ICT Adoption for Distance Learning – a Challenge for Convention (The Israeli Agricultural Extension case study)

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Abstract: *Initial convention assumed Distance Learning (DL) to be an Information and Knowledge transfer solve-all. Regardless the details of difficulties and are becoming manifestly dominant. They include a lack of essential learner skills, inadequate DL responsive human interactions, insufficient subject matter feedback into the system's knowledge content, selective impact on different target groups and economic problems. This complexity in turn is augmented by the lack of full comprehension of DL's impact on social restructuring, community viability enhancement, employment consequences and resulting spill-over. Conceptualization and addressing these issues constitutes a unique challenge and crucial concern in all countries - worldwide. One way to approach and attempt to cope with these issues and evaluate solutions is to share the DL experience of a comparable, well defined target group with its relevant knowledge dissemination entity. Such a group is exemplified by the Israeli Agricultural sector and the Israeli public sector's Agricultural Extension Service (IES). They are dependant on adoption of innovative ICT, an intimate integration of the upcoming "digital natives" into the agricultural professional hierarchy and they, dictate rapid implementation of cutting edge research results are characterized by a well established balance with conservative traditionalism's constraints. These are familiar and urgent DL operational issues. DL content and dissemination methodologies are constantly evolving. This suggests conferring on "ICT for DL" a "critical success factor" status – justifying regional and national priority allocation of intellectual, social, research and economical resources over and above today's pittance. These as yet unresolved issues are a challenge to conventional "learning" solutions.*

Keywords: *Distance learning, Knowledge transfer; Innovation adoption commonalities*

Background

The collaborative contribution of Agricultural Extension and Research as a source of knowledge to Israel's agricultural productivity and profitability hails back to the late 19th century. It facilitated technological innovation, transfer of information, training of farmers, feedback to research and rural sector viability. These were in effect the response to the dictates of continuously deteriorating agricultural terms of trade, crippling water shortages and severe climate and soil constraints. Perspectives and insights gained in this learning process have stood the test of time. They were in turn enriched by DL - enhanced with the adoption of ICT to the content and technicalities of knowledge sharing, feedback and intimate integration with research, agricultural services and international interaction - professional and economical. The very wide range of Israel's agricultural product categories include food, raw materials, agricultural inputs, leisure products, primary and secondary services, resource management technologies and derived products of education, science and culture. The sector's viability requires and depends on specialization which dictates basic and Life Long Learning (LLL) practices – characteristic of DL. These require an ever growing emphasis on innovation, professional competence, intimate association with R&D and collaborators – in Israel and abroad. Failure to keep pace with understanding, disseminating and implementing innovation has dire consequences for learners/farmers individually and for the agricultural sector in general. The potential contribution DL can make in avoiding such failure can be substantial. The methodology adoption similarity between DL and

ICT is supported by Katz, Ben David (1975). They suggest that it is almost impossible to exaggerate the importance of ICT (re DL as an example) in enabling and maintaining smooth interactions between innovation developers, knowledge providers (teachers/researchers), End-users (learners/farmers), the various beneficiaries of ICT (DL) and the public at large.

The history and background of Israeli agriculture, its Extension Service (IES) and the adoption of ICT are detailed by Elkana, Y. (2001) and Gelb, E., Gal, B. and D. Wolfson (2009). Saravanan (2010) completes the "ICT interaction with DL" overview by reviewing the international Agricultural Extension scene today. All three detail the contribution of ICT to Extension methodology, to ICT Adoption constraints and the learning process. They indicate that the adoption of ICT is one instance of technological innovation that dramatically improved the transfer, sharing and management of information, production chain efficiencies and integration within and with the agricultural sector - all being learning and DL processes. They specifically review the details and constraints of ICT reflected in the various information technologies and their contribution. A general overview of ICT Adoption in Agriculture is presented by Gelb, E. and Offer (2005.)

Looking at a more general overview of Innovation adoption and their definition in the context of commonalities between Extension and DL's adoption of ICT is facilitated by the following resources - Rogers, E. (1962), Pavitt (1984), Dossi (1988) and Hipple (1988). They discuss and evaluate in detail definitions of technological innovation while conceptualizing its diffusion. Gelb, E., Schmidt, J. and R. Rauschkolb (1985) focus the discussion by reviewing the role of computers in Agricultural Extension with specific insights, Iddings and Apps (1990) try to quantify the parameters that influence Farmer's computer use in general. Gelb E. and G. Bonati (1997) go a step further by evaluating ICT (Internet) for Extension with elaborate definitions.

Gelb, E., Gal, B. and D. Wolfson (2009) complement the earlier Internet findings by defining adoption and success/failure factors pertinent to DL constraints shared by IES's Internet experience. The factors included:

- Technical uptake problems;
- User benefits from using Internet;
- Drawbacks from using Internet;
- Organizational aspects and responsibilities;
- Obstacles to the use of Internet for learning;
- Knowledge gaps and new trends if any;
- Proposed and/or potential development alternatives;
- Additional issues of impact and/or influence;
- exchange of information between specialist/specialized groups;
- exchange of information between specialist and the farmers;
- a short response time for accessing information and/or guidance;
- integration of disciplines;
- accessing information from outside organizational sources.

The critical success factors for Internet, as for DL adoption were identified as:

- technological infrastructure;
- computer and Internet literacy;
- relevant and timely information availability;
- change in work habits;
- focused organizational effort.

Gelb, E. and A. Offer (ed. 2005) collated additional perspectives of ICT Adoption in Agriculture in a generalized overview while Gelb, E. and C. Parker (2006) by then ask "Is ICT Adoption for Agriculture Still an Important Issue?". Gelb, E. and H. Voet (2009) summarize ICT adoption trends in Agriculture over the

past decade. Gelb, E. and D. Levanon (2008) outline the role of Public Funding of Agricultural Research in the process and Gelb, E. et al. (2008) summarize an international workshop evaluating the role of ICT in Agricultural Development and Rural Viability.

The essence of *"technological innovation adoption commonalities"* re above references - in this case Extension and DL - was reviewed and addressed in detail during a cross theme session of the Joint International Agricultural Conference (JIAC) held in 2009 in Wageningen, Holand. The session was titled: "Constraint Commonalities of Technological Innovation Adoption"- http://www.jiac2009.nl. Specifically the session attempted to decipher ICT development and adoption constraint commonalities as guidelines to explain for example *"why significant ICT potential benefits for agriculture and rural development remain unrealized"* as is the case with DL. It was assumed that evaluation of constraint commonalities can go a long way to rectify this situation - at least by avoiding repetition of past mistakes and sidestepping conventions. One session presentation suggested that the following are common and dominant constraints - which apply to unsuccessful DL applications as well:

- lack of ICT (DL) applications "tailored" to end-user needs;
- insufficient ICT (DL) proficiency to match application complexities;
- inadequate DL synchronization updating with needs, educational dictates and DL market realities.

The realities of agriculture today, the information and knowledge needs of farmers, students of agriculture and learners in the rural sector represent essentially the challenges and conventions confronting DL today. These especially relate to the scope and magnitude of new knowledge, new "learning" technologies and their implementation. A unique insight was verbalized – namely that: *"The assumption that an ICT (DL) adoption constraint once mastered will neutralize any similar innovation constraint in the future is no longer indisputable…".* This translates to a significant insight that the crucial role of agriculture extension as an intermediary between research, adoption of results, feedback to research and proficiency acquirement has much to share e.g. with all demands inherent in expectations from "learning" in general and increasingly from DL - including ICT supported features such as on/line - real/time activities, data mining, implementing research results and knowledge, connectivity at various levels, timing and composition of participants, etc.

DL and Extension Commonalities and similarities

Transcribed from JIAC discussions the following ICT adoption constraint commonalities seem relevant to the development of DL methodology, alleviating DL implementation constraints and addressing conventions inherent in ongoing learning:

- *Teacher and other intermediary considerations:* There is an imperative need for preferably neutral intermediaries to alleviate adoption constraints which include unsuitable teaching methodologies; Innovative interaction methodology with learners must include innovative incentives, adoption models based on end user choice of priorities and learner involvement; recently available open source software should be utilized.
- *Learner considerations:* DL innovations must be tailored to specific learner characteristics not only "accepted conventions"; learner participation in the initial design stages of DL innovations is a critical success factor; learner interaction, collaboration and competition can alleviate DL innovation adoption constraints; within these DL adoption innovators, agents of change and intermediaries are critical adoption success factors; "Doing the same" but more efficiently (incorporating the innovation into existing practice) is often as productive as an "innovation" - conditional on learner confidence in the innovation's value and reliability.

- *DL provider considerations:* Ensure compatibility with standardized definitions and real life updates including those initiated and or adopted by learners and their peers; Man-machine-interface (MMI) remains a dominant DL adoption impediment needing meticulous attention - hopefully with learner involvement; DL specifics must be compatible with overall supporting infrastructure (including labs, broadband, input supply logistics, built-in trouble shooting, etc).

The sources of "new" knowledge and information to be disseminated, beyond classical subject matter such as reading, writing and arithmetic are shared by IES, DL and rural learners.

They include

- Regional services and government
- Regional R&D, learning and information provider entities
- Upstream entities, services,
- External, international and other random knowledge providers.

They are also substantial sources of DL financing for technical and methodology support via budgeting, taxing, subsidizing, grants, loans, etc. As such it is imperative that they should be involved in DL planning, development and implementation. The convention that these are "a given" can be a major inhibiting impediment to successful DL implementation.

An issue of primary significance for successful DL implementation is the identification of the source of innovation and its adoption methodology. The convention that only "experts" and/or the "professionals" are competent to tackle DL implementation can be a major inhibiting impediment as well. Rogers's (1986) model of innovation adoption is helpful and is adaptable to current IES methodology, practice and DL. An interesting Israeli example - a program of "agricultural education" - demonstrates potential adoption commonalities between the IES and DL. In this program IES and other "teachers´" use demonstration and research oriented, school located, green houses for information generation. They routinely include in the program all the regional and government services. DL is then utilized for dissemination of this information. The partnership ensures that DL content is currently relevant and suited to "learner" requirements.

To go into further detail the IES experience and findings suggest issues relevant to DL competence and achievement. The categories and guidelines include and suggest:

- verification of statistics, relevance of information, results of automated calculations, forecasting and projections;
- learning via model manipulations, simulation and optimization of expert systems;
- gradual DL adoption at all learner levels without structural changes;
- computer facilities will be accessed, shared and not duplicated;
- ICT training is essential and should be included in every possible extension activity;
- ensure maximum IES flexibility;
- ensure that DL will be incorporated into existing collaboration with learners, research and services.

Some major issues, constraints and insights which emerged early on during IES ICT development and implementation were methodologies seemed to be appropriate for DL adoption and implementation – many in tune with but still challenging to education realities:

- the ability of "management" to guide regional DL activities and support them;
- defining procedures and securing funds for DL equipment procurement;
- lack of tools for evaluation of improved staff effectiveness;
- formulating guidelines for allocation of priorities of DL issues;

- over-enthusiasm and unrealistic expectations;
- recognizing and sharing benefits inherent in openness and collaboration;
- a need for DL dictated staff retraining, education, reassessment of programs and their goals;
- how not to stifle initiatives, unplanned but successful scenarios and insights;
- how to cope with restructuring within the organization's balanced hierarchies, management competencies, individual conservatism, competition and in-service inadequacies;
- how to define and meet personal, political and organizational expectations;
- improved services to learners over and above efficient "delivery";
- inclusion of previously excluded potential DL beneficiaries;
- shared social networks – mainly interpersonal learning enhancement and potentially central monitoring of the process and results;
- a better farmer/learner understanding of subject matter and biological systems;
- improved professional communications – between "knowledge" and learners;
- additional ICT supported learning dimensions including e.g. remote sensing and control, real time imaging, simulation, signaling of priorities to the private sector and integration with complementary and associated education systems;
- a basis for joint professional development of programs and "teaching" personnel;
- ensuring a focus on optimizing scarce human capital and funds;
- verification of the primacy of the human element in all programs: limiting, if necessary the impact of market forces and interests.

Dedicating a unique Internet IES site for learning (DL) elicited the following points for evaluation:

- Technical uptake problems;
- User benefits from using the site;
- Drawbacks from using the site;
- Critical success factors in operation and utilization;
- Organizational aspects and responsibilities;
- External non learning constraints to the use of Internet for learning;
- Knowledge gaps and new trends if any;
- Proposed and/or potential development options;
- Additional issues of impact and/or influence.

Their evaluation elicited what were considered "critical success factors":

- technological infrastructure;
- computer and Internet literacy;
- relevant and timely information availability;
- change in work habits;
- focusing the site host's organizational effort.

ICT and mobile telephony efficiently facilitated IES with a direct parallel to DL

- transferring, diffusing, teaching and introducing information and innovations directly to individuals and or designated groups;
- multi directional exchange of data, information and/or knowledge;
- Real time, 24/7 direct and/or conference contact with all beneficiaries;
- A higher degree of independence in sharing written communications, addressing recipients and diminished dependency on secretarial services;

- Ongoing input, access, formal organizing and recording of data in the various IT options – including direct and remote numerical, visual, audio and other forms as part of the learning process;
- Documentation of input, output and authentication;
- Real time access to data, records, information, colleagues and clients;
- Ongoing follow-up of trends within subject matter domains;
- teacher/extension staff availability and short response times;
- diminished dependency on "physical" presence.

Site drawbacks included an overload of information, irrelevant requests which overloaded the system, reduced information ingestion effectiveness and imposed an unproductive, additional work load on extension staff. Specifically mentioned were:

- an overload of information;
- a possibility of widespread dissemination of incorrect information, non-optimal recommendations and in the extreme spread of malicious disinformation;
- an unproductive demand on (officer, farmer, research, client)'s scarce time;
- a dependency on ICT involving loss of physical contact, intuition and precision of decisions.

Discussion

The following ongoing challenges and issues facing adoption of ICT for Extension and the agricultural sector everywhere present a similar challenge for DL adoption as well. For example some crucial ICT innovations and related issues became none issues over time just as some basic proficiency constraints became irrelevant e.g. using a computer for internet access:

- the profile of the "average" DL client is constantly changing;
- ICT capabilities have in many cases surpassed imagination:
- Innovative ICT supported systems including DL are constantly enabling Extension and Farmers/learners to continue doing their respective activities more efficiently, with more sophisticated interactions and superior connectivity – at a cost. For example use of non optimal ICT. Correct selection of ICT systems and priorities and their use is imperative;
- Expectation from new ICT vs. adoption results can render initiative priorities irrelevant over time. An example is the planned training for adoption of e-mail, justification for the use of laptops, relevance of spreadsheets and other redundant ICT and DL priorities.
- ICT can produce an overload of information, an overload of data entry dictates, non essential connectivity, distraction from essentials, loss of intuition in decision making, reliance on "popular" vs. verified information, shared but non-specific field trial summaries, etc. Verified routines to handle these pitfalls must be part and parcel of Extension/DL responsibilities;
- ICT supported connectivity between research, learners, agents of change and early-majority innovators is intensified and can eventually become multi-directional. Specifically it may be a farmer/learner feedback that is the source of innovation, the source of innovation may be from abroad jointly evaluated by farmers, extension and research, etc. This changing multi-directional flow, its routine and evaluation needs constant verification especially considering IES's comparative advantage as an agent of change itself and DL as a disseminator of knowledge;
- Convention suggests that "farmers are conservative" and "slow in innovation uptake". The impact of this convention on DL goals is a critical challenge;
- Organizational inertia and management resistance to change in various degrees are inevitable – being a serious challenge to DL as well;

- ICT utilization tends to create communities - some of which may be within IES and DL sphere of interest, responsibilities and concern. Although publicly funded DL may not be in a position to serve these communities and/or be in a position to initiate new ones as needed. This dilemma essentially entails various collaboration efforts with unexpected partners;
- How to measure the add on ICT benefits as attributed to DL efficiency and results;
- How to sustain familiarity and personnel ICT competence within the DL programs and participants?
- How to ensure DL program content compatibility with community needs, employment opportunities, environmental considerations and rural quality of life;
- To what extent is DL effectiveness dependent on ICT proficiency and compatibility with innovative, learner accessible ICT.

Summary

DL challenges many traditional technical and methodology learning-conventions. One major reason is the current relentless rate of changing ICT - features, interfaces, content availability, end user requirements, "learning" demands for updated content, expectations of modern living – to name just a few. Sharing experiences of development, implementation of learning methodologies and adoption of innovations can go a long way to avoid repetition of mistakes, unnecessary costs and misuse of scarce human capital. Effective sharing is dependent on meticulous definition of comparable parameters - for example conceptualization and details of innovation adoption. The IES and Israel's agricultural sector are a well studied and suitable case study for focusing on DL's ICT Adoption challenges – ICT being an innovation and a DL critical success factor.

The IES related findings and discussion detail many commonalities between adoption of ICT for extension – a teaching and learning entity – and ICT adoption as a current DL core prerequisite. This includes current methodology updating, development and repositioning vis a vis established conventions. Elementary innovation adoption rules are a good guide to alleviate in general DL's confrontation of "conventional innovation adoption methodology and learning practices" with ICT adoption challenges. Overcoming conventions by designating "ICT for DL" as a "critical success factor" will justify priority allocation of intellectual, social, research and economical resources over and above today's dearth of resources.

In detail the IES experience in adoption of ICT provides a comprehensive example of innovation adoption by a service providing the public with basic information, reports of updated knowledge, learning facilities and enhanced learning inclusion. Demonstrating the potential benefits of "bottom up" participation in the innovation adoption process is a unique challenge to convention as is the unique IES pattern of collaboration between research, extension, "learners" and collaborating agents of change. Hopefully incorporating this experience into DL's aspirations will enable meeting challenges presented by traditional learning conventions.

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