identify potential employees/partners capable to work within these redefined roles and positions, so as to rapidly ramp-up the capabilities of the data producing or data using organizations.
- ?? To help senior officials implement the WSIS consensus on a data-driven approach, and to create proper mechanisms to control communicate and control change throughout policy making communities.
- ?? To help policy units in key areas of ICT and e-business to identify specific line-of-business and technological capabilities required for in-depth analyses, and to identify policy coordination opportunities to reach new levels of efficiency and effectiveness.
- ?? To carry out some reengineering exercises to demonstrate the validity of these new standards and approaches, and to properly monitor the emergence and implementation of this new information infrastructure for e-measurements.

1.5. Providing New Metrics/Tools

Researchers are constantly finding new ways of measuring the development impact of such complex technologies as ICT and e-business. As such, universities are best positioned not so much in producing massive databases, but instead for developing, testing, and refining complex metrics. Academic research teams can accomplish this by leveraging their wide knowledge base of technology, policy, and data-driven analysis. Several initiatives can be launched, such as:

- ?? To integrate and repackage survey instruments, especially built for various regions of the world, so as to customize them for various contexts/constraints.

- ?? To create a global network of ICT suppliers to build a common template to assess technology capabilities of ICT industries, especially for complex technologies and wide-ranging, deep development impact (e.g., surveying the networks of partner firms of large ICT providers such as IBM and Microsoft, and measuring their relative impact on development, factoring for the impact of ICT investments on trade or FDI, and vice versa).
- ?? To use groups of students, especially at the graduate levels, as field agents to find new metrics, validate tools, develop new industry contacts to help fuel ongoing data gathering efforts, to properly target development needs of various ICT and e-business policy initiatives, etc.

1.6. Providing New Forums

The development of a complex data-driven policy making infrastructure cannot emerge without some sense of community of practice. Yet, as we know too well, professional communities often loose touch with knowledge development, and become a “static” milieu where practices reproduce themselves without much concern for innovation.

Research institutions could serve in providing alternative forums for this community of practice to emerge. Naturally, we should not assume that universities have a monopoly (let alone leadership) over innovation. However, as institutions specifically endowed with a knowledge development mission, they can at least serve as strong guarantors that a rigorous data-driven policy making view is enforced throughout the evolution of the e-measurement infrastructure.

As such, we may think of a series of joint academia-professional forums focused on measurement innovation, and primarily concerned with designing and testing new ideas, concepts, models, methods, tools, etc. These forum initiatives can take several forms, such as:

- ?? To invite NSO’s and ICT analysts to international academic meetings, whether to attend research conferences in the substantive fields of NSO’s, or as special regional workshops in the various technical areas of key ICT and e-business initiatives.
- ?? To build an international, virtual, online support network, allowing for extensive and deep discussions on leading issues, and actively moderated by NSO’s willing to lend support to this international capability building effort.
- ?? To maintain through this virtual network a constant flow of cases, news, models, new data, methodologies, instruments, etc., especially in specialized ICT and e-business policy areas, where the cost of researching for such innovative tools is often born by lower ranking policy analysts, and making the policy analysis and planning less effective.
- ?? To identify private consultants ready to pass a certification process managed by more experienced NSO’s, and who are willing to join these virtual networks as well as deliver practices internationally.

1.7. Providing New Graduate Degree

Traditionally, universities have developed graduate programs (Masters or Doctorate) by focusing mostly on general concepts. It was long assumed that advanced professionals and managers would learn the “how to” on the job.

Long gone are those days, as most professions have become more technical and now require extensive exposure to elaborate models, methodologies, and tools. Very often, this knowledge base is driven by a complex array of underlying information technologies, and complex workflows to leverage such assets through the analysis process.

This is why universities are, today, well prepared to tackle the challenge of training an international network of a data-centric policy analysts and statistical officers. Higher education institutions can provide valuable efforts, such as:

- ?? To build a complete graduate (MS or PhD) degree, fully accredited through leading international bodies and professions, and allowing governments to stimulate the implementation of the new e-measurements infrastructure by offering this training to their professionals and managers as an incentive for policy and statistical analysts to innovate.
- ?? To carefully weave and synthesize, on one hand, the emerging standards and guidelines in managing the international e-measurement process, and on the other hand, the hands-on skills required to properly operate the complex business intelligence and database tools and technologies.
- ?? To provide a flexible, hybrid model in delivering this international training program, mostly by relying on an accredited research institution as the hub, and forging strong alliances with local institutes to deliver the program according to regional needs:
 - a. The theory half of this program would most likely be developed and delivered in a remote or e-learning mode, so as to ensure common standards and guidelines are the same everywhere.
 - b. The methods half or technology-bound skills of the program would be best delivered in a face-to-face mode, especially to capture the full range of strengths and weaknesses of local policy communities in using such tools and resources.
- ?? To ensure the highest levels of expertise by allowing face-to-face, technical training to be delivered by the most experienced NSO's, who would effectively become the

guarantors of quality hands-on knowledge, backed by their own tested and proven cases and methodologies.

Conclusion - Next Steps Toward a Multilateral Effort

While this paper has provided a singular, university-born view of this new and emerging e-measurement infrastructure, it remains embedded in a genuine concern for the practical needs of its implementation environment.

As such, participants to this meeting are cordially invited to discuss, revise, and expand this viewpoint, and to see how it can contribute to strengthening the ICT and e-business policy-making initiatives of various developing countries.

Among other issues we may want to address, we are concerned about the actual “action plan” to develop and deploy this new information infrastructure. Given the dispersed and uneven capabilities of the e-measurement community, it is crucial to think in terms of “orchestration” of very diverse and remote efforts. The varying scope and depth of the respective mandates, endowments, and capabilities of the organizations involved calls for a careful coordination to ensure a rapid yet efficient emergence of this infrastructure.

In our view, two of the most interesting actors in this process could be the NSO’s and universities. Each one can share responsibilities in key areas of expertise, and as presented earlier, can effectively deliver the services needed throughout the emergence of this infrastructure.

1.8. NSO’s

Statistics agencies remain in many countries the leaders and proponents of a more rigorous, data-driven approach to policy-making. At least this has been so far the case with experienced NSO’s in the field of ICT and e-business measurement.

Consequently, we may think of NSO’s as responsible for steering the emergence of this information infrastructure, and for its deployment among various sectors and levels of ICT policy making. We may envision the following steps in the evolution of such an initiative:

1. **Identify users:** Given the wide-ranging diversity of ICT and e-business policy areas, it is crucial to better identify and survey end-users. This is also the most effective way to finally confirm the importance of such an infrastructure, and to even estimate the potential value it may bring to various policy sectors.
2. **Build consensus:** As most changes in organizational culture take time, NSO’s will need to proceed cautiously and patiently in preparing the ground for this initiative. The key turning point will be the establishment of a high level consensus on the need for an e-measurement infrastructure, and its possible architecture and underlying international guidelines.
3. **Set priorities:** This initiative must also serve as a valuable opportunity to reset ICT and e-business development priorities in their right order. The case for a more rigorous

policy making process must also be coupled with due consideration to the urgency of reducing the digital divide (a goal that is often absent from many policy initiatives).

4. **Create NSO unit:** To be capable to pursue this initiative, NSO's must build the central command unit necessary to interface a wide diversity of policy areas, institutions, international channels, etc. This shall require a different skill set than the usual ICT and e-business statistics office, most likely focused instead on policy community management, and extensive ICT experience in the private sector (so as to ensure thorough understanding and relationship with various policy sectors as end-users of the data).
5. **Adopt standards:** The NSO unit responsible for this initiative should be the leading group demonstrating the state of the art in implementing international guidelines. It shall act as a host for other policy areas to learn how to implement these standards and processes, and serve as a consulting office to build and certify fully operational data-driven policy analysis units in the various priority action areas of ICT and e-business for development.
6. **Invest in tools:** Given the difficulty in using high-end analytical technologies, the NSO unit would be responsible to serve as a regional operation and maintenance center for the business intelligence information systems used by their regional policy communities.
7. **Invest in training:** All parties, including the NSO unit leading the initiative as well as their policy constitutions, should actively participate in a common international training program. This would become the key incentive and driver of the initiative in difficult moments, especially in times of implementing new processes, staffing new positions, and using new technical tools.
8. **Share outputs:** All parties should take leadership in their respective areas to share the results of extensive data-driven policy analyses. This shall serve as a legitimizing factor and also in promoting the proper approach in using various e-measurements for policy making.
9. **Improve DB tools:** As active members of this international e-measurement infrastructure, all parties should have a continuous quality improvement plan in place, in particular focused on systematically developing and testing new tools, especially in partnership with leading international authorities in their field of expertise.

1.9. Universities

If universities were allowed to play a key role, along the lines outlined in section 5 of this paper, we may think of them as close partners of NSO's along similar steps towards a fully coherent and operational e-measurement infrastructure.

Academic institutions should therefore consider the following steps in fulfilling their role, and pay close attention to synchronizing their efforts with NSO's:

1. **Assess needs:** As NSO's would identify end-users, universities should help them in identifying their needs. This may take the form of active observers in various negotiations, and in documenting processes and requirements.
2. **Identify experts:** Universities should leverage their international networks to help NSO's and ICT and e-business policy organizations to staff this new infrastructure. This effort should feedback into the NSO consensus building initiative, as experts would help take in action some communities in need of leadership.
3. **Set deliverables:** As NSO's would arrive at a clear set of ICT and e-business policy priorities, universities should be better able to identify the gaps necessary to be filled by the e-measurement infrastructure. As such, it would define the key deliverables that universities shall provide this community. It would also help determine the scope of the initiative, and to properly allocate work among the international network of supportive institutions.
4. **Find incentives:** The creation of an official NSO unit dedicated to steering the e-measurements initiative should coincide with the identification of key resources to provide incentives to universities to continue their involvement in this international process. It should be a opportunity for educational institutions to recover the upfront cost involved in researching best practices and in developing basic international guidelines.
5. **Optimize process:** Once universities are endowed with the proper resources, they should rapidly work with NSO units to bring these best practices into standards. In that case more efforts may be required to reengineer and optimize several policy-making processes in various ICT and e-business areas. As such, universities would take a consulting role throughout the various policy communities in determining the scope and scale of changes required to properly implement a data-driven approach to policy making.
6. **Create DB tools:** The development of the underlying information systems and IT tools required to run this infrastructure would need to be built in phases. As NSO units would progressively invest in these tools, universities should launch various initiatives to research and customize tools to various policy communities.
7. **Launch degree:** As the primary providers of training in this initiative, universities should build a graduate degree in close partnership with leading and experienced NSO's. This should also be a public demonstration of the effectiveness of university contributions, providing for a lasting impact throughout the communities of practice surrounding e-measurement.
8. **Publish findings:** To provide greater visibility and credibility to the data-driven policy analyses of various NSO's and policy units, universities should partner closely with these actors to help publish these findings in various avenues. This shall also prove useful in bringing e-measurements to bear some impact in the public domain, beyond regular policy debate forums.

9. **Improve standards:** As NSO practitioners would continue improving the technical side of the infrastructure, universities could partner with the policy leaders of various ICT and e-business areas so as to constantly improve the standards and processes used by these constituencies. This shall serve as a vital renewal of training programs, and also a mechanism to ensure continuity throughout the international community of practice in e-measurement.