eGovernance: Information and Communication Technology, Knowledge Management and Learning Organisation Culture

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Changes in information and communication technology (ICT) require continuous modifications in contemporary organizations and in corresponding work processes. The integration of new technologies is highly correlated with the emerging principles of knowledge management (KM) and learning organization (LO) culture. However, the interactions of these two concepts with ICT are rarely studied. This paper addresses this complex issue by first conceptualizing the notions of ICT, knowledge management and the learning organization. It analyses their interrelation and potential impact on eGovernance. Finally, the conceptual model was estimated by normal theory maximum likelihood using the LISREL 8.51 program [28] . It was estimated on data from a survey of Slovenian public administration organizations. The main finding is that – beyond the impact of ICT – the application of knowledge management (KM) principles considerably supports and stimulates eGovernance.

Povzetek: Prikazana raziskovalna naloga vsebuje analizo vplivov "tehnologij informacijske družbe" na razvoj organizacij v javni upravi.

1 Introduction

Notwithstanding the views of Nicholas Carr [39] , information and communication technology (ICT) continues to be a powerful force in transforming the ways in which societies and economies operate. The widening use of ICT is having profound impacts on patterns of living, communicating and work. At the same time divisions between an ICT perspective and other disciplinary perspectives (e.g. economics, politics, sociology) are becoming less firm. The impacts of ICT are more than just those of efficiency and effectiveness. The impact of ICT is moving deeper and deeper into substantial economic and social science domains, where it increasingly interacts with them [40] . To understand modern transforming public administration one could not avoid studying the emerging role of ICT and its driving role to improve public administration.

All too often, when the role of ICT is conceptualized, the emphasis is frequently only on its technological aspects and omitting other impacts (e.g. social) [41] . Of course, within public administration, the flow of information society services and applications cannot be understood if detached from an ICT technical prospective. Previous “paper oriented” work activities have now been replaced by modern ICT supported processes, coupled with new organizational principles, where activities and services are provided through flexible and complex multi-organizational structures [3] . ICT advances (networks, computing power, applications, etc.) have enabled disbursed information to be assembled into accessible complex organizational database knowledge repositories. ICT brings new quality to services as it re-organizes knowledge and effectively incorporates intelligent access to and use of the data [18] . The researchers working in the areas of

economic and social policy and public administration increasingly need to incorporate knowledge about the role of ICT in the processes studied.

As previously stated, ICT related technological aspects are only one component of what needs to be understood for proper understanding and effective implementation of ICT. Other aspects that need to be understood relate to the broad array of supporting activities within an organization, and within that organization's societal environment. Within this context, the essential components are (1) knowledge management (KM) and it's emerging principles; and (2) learning organization behavior (LO).

Individually, KM and LO, as well as ICT, are already well explored. However, they are rarely studied simultaneously and in an interactive fashion. This paper addresses that challenge: how to conceptualize the interaction of ICT, KM, and LO, to understand their impact on the specific outcome of organizational behaviour. In this study we focus our attention on the governance principles and practices that arise from ICT usage in the public sector, i.e. we focus on eGovernance. The main objective of this study is to build a model of the relations between ICT, KM, and LO, and use that model to test some relationships against Slovenian public service data.

The paper starts with an overview of the basic concepts. Next, a theoretical model is constructed for ICT, KM, LO and their impact on eGovernance. The resulting causal model is applied to survey data on eGovernance practices in Slovenian public administration organizations. The paper concludes with a summary of the results, together with the suggestions for future research.

2 Basic concepts

We first review the terminology and concepts to be used in the work. Technically speaking, **information and communication technology** (ICT) is a mixture of *hardware* (equipment), *software* (operating system, applications, etc.), and *communications facilities* (local area networks, wide area and backbone networks, communication protocols, etc.). Work on the expanding role of ICT on business and administrative processes has been underway since early 1970's, when the process of massive computerization began. However, the corresponding social and economic dimensions were considered only with some delay [24] . The introduction of personal/desktop computers in the 1980's, linked through the Internet in 1990's, further increased the role of ICT, as well as the importance of the accompanying social contexts. This was particularly important for the supportive and innovative aspects of governance in organizations [8] . ICT advances have become a permanent force bringing continuous and sometimes unpredictable changes to organizational structures and processes, including services delivered, management practices and governance.

Knowledge management (KM) is a relatively new concept, whose emergence is only indirectly linked to the above described ICT developments. It arose within a well-known, and well researched, "Initiative for Managing Knowledge Assets", undertaken in 1989 among a consortium of US companies working on a platform for managing knowledge [42] . Since then, the idea expanded in many directions, from the local and regional level as "Communities of Practice", to within the private sector as a "Corporate Knowledge management", or "Knowledge and Innovation management". Failed KM is even identified as one of the factors playing a major role in the February 2003 Columbia space shuttle disaster."[1]

The literature increasingly focuses on how organizations and institutions implement ways of accumulating employees' knowledge in electronic databases so as to use them as repositories of the shared, company/institutional wide "structural capital" [36] . Current conceptions and approaches to KM focus on handling *explicit* knowledge that is "transmittable in formal, systematical language" and can be stored in specifications, reference manuals and institutional handbooks [15] . Knowledge resides in the users and not in the collection. It is how users react to a collection of information that matters [3] . It usually falls short of using knowledge management to create a climate and culture of known practices and assumptions, which are stored in an employee's brain. This can constrain an organization to the limits of the Drucker Theorem of "doing more of the same better and better, however, with diminishing marginal returns" [42] .

KM scholarly papers and books began to appear in early 1990's, e.g. Senge's *The Fifth Discipline* [15] and Sakaiya's *The Knowledge Value Revolution* [36] . The first KM textbooks appeared only by the end of the 1990's. The KM concept continues to receive increased, illustrated by a quote from Larry Prusak, the executive director of the IBM Institute for Knowledge-Based Organizations (IKO)[2]:

"In the emerging economy, a firm's only advantage is its ability to leverage and utilize its knowledge".

Modern ICTs have another consequence in that they can centralize or decentralize teaching and learning. Either way, this can radically broaden the access to learning. This is closely linked to another focus from 1990's, that of the **learning organization** (LO). LO, LO behaviour, and LO culture, relate to the

[1] See ComputerWeekly.com: http://www.computerweekly.com/Articles/2003/08/27/196769/ReportKnowledgemanagementfailurescentraltoShuttledisaster.htm (August 2003)

[2] See: http://www.providersedge.com/kma/ (October 2005)

notion that organizations, and the people within them, continually expand, and access, their collective knowledge and skills in the pursuit of desired outcomes, or organizational deliverables. Within a learning organization culture, new and expansive patterns of thinking are nurtured, collective aspiration is "set free", and people are encouraged to see challenges and opportunities within "the big picture" [15] . In successful LOs, individual learning is continuous, knowledge is shared, and the organizational culture supports learning. Employees are encouraged to think critically and take risks with new ideas: all employees' contributions are valued [22] [23] . Pedler, Burgoyne, and Boydell define the LO as an organization that facilitates the learning of all its members, in support of the continuous transformation of itself in pursuit of the organizational mission and vision [11] .

We now turn to apply these ideas to governance and public administration. Within this work we understand **government** as the system and the organizational process by which a given community is governed. Governments produce huge volumes of information and documents. ICT enabled information networks (e.g. LANs, Intranets, Internet) increasingly remove the boundaries separating internal parts of the government from each other (improving efficiency) and from users (improving effectiveness) [7] .

The concept of **eGovernment** is commonly understood as governmental procedures and tasks supported by (ICT enabled) digital means: "eGovernment is the use of information and communication technologies to improve the activities of public sector organizations"[3]. For purposes of analysis, we propose to decompose government procedures and tasks in two components [1] :

- **iGovernment:** converting existing information processes and paper objects into digital form. This first step focuses on the internal digitalization of documents, and contributes to the efficiency and effectiveness of public administration.
- **eGovernment:** upgrading and building on previous step of iGovernement, it relates to Internet-based digital services offered by the government administration to its non-government clients (i.e. citizens and businesses). eGovernment is converting literal services into virtual services.

Public **governance** is also recognized as the strategic exercise of economical, political and administrative authority to manage the nation's affairs at all levels. Ewalt sees governance as blurring of boundaries and responsibilities for tackling social and economic issues [3] . Peters and Pierre suggest that governance is about a political theory, and that Public Management is a form of organizational theory [13] .

The OECD characterizes effective public governance as helpful for strengthen democracy and human rights, helpful to promote economic prosperity and social cohesion, to reduce poverty, to raise capacity to learn, to enhance environmental protection and deepen confidence in public administration [10] . The International Teledemocracy Centre proposes that eGovernance should support ocommunication between government and civil society [17] . Papers by Clift [2] and Vikas [8] argue that the concept of **eGovernance** relates to strategies of government where ICTs have a substantial role.

For our work we start with the all encompassing OECD role for governance and explore how ICTs enable and deepen KM and LO behaviour. There are many concepts of eGovernance (Malkia, Anttiroiko and Savolainen [19] , Reinermann and Lucke [20] etc.). Here, in narrow terms, we will basically understand eGovernance as the use of ICT to improve the effectiveness and the efficiency of all phases of the public institution processes. eGovernance is also closely related to **eDemocracy**, which combines the ICT with increased levels of democratic incentives [2] , as well as with promotion of **knowledge society**, characterized by new measures of competitiveness, such as knowledge generation, increased research and development, the availability of knowledge to citizens [8] and their enhanced capacity to learn [6] .

The concepts of ICT, KM, LO and eGovernance are relatively new and, within limits, their definitions are constantly changing. It is thus not surprising that measurement and evaluation face serious problems with regard to corresponding definitions.

Within ICT measurement and evaluation are already an inherent and almost endemic problem, spanning early discussions around the "productivity paradox" to contemporary discussions dealing with the return on ICT investments (ROI) and problems with ICT evaluations [27] . The role of ICT is also extensively analyzed in the studies of national economies, productivity growth and the components of product added-value [25] .

Similar definition and measurement problems accompany the concept of KM [14] . KM is related to variables and attributes that are hard to standardize and evaluate. These include contents, relations, processes, procedures, infrastructures, networks, institutions, modus operandi, linkages, capacity to learn and evolutionary processes [32] . Though there exists a huge community focusing exactly on measuring challenges e.g.: the Intellectual Capital community with several publications as: Journal of Intellectual Capital, World Congress on Intellectual Capital, European Congress on Intellectual Capital etc.

One can generally distinguish between two different processes of organizational change that are associated with LO [33] :

[3] Source: eGovernment for Development, *Basic Definitions Pag,* Richard Heeks, IDPM, University of Manchester, UK, 2004 - http://www.egov4dev.org/egovdefn.htm, June 2006

- **Adaptive learning**: internal changes that have been made in reaction to changed external environmental conditions.
- **Proactive learning**: organizational changes that have been made on a more wilful basis. This is learning into action which goes beyond simply reacting to external environmental changes.

A LO, and learning organization behaviour, have to promote information exchange between employees, and create a more knowledgeable workforce. A LO seeks a very flexible organizational structure where people will accept and adapt to new ideas and changes through a shared vision[4]. This brings a new perspective and growing importance to organizational knowledge, which can be responded by the "learning organization" as the challenge of creating a culture of managing knowledge [15] .

Several studies have developed methods for assessing knowledge through the LO environment. The include Krebs Valdis: Knowledge Networks - *Mapping and Measuring Knowledge Creation and Re-Use*, 1998[5]; Lethbridge Timothy Christian: *Practical Techniques for Organizing and Measuring Knowledge*, [doctoral thesis] November 1994[6]; and the Gurteen Knowledge Conference 2003[7]. Within this context, Perkmann suggests the measurement of the value of knowledge from two perspectives: the macro view (which quantifies the intangible assets of an organization) and the micro view (where the impacts of individual knowledge projects can be assessed and quantified) [12] . Riley frames KM to include the active creation, transfer, application and re-use of (tacit) individual knowledge, as well as codified (explicit) collective knowledge, supported by new approaches, relationships and technologies [21] . Both aspects are used to increase the speed of innovation, decision-making and responsiveness to organizational objectives and priorities, and can be a basis for the effective implementation of LO culture. Recent literature reminds us that if knowledge is explicit then it can (perhaps) be managed, measured, codified, etc. But, for tacit knowledge, it "can only be learned", but it must shared, fostered etc., to persist and survive within the organization. Noordegraff takes the utilitarian view that managing knowledge is "the configuration and control of operational knowledge processes in such a way as to promote the yield and pleasure of knowledge as a factor of production" [9] .

New definitions of KM are repeatedly proffered, trying to capture the essence of the concept. See: Drucker: Management Challenges for 21st Century [34] ; Sveiby: Managing and Measuring Knowledge-Based Assets [35] ; etc. Each complements the understanding of the KM concept, but observed from different perspectives.

[4] See: http://www.see.ed.ac.uk/~gerard/MENG/MEAB/learning_organisation/definition.html (August 2006).

[5] See: http://www.orgnet.com/IHRIM.html, Sept. 2003

[6] See There are many concepts of eGovernance (Malkia, Anttiroiko and Savolainen [17]; Reinermann and Lucke [18]), however we view it as the use of ICT to improve the effectiveness and the efficiency of all phases of public institution processes and its outputs: http://www.csi.uottawa.ca/~tcl/thesis_html/thesis.html, Sept. 2003

[7] See: http://www.gurteen.com/gurteen/gurteen.nsf/0/1878458C9E62DB7E80256C9E0062814F/, Sept. 2003

3 Model and hypothesis

Our intent is to construct a model that can assist in analysing here the relationships between ICT, KM, LO, and diverse social, economic and technological factors. More specifically, we examine the relationships between ICT, KM and LO culture within the context of their influence on governance (eGovernance) in public administration. Our ultimate aim is to identify and assess the factors that contribute to the improved eGovernance (Figure 1).

Within this context, we primarily investigate a theoretical model to understand KM, ICT and LO culture can work together to organize government in pursuit of improving **iGovernment** (organized digital and on-line information), **eGovernment** (on-line services) and finally to achieve good **eGovernance** (promote inclusion, democracy, etc.).

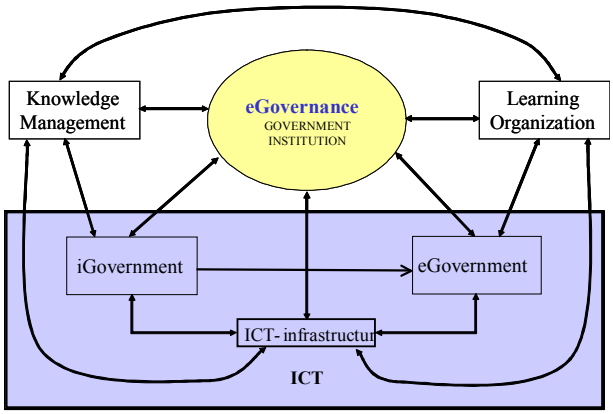

Figure 1: Conceptual Model for Research

Our key hypotheses are as follows:

H1: ICT, LO and KM all have strong (and measurable) impacts on **eGovernance**,

H2: While ICT impacts LO and KM, we also expect a causal link from KM to LO, because LO culture is stimulated by the KM practices [15] .

H2: The impact of **eGovernment** on **eGovernance** is high, while **iGovernment** has only indirect impact on **eGovernance** via **eGovernment**.

3.1 Operationalizing the Model

Each of the key concepts discussed above needs to be further operationalized and elaborated upon, so that the model can be empirically tested with survey question data. Here we develop these concepts into measurable components. The labels in the brackets denote the actual name of the corresponding compound variable in table 2 (appendix B). There, the variables are arranged hierarchically according to the final causal model structure (Figure 2), which expands the initial conceptual model from Figure 1.

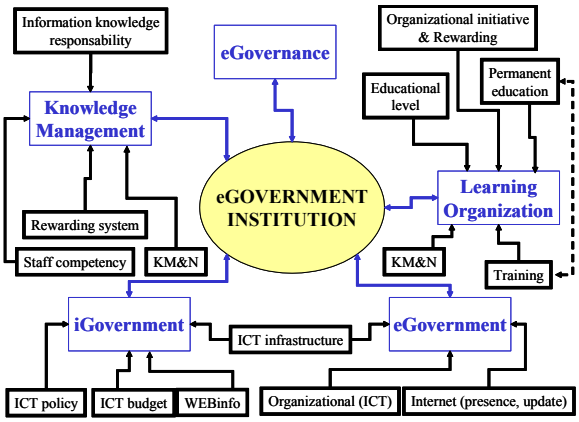

Figure 2: Elaborated relations of Conceptual model for Research

1. We operationalize **ICT** in the following components:
   - **ICT Infrastructure ("infrastr"):** hardware (computers, ranging from PCs, laptops and personal digital assistance to servers), communication media (networks, cables, routers, switches, etc.) and software (programs, applications, tools). In Table 2 this variable includes 14 elements, ranging from percentage of employees using computers (see: variable "v2_1" from Table 1) to the usage of various ICT services. We expect that this variable has an impact on eGovernement as well as on iGovernement, thus it appears twice on the corresponding left side in Table 2. For this reason it is also shadowed.
   - **eServices ("webinfo"):** intra and inter organization interactions including business to business (B2B), business to government (B2G), internal (G2G), as well as to business to customer (B2C), and government to customer (G2C).
   - **Internet ("webpres"):** communication tools (e-mail, browsers, search engines, blogs, text messaging, etc.). Also includes information, archiving, presentation, marketing, multi-media deployment (e.g. peer2peer, Skype), finance transfer vehicles (e.g. eBanking, eStock-Exchange) and much more.
   - **ICT policy ("policy"):** explicit policy or tacit organizational culture defining working processes, organizational behaviour and the processes that produce "outcomes". It also defines how and why and where data, information, transactions, etc. are to be located within electronic (digital) system.
2. Within the model **organizational behavior** is made operational with the following components:
   - **Organizational initiative ("organiza"):** organizational *changes* related to events and environmental factors including technological changes, as well as changes in organizational structure and processes.
   - **Educational level ("educat")** refers to different knowledge and skills, including the array of professional qualification,
   - **Permanent education ("trainb"):** Once a person leaves the formal education system, for a person within a Learning Organization, a life-long learning process becomes necessary and ICT is one specific vehicle for obtaining new knowledge, training and skills (eLearning).
   - **The reward system ("reward")** relates to monetary incentives (salary, options, etc.) for both efficient and innovation work, and it also includes other types of rewards (job satisfaction, prestige, promotion etc.).
3. **Knowledge management and networking** has the following operational elements**:**
   - **eCapture of staff competency ("eCapture"):** organizational knowledge may be tacit and reside within an employee's head or it may be explicit and clearly documented. Similarly, skills accumulate as a result of learning by doing, if properly identified and motivated, can be effectively accessed and brought into use for the mission of the organization.
   - **Information and knowledge networking ("network"):** A networking "culture" needs to be present and voiced in support of KM. The management must first act as a catalyst or enabler by setting examples, creating trust and inspiring a cohesive and creative knowledge network. A clear communication of vision and scope for an information and knowledge network must be present within an organizational structure. Here, the top management support is crucial for the promotion of effective information and knowledge networking. As seen in Table 2 and in Figure 3 this component contributes to both, the KM and LO outcomes.
   - **Knowledge and information responsibility ("info"):** KM is one of the most important tasks, particularly with relation to "organizational knowledge ", "personal knowledge" and employee skills. The information sharing also needs to be based on a system of rewards. Having someone directly responsible for managing these tasks

gives an organization the ability to carry out effective KM practices.

4. We also used two financial concepts related to **budgeting ("budget1", "budget2")** that measure two different resources devoted to the above listed organizational attributes. With this the "devoted commitment" of top management to could be effectively measured.
5. The following previously described concepts serve in the model as intervening variables (presented also in second column of Table 2) for impacting on the target notion of **eGovernance**:
   - **iGovernment ("iGovern"):** An activity of converting existing processes and paper objects to digital forms. ICT infrastructure, ICT Policy and ICT Budget are the main building blocks that impact the level of digitalization of the processes.
   - **eGovernment ("eGovrn")** refers to converting existing literal services to virtual services as well as the initiation of new services and new mechanisms.
   - **Knowledge Management ("KMan"):** organizing and optimizing the knowledge embedded within, and used for, services, policies and procedures. The KM literature often refers to a special KM organizational unit, distinct from human resource or ICT unit. The presence of appropriate enablers and rewards is a good indicator of whether or not an organization has properly operationalized the unique properties and circumstances associated with its KM strategy. In this research we measure KM with direct questions about organizational KM practice.
   - **Learning organization ("lear_org"):** behaviour (or culture) that enriches and makes organizational knowledge more effective. It also means that workers need to be formally engaged in corresponding learning processes. Budgetary support for training and other knowledge promotion activities emerge as key elements for creating and sustaining a LO culture.

The ultimate concern in this study is how **eGovernance ("eGovance"),** relates to the use of ICTs, KM and LO to promote the broad objectives of a contemporary democratic government. Mechanisms include digital inclusion, e-participation, computer literacy, and the like. A properly deployed ICT strategy ensures that every local or rural community has access to information and services available on the digital venue. The applications of ICT that support and facilitate government "front-office" services can be divided into three categories: *access to information*, *transaction services* and *citizen participation*. The ICTs, is reducing barriers to access to information, services and communication with institutions and officials [24]. In addition to those front-office functions the back-office serves two vital and inseparable objectives: to *enhance the performance* and *ensure the conformity* of government.

However, the unique challenge of eGovernance is that, unlike iGovernment and eGovernment, which are mostly technology related and have parallels in the private and business sectors, eGovernance is uniquely linked to the responsibilities of government in a democratic society. This is an extremely important issue and the challenge is for it to lead - rather than borrow from - the private business and civil society institutions with regard to issues such as access, accountability, and participation.

As we see in next section, and in table 2, this concept is measured with an array of elements, from explicit e-mail policy regulation to various levels of digital services. There, based on expert judgments, more advanced levels received increased weights in this compound variable. For example, having on-line payment systems for government services has the highest weight (seven).

The above described concepts are observed graphically in Figure 2, which further elaborates the simple conceptual structure in Figure 1.

3.2 The empirical model

3.2.1 The data collection

The above conceptual scheme was designed and tested on the data obtained from a survey among Slovenian public organizations including: Ministries with constituent office(s), Government offices, Local government offices and Municipality offices**.** The remaining public administration bodies, e.g. Constitutional Court, Parliament, Ombudsman, Courts of justice etc., were not included, because they perform more narrow specific tasks, and are more heterogeneous.

Information from respondents was obtained by mail questionnaire, targeted to public institution managers and was based on the concepts developed in previous section.

	Included	Replied	Reply percentage
Ministries	14	14(+12*)	100%
Government offices	24	20	83.3%
Local government offices	58	53	91.4%
Municipal offices	192	44	22.9%
TOTAL	288	143	49.7%

Table 1: The response rates by categories

***** The "stand-alone" constituents' offices of ministries (e.g. Police) replied separately

A total of 288 Slovenian public organizations were invited to participate in the survey in 2003. Help from two governmental offices was provided (Office for the Organization and Development of Slovenian Administration, and Office for Local Autonomy – through association of municipality secretary). After the initial mailing, which provided 58 responses, email and telephone follow-ups provided a total of 143 responses.

3.2.2 The questionnaire and the variables

The concepts described in previous section (illustrated in figure 1 and figure 2) were made fully operational with data from the explicit survey questions listed in appendix A. As well, some questions from OECD KM survey questionnaire in the public sector[8] [38] were used. In addition to these OECD question items, further questions were constructed and tested to provide information for the concepts developed in this research.

Both descriptive and attitudinal variables were used. The descriptive variables measured the actual characteristics of the organization, such as ICT profiles, budget spending, number of employees, explicit KM and LO organizational features, etc. Variables of this type dominate in the first two modules, the *Background module* (1) and the *ICT infrastructure module* (2), *of* the questionnaire (see Appendix A), They also figure prominently in the remaining two modules of the questionnaire, *ICT services and business module* (3) and in *KM and LO module* (4), where in addition, two blocks of variables were also related to attitudes and other features (see: questions 3_56 and 4_01).

To support the measurement scale employed in the research, three types of the survey questions were used. The first type consists of nominal or dichotomous variables (YES=1/NO=2), related to specific phenomena such as whether an organization has its own Internet connection or not. The second group of variables were numeric and on the ratio scale. Typically, they measured the share (percentage) of budget, number of employees, etc. devoted to certain purposes. The last group of variables were attitudinal on 1 to 4 points (strongly disagree – strongly agree) ordinal Lykert scale.

The compound variables in the model were constructed as simple linear combinations of the above elementary variables from the questionnaire. This is described in Table 2 in appendix B. Most typically, these were simple sums, i.e. question items were equally important and given equal weight. The only exception was the concept of eGovernance (**eGovance**), where weights were attached to the elements with increased importance.

The variables from the questionnaire (Appendix A) were transformed into the variables that correspond to the concepts from figure 2, using the some simple linear transformations described in table 2, appendix B. For some skewed variables (e.g. number of employees) a logarithmic transformation was used. We tested the normality assumptions of all these newly constructed variables in the model and the tests showed that the assumption is acceptable.

3.2.3 The model

The empirical model is built on the concepts described in previous sections, starting with the relations in figure 1 and figure 2. We start with an array of independent operational conceptual variables constructed from the questionnaires, and build variables for our model. Simple linear combinations are used to explain the key output (exogenous) variable (eGovernance). Four intervening (endogenous) variables are also used in the model: iGovernment, eGovernment, KM and LO.

The model was estimated by normal theory maximum likelihood using the LISREL 8.51 program [26]. As mentioned, all the variables in the model were approximately normally distributed. With the remaining discrepancies we refer to several studies indicating high robustness of these models with regard to the assumption of normality [29] .

The obtained causal models use the standard diagnostics expressed with χ^2 statistics and corresponding *p*-values. We obtained here an acceptable value of p= 0.13. The *p*-value is typically requested to be above $p = 0.05$ and preferable closer to $p = 0.5$, because we are seeking the model which cannot be rejected, so that it's fit to our data is accepted. We obtained here an acceptable value of p = 0.13 which is within predefined boundaries.

Another key measure to evaluate these models is the ***Root Mean Squared Error of Approximation*** (***RMSEA***) value. According to Saurina and Coenders [30] the standardized χ^2 test of the hypothesis of perfect fit to the population covariance matrix (i.e. the *p*-value) should be given less importance than the measures of the degree of approximation between the model and the population covariance matrix. Values equal to 0.05 or lower are generally considered to be acceptable [31] and we obtained here the value 0.04. We can thus conclude that our final model fits the data according to key benchmarks of linear structural modelling.

The path diagram for our model is in figure 3 and it follows the conceptual model from figure 1 and figure 2. We assume that the causal order flows from basic characteristics of the organization to intervening (endogenous) variables – i.e. eGovernement (**eGovern**), iGoverment (**iGovern**), Knowledge

[8] *The results exclude open-ended questions in the OECD survey.* That contains conclusions from the results of the survey of knowledge management practices for ministries/departments/agencies of central government in OECD member countries.

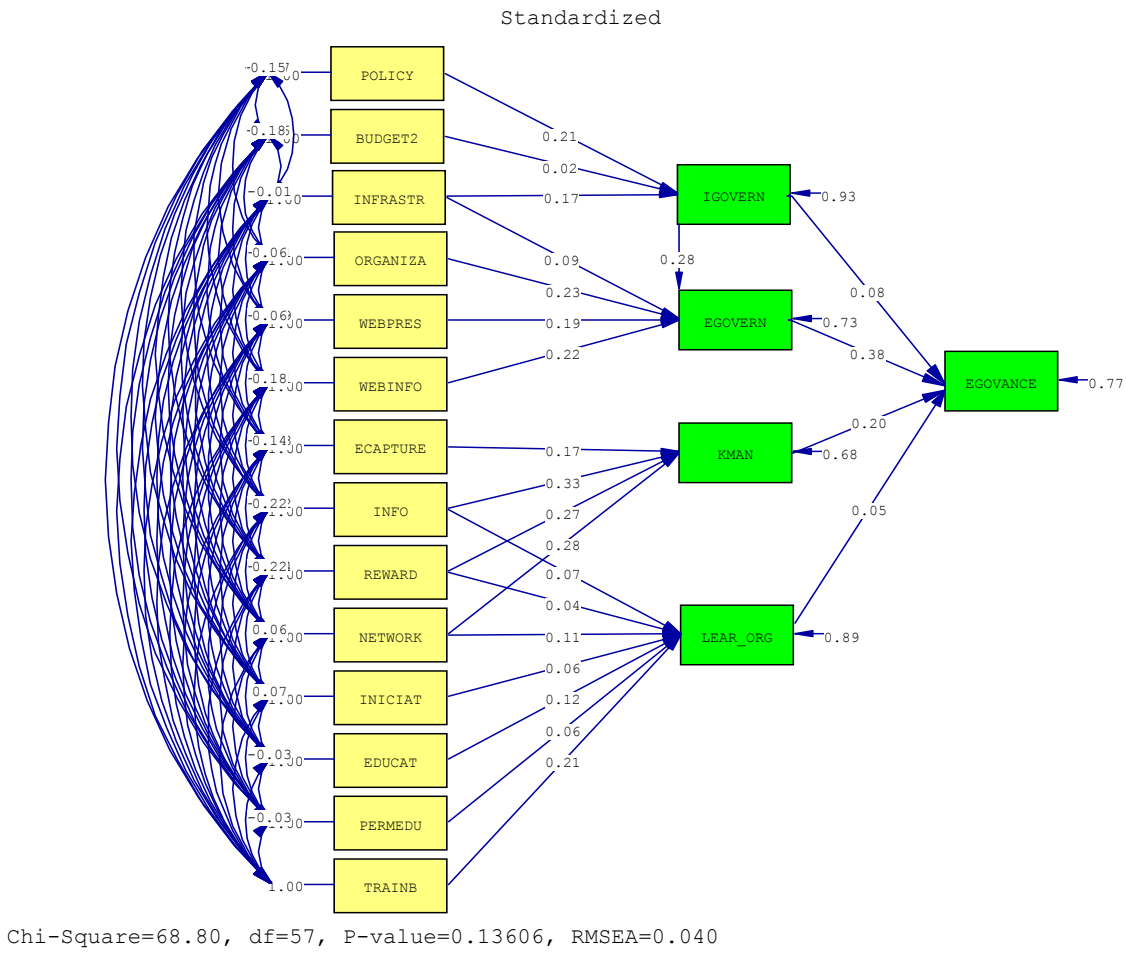

Figure 3: Path diagram with standardized values (β) of the estimates for the causal effects (n = 143)

Management (**KMan**), Learning Organization (**lear_org**) – and to eGovernence (e**Govance**).

The path diagram in figure 3 includes the standardized regression coefficients labeled over the arrows. For example, the value β = 0.20 in the case of the arrow pointing from **KMan** to **eGovance** means that the change in one standard deviation of the independent variable **KMan** causes a change/increase that can be expressed as 0.20 of the standard deviation in the dependant variable **eGovance**. The corresponding ***t***-values, which accompany these coefficients, are not presented in the Figure 2, however, we will explicitly discuss the ones that are larger than t = 1.96, as they denote a statistical significant causal relation among the two variables.

The path diagram also shows the amounts of unexplained variances (the short arrows pointing to the variables), which is the share of variability in the exogenous intervening variables that was not explained by the model. Higher values thus denote substantial levels of the variability that remained unexplained. However, the proportion of the unexplained variance for the key target variable (**eGovance**) has the value of 0.77, what is acceptable. Even more, such a value is much above usual expectations for this type of models, where measures of attitude are involved. On the other hand, the proportions of the unexplained variance for some intervenient variables are much higher. In particular, we have value 0.93 for the iGovernance (**iGovern**), which was otherwise strongly influenced by the policy regulations (**policy**) with the standardized regression coefficient of β = 0.20 (t = 2.35) and ICT infrastructure (**infrastr**) with β = 0.17 (t = 1.82). The other three intervening variables have much lower values for the share of unexplained variance, **KMan** (0.68), **learn_org** (0.89) and **eGovern** (0.73).

When the proportions of the unexplained variances are higher (particularly in case of LO and iGovernance) we conclude that their values are relatively independent of the measured characteristics. They may be influenced by some other variables, not included in the model, or they may be truly independent of the environment we measured.

We have also tested various other models, particularly the ones, which have the causal links between intervening variables. However, the only relation that was improving the model was the link from **iGovern** to **eGovern**, with a relatively high value of β = 0.28 (t = 3.21). This illustrates the facts that eGovernment is truly built on the foundations of iGovernement. On the other hand, the link between eGovernement and KM and LO did not improve the model, what was also particularly true for the link from LO to KM. A comparison of the primary model and the changed models validated primary one due to results that showed the changed models to perform worst. As well to test some important variables the Cronbach's alpha coefficient of reliability (or consistency) was used.

Let us briefly concentrate on coefficients with values larger than β = 0.2, which are in this model (given this specific given sample) also the ones that are roughly statistically significant:

- The path diagram (Figure 3) shows that explicit ICT policy (**policy** - β = 0.21, t = 2.35) has significant a effect on iGovernment,
- ICT organization (**organiza** - β = 0.23, t = 2.56) and WEB update of information (**webinfo** - β = 0.22, t = 2.48) are also seen to be significant for eGovernment,
- The responsibility for information and knowledge sharing (**info** - β = 0.33, t = 4.15), rewarding of sharing (**reward** - β = 0.27, t = 3.17), and knowledge networking (**network** - β = 0.28, t = 3.43) were identified as significant factors for good KM process within institutions,
- Training budget (**trainb** - β = 0.21, t = 2.10) standardized values suggest that it is an important factor when developing and sustaining a good LO culture.
- The Information and Knowledge Networking variable (**network**) has a strong impact on both KM (**network** - β= 0.28, t = 3.43) and LO culture (**network** - β= 0.11, t = 1.06) underlining the importance of knowledge networking to best utilize the existing stock, and new acquisition, of employees' knowledge.

With respect to the impact of the four intervening variables on the key target variable (**eGovance**) we can summarize the following:

- As expected, strongly articulated eGovernment characteristics (**eGovern**) also impact the target variable of eGovernance (**eGovance**). We can observe here the strongest causal link in the whole model, with the value β = 0.38 (t = 3.93).
- The impact of iGovernment (**iGovern**) seems to be much lower (β = 0.08, t = 0.83). This is also the consequence of the indirect link via eGovernment, where we already reported high coefficient (β = 0.28, t = 3.21). Another explanation may be the fact that basic activities of iGovernment do not provide advanced services, so we cannot expect strong impact on eGovernance.
- As expected, the KM has relatively high impact on eGovernance (β = 0.2, t = 2.13), and supports our main hypothesis. Nevertheless, it is weaker than the role of eGovernment.
- Relatively low link of LO (**learn_org**) factors (β = 0.05, t = 0.57) is somewhat surprising, as we expect it to be much higher. A close inspection of co-linearity diagnostics showed that there was no major co-linearity between independent input variables. In addition, we also expected an explicit link from LO to the KM component. However, this was shown not to be strong for the model.

With the relation to our initial hypothesis we can thus conclude the following:

- *H1: ICT, LO and KM have all significant impact on eGovernance.* This hypothesis was confirmed for KM and also for ICT, which demonstrated its impact indirectly, particularly thru eGovernment. Contrary to our expectations, the role of LO was found to be relatively weak.
- *H2: LO impact on KM.* This link was not found to be significant, at least not in this formulation of the model, where the target variable is eGovernance.
- *H3: The role of eGovernment on eGovernance was found to be high, while the iGovernment has only indirect impact on eGovernance via eGovernment.* These relations were fully supported by the evidence.

The weak role of LO and the lack of the causal link between LO and KM may be the result of low actual role of LO in the organizations under study. However, it may also arise from how we operationalize these concepts in the study. Recall that eGovernance was measured with regard to the level of ICT sophistication of the governmental services, ranging from Web page presence to on-line payment for governmental services. The LO concept was measured based on the extent of an applicable rewards system, information sharing and networking, and as well by time employee spent in educational activities. On the other hand KM was measured with explicit questions about actual KM practice. It is possible that the LO concept was not measured adequately here. This possibility is supported by the high level of unexplained variance, and by the poor impact on eGovernance and weak role in KM.

4 The research results and Slovenian eGovernance

Although the main focus of this research was to build a credible model linking ICT, KM and LO to eGovernance, our results also provide an opportunity for some substantial comments on the Slovenian eGovernance situation. Gaining its independence in 1991 Slovenia was among the most developed "transition countries" joining EU in 2004. Although still with a substantial lag in GDP/per capita (around 80% of EU15 average in 2006) Slovenia's ICT was highly developed. The comparisons with corresponding results for OECD countries[9] confirm that Slovenia's ICT deployment in public administration was at high level compared to OECD

[9] Elsa Pilichowski: The Learning Government: Introduction and Draft Results of the Survey of Knowledge Management Practices in Ministries/agencies/departments of Central Government, 09-Nov-2005 http://www.oecd.org/statisticsdata/0,2643,en_2649_34129_1_119656_1_1_37441,00.html

average. Similarly, there was strong budgetary support for "hard-core" ICT, such as equipment, maintenance, etc. In this respect Slovenian public administration organizations were better equipped than OECD average. This is not surprising and is in line with historical developments of ICT in Slovenia[10]. It also matches results from 2006 IDC study[11], where the share of ICT spending (around 1%) within the government budget was among the highest in EU, and is in accord with the corresponding Eurostat 2005[12] comparisons for the companies. We observe that Slovenian companies are above the old EU15 member states average in (broadband) Internet access and PC/employee ratio.[13] However, there appears to be an increasing lag with respect to the advanced use of technologies such as video conferencing, intranets, etc. Similarly, the OECD study comparisons show that Slovenian public administration institutions lag in the application of the advanced features of ICT. A strong orientation towards technology solutions still takes precedence over organizational and knowledge issues. An indicator of this is that, for specialist positions responsible for KM, in Slovenia not a single position of Chief Knowledge Officer (CKO) was found, in contrast to 15% for all institutions in the OECD study. This is in sharp contrast with institutions from the USA, Canada and the United Kingdom where more than half of have a CKO. The system of rewards is another indicator that differentiates Slovenian results – where these systems very rarely exist - from the OECD, where 60% of public administration organizations report that employees are rewarded for sharing knowledge and information, and where 80% of them list knowledge/information sharing as a criterion for the assessment of staff performance.

The survey results suggest that many Slovenian decision-makers still think that KM begins and ends with building sophisticated information technology systems and that no further organizational change is required. As a consequence a certain gap is appearing, one already observed in 2003 SIBIS[14] study. The study reported that, technically speaking, Slovenia provided a rich array of on-line services, but that they were not optimized for users. Citizens wouldn't use them if they are not "user friendly" or they are not even aware of them.

We can observe the persistence of this situation in 2006. There are numerous eGovernement on-line services provided, but they are not optimized. A recent CapGemini 2006 study thus revealed that with respect to sophistication of on-line services Slovenia ranks a high 7th position among 28 European countries (EU member States and Norway, Iceland and Switzerland) and just ahead of Denmark, Finland, France and Ireland. [15] However, it is noted that everywhere eGovernement on-line services are very often not effectively used. After three years of an on-line income tax filing option, only a small percentage of taxpayers actually use the service. In the 2005 UN Global eGovernment Readiness Report (2005)[16] Slovenian eGovernment services ranked 26th place (index: 0.6762) out of the 191 Member States of the UN researched for an eGovernment Readiness index. In the web index that measure the websites of the governments to determine if they are employing eGovernment to the fullest, Slovenia ranked 36th (index: 0.5923). A 2005 e-participation Index, measuring how relevant and useful the e-participation features of government websites around the world ranked Slovenia 46th (index: 0.2222). The ranking in this last index shows a lack of real access and inclusion, a challenge shared by the majority of countries in the world. In part this can be attributed to poor ICT strategic planning and the failure to maximizing the potential benefits from KM and LO efforts.

Another important finding relates to the factors that affect the introduction of LO principles into public organizations. There, decentralization strategies are highly relevant. We note that 75% of the OECD organizations, but only 20% of Slovenian organizations, report that they have taken initiatives in recent years to decentralize and delegate authority to lower hierarchical levels. In the absence of such decentralization, KM and LO initiatives are difficult to undertake, and when attempted face serious obstacles.

For an effective eGovernance a vision for systemic change throughout the whole organization is called for. This includes the implementation of KM principles and a culture of LO behavior, supported with ICT tools. We can summarize by paraphrasing an introductory statement on OECD eGovernement site:[17]

"eGovernance" is much more about "Governance" than about the "e"." The results of this study, for Slovenia in particular, confirm that ICT alone is not enough.

5 Conclusions

[10] Next steps in development Information Society Services in the New Member States. The case of e-Government, Draft, August 2006, http://ipts.ris.org.

[11] http://www.gzs.si/DRNivo2.asp?ID=27615&IDpm=511

[12] http://epp.eurostat.ec.europa.eu

[13] http://slovenia.ris.org/index.php?fl=2&lact=1&bid=64&menu=0

[14] http://slovenia.ris.org/index.php?fl=2&lact=1&bid=58&menu=0

[15] http://www.de.capgemini.com/m/de/tl/EU_e Government-Studie_2006.pdf

[16] UN Global E-government; Readiness Report 2005 - From E-government to E-inclusion; UNPAN/2005/14; see: http://unpan1.un.org/intradoc/groups/public/documents/un/unpan021888.pdf, (September 2006).

[17] http://www.oecd.org/topic/0,2686,en_2649_34129_1_1_1_1_37405,00.html

In this research we have investigated the strategic influences of information and communication technology (ICT), knowledge management (KM) and learning organization (LO) principles and culture on eGovernance in public administration organizations. We first developed a conceptual model linking ICT, KM and LO. We then made it operational and empirically tested it on data from Slovenian public administration organizations.

Through our conceptual model, its operationalisation, our researched hypotheses and empirical testing, we are contributing to a better understanding of the principles and practices involved in building the foundations for good eGovernance practice. We demonstrated that building the new ICT infrastructure is not enough, nor is it enough to digitalize the processes, or just provide appropriate knowledge, skills and training to use the technology effectively. Of course, the role of ICT (via iGovernement and eGovernement) was shown to be a strong driver for the eGovernance developments. However, the role of KM was found to be also extremely important. In order to harvest the real benefits of the technology, KM principles need to be applied as an important element for effective eGovernance. The same is likely true for the implementation of a LO culture, although the evidence is weaker.

Our findings about the relationships between ICT, KM, LO and eGovernance are relatively general, and relevant for governmental organizations as well as for other organizations in developed countries. However, they prove to be particularly relevant for the Slovenian situation. On one hand Slovenia is positioned among the leading EU countries with respect to the array and sophistication of its implementation of ICT into eGovernement services. However, on the other hand, the lack of other crucial activities, particularly those related to KM and LO, presents a considerable obstacle for achieving the full benefits of each part in the delivery of eGovernance services.

One of the limitations of our study is that with regard to the effectiveness and efficiency of eGovernance we used no data from users' side. We had no data from citizens with regard to─user's satisfaction (with regard to connectivity, transparency, 'kindness', etc.). We also have no measures of public sector/citizen views on the adequacy eGovernance outcomes (taxation policy, social services, etc.). Our research was focused entirely on the providers' side of the eGovernment process. As well, we note that we actually studied the entire target population, all of the public administration sector, and not just a sample from that sector. Such approach reduces sampling error and bias to zero, and is preferred when feasible.

Another limitation in our research may be the relatively low response from municipal offices. However, with respect to the key variables we found little difference between them and the larger public administration bodies where we obtained remarkably high response rates. This lack of difference is also true across the various segments of surveyed institutions.

We note that we actually studied the target population, the public administration sector, and not just a sample from that sector. Such approach is preferred, when feasible. In our model we implicitly assume that the behaviour of observed units is just the manifestation of some general principles or causal relationships that we want to identify. As well, in such work we need a critical number of units in order to have statistically significant results.

One additional conclusion from this research suggests that "how the LO principles fit into the model" was not optimally (or adequately) addressed in our research and therefore the results show relatively low link of LO (**learn_org**) factors. This area requires further work, in particular in elaborating the relationship between LO and KM. Within a refined model, much more profound analysis could be performed using advanced tools of causal modeling. Full three-way interactions could be addressed, exploring the extent to which various levels of LO development create different relationships between KM and ICT, and in turn how they affect eGovernance.

ICT, via both computational power and connectivity and the resulting digital venue, is a major player in an organization's pursuit of its mission, vision and mandate. It is reshaping the way organizations communicate within and without, carry out their organizational practices, and deliver services to the public. It is not enough to attempt to improve only one element, ICT, in the ICT, KM, LO triad, and fail to recognize that LO, and particularly KM, are essential for proper targeting eGovernance objectives. Progress depends on both technical and organizational change, and ICT professionals need to work closely with top management, including human resource management, in the deployment of KM and LO strategies.

The speed of technological change, and the fast pace of development of new services and products, raise KM to a crucial role in eGovernment. Workforce reductions, cost cutting measures, and the demands of just-in-time and life-long learning are further factors that raise the importance of KM principles. We suspect that further research in organizations with differential learning organization culture, will also elevate LO culture to the status of a key element in organizational behaviour for efficient and effective eGovernance.

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APPENDIX A

The QUESTIONAIRE

1) Background

Please specify on behalf of whom you are filling this questionnaire:
1/01 - ☐ The Ministry of: _____
1/02 - ☐ The constituent offices: _____
1/03 - ☐ The local government of: _____
1/04 - ☐ The municipality of: _____
1/05 - ☐ The government office of: _____

Please fill the background information on your institution:
1/06 - The total budget of your institution in last year:
1/07 - The total number of employees
1/08 - %) of employees spending their entire employment within the public sector

Please indicate in percentage (%) educational structure of your institution:
1/09 - The primary school or less _____
1/10 - The secondary school _____
1/11 - The tertiary diploma (below university BA/BS one)_____
1/12 - The university diploma _____
1/13 - The masters degree _____
1/14 - The PhD _____

Please define in approximate percentage (%) your customer structure:
1/15 - Within public sector: _____
1/16 - Outside of public sector: _____

2) ICT infrastructure

Approximate what percentage (%) of your staff (or working posts):
2/01 - Are equipped with a computer: _____
2/02 - Are linked to a local area network: _____
2/03 - Has access to the Internet: _____
2/04 - Has an e-mail address: _____
2/05 - Has a "secureID" acces: _____
2/06 - Has a "CA-sigov" certification key:_____

Your institution has (*SEVERAL ANSWERS POSIBLE)*
2/07 - ☐ An internal document for ICT Security and Protection
2/08 - ☐ A System for Data achieving (e.g.: tape, disk, etc.)
2/09 - ☐ A system for virus protection
2/10 - ☐ A contiguous plan

Your institution has an Internet site:
2/11 - ☐ YES → which year from____
2/12 - ☐ NO but we are planning to have in next 5 years /Please precise date: _____/
2/13 - ☐ NO but we are not planning to have an Internet site → *GO TO QUESTION 9.*

Your institution has an information center?

	YES	NO	
2/26 -	☐	2/27 - ☐	Our institution has information center
2/28 -	☐	2/29 - ☐	The center representative is attending board meetings

Please specify the percentage of total budget spent for ICT _____ - 2/30

Has this percentage increased in the last five years? 2/31 - ☐ YES 2/32 - ☐ NO
If YES, by how much (%): _____ - 2/33

3) ICT services and e-business model

In your institution, initiatives have been/will be taken, such as:

YES,	NO, but we plan	NO, no planning	
3/01 - ☐	3/02 - ☐	/03 - ☐	Decentralization/delegation of authority to lower hierarchical levels
3/04 - ☐	3/05 - ☐	3/06 - ☐	Reorganization of internal process
3/07 - ☐	3/08 - ☐	3/09 - ☐	Reorganization of offices
3/10 - ☐	3/11 - ☐	3/12 - ☐	Internal network to share information

Please specify percentages (%) of your employees using information tools:

3/13 - ☐ Text editor (e.g.: Word): _____
3/14 - ☐ Spreadsheet (e.g.: Excel): _____
3/15 - ☐ Tool for presentation (e.g.: PowerPoint): _____
3/16 - ☐ e-post system (e.g.: SPIS): _____
3/17 - ☐ e-government meetings: _____
3/18 - ☐ Legislation procedures of Parliament: _____
3/19 - ☐ e-budget planning (e.g.: MFERAC): _____
3/20 - ☐ Infoklip: _____
3/21 - ☐ e-Project office: _____
3/22 - ☐ Other /please specify/ _____

Your work procedures are based on:

YES	NO	
3/23 - ☐	3/24 - ☐	A specific team responds to e-mail on institutional general record
3/25 - ☐	3/26 - ☐	Maximum delays for responding to e-mail have been established
3/27 - ☐	3/28 - ☐	Clearance mechanisms for correspondence with citizens have been simplified
3/29 - ☐	3/30 - ☐	The policy for responding to e-mails is similar to formal letters
3/31 - ☐	3/32 - ☐	e-mail notification for meetings is used within our institution
3/33 - ☐	3/34 - ☐	e-calendar is used for coordinating meetings within our institution
3/35 - ☐	3/36 - ☐	e-addresser is used for our customer base
3/37 - ☐	3/38 - ☐	We have internal digital base for advertisement post for employees
3/39 - ☐	3/40 - ☐	We are involved in current e-administration projects

3/41 - If YES, please specify: _____

On your institution's Internet site, it is possible to:

YES	NO	
3/42 - ☐	3/43 - ☐	Access administrative information
3/44 - ☐	3/45 - ☐	Access information about current events related to your institution
3/46 - ☐	3/47 - ☐	Download publications, reports from your institution
3/48 - ☐	3/49 - ☐	Access to statistical or quantitative data
2/50 - ☐	3/51 - ☐	Download administrative forms/applications
3/52 - ☐	3/53 - ☐	Fill in administrative forms electronically
3/54 - ☐	3/55 - ☐	Make certain payments (taxes, public fees, etc.)

3/56-3/83 **Please indicates your level of agreement (1 strongly disagree… 4 strongly agree):**

3/56-3/59 Your institution delivers on your Internet site all important documents and information
3/60-3/63 Information delivered on your Internet site is well packed (clear, understandable, etc.)
3/64-3/67 Information delivered on your Internet site is updated on a regular basis
3/68-3/71 Information communication technology is improving working results
3/72-3/75 Information communication technology is improving internal communication (within institution)
3/876-3/79 Information communication technology is improving external communication
3/80-3/83 Information communication technology is improving knowledge sharing

Do you systematically register working processes:
3/84 - ☐ On paper
3/85 - ☐ With e-Documents
3/86 - ☐ In Database
3/87 - ☐ Within Expert system
3/88 - ☐ Stays with Experts working in your institution

4) Knowledge Management and Learning Organization practices

4/01-4/20 **Please indicates your level of agreement (1 strongly disagree… 4 strongly agree):**

4/01-4/04 Your institution is using knowledge management practices
4/05-4/08 In your institution employees have time for knowledge management practices
4/09-4/12 Your institution »culture« is encouraging knowledge management sharing
4/13-4/16 Your institution has understanding for knowledge management techniques
4/17-4/20 In your institution organizational processes are designed for knowledge management

In your institution YES NO
4/21 - ☐ 4/22 - ☐ There is a database of staff competencies
4/23 - ☐ 4/24 - ☐ There is a database of presentations and documents for common usage that is systematically updated

Which of the following groups has the overall responsibility for knowledge and information management and transfer practices in your institution?
4/25 - ☐ Human resources management team
4/26 - ☐ Information technology team
4/27 - ☐ Special knowledge and information management unit (knowledge officer)
4/28 - ☐ Top management
4/29 - ☐ Other, please specify: _____
4/30 - ☐ None

In your institution, workers are rewarded for knowledge and information sharing:
4/31 - ☐ YES →*Incentives include (TICK AS MANY BOXES AS YOU DEEM NECESSARY):*
4/32 - ☐ Monetary incentive
4/33 - ☐ Prizes / Rewards
4/34 - ☐ Promotion
4/35 - ☐ Informal encouragement
4/36 - ☐ Other, please specify: _____
4/37 - ☐ NO

How many days of training per staff (on average) are provided each year by your institution?
4/38 - ☐ None
4/39 - ☐ 1 day: _____
4/40 - ☐ 2 to 5 days: _____
4/41 - ☐ 6 to 10 days: _____
4/42 - ☐ More than 10 days: _____

Is there a special budget allocated to training in your institution?
4/43 - ☐ YES, please indicate percentage (%) of total budget____, 4/44 - ☐ NO

Has percentage increased in last five years? ☐ YES 4/46 → **how much (%):** __ - 4/47 ☐ NO 4/45

Please specify the approximate training percentage (%) by type (on day per employee basis):
4/48 - General (e.g. language, etc.): _____
4/49 - Professional (e.g. learning to get higher degree, etc.): _____
4/50 - Information technology: _____

APPENDIX B

Compound (Independent) variable name	Compound variable calculation (survey questionnaire questions from APPENDIX A are in the form: "vX_Y")	Second layer endogenous (intervening) variable	Exogenous variable
ICT Infrastructure	infrastr = (((v2_1+v2_2+v2_3+v2_4+v2_5+v2_6)/6)+ ((v3_13+v3_14+v3_15+v3_16+v3_17+v3_18+ v3_19+v3_20)/8))/2	**iGovernment** iGovern = v3_84+v3_85+v3_86+v3_87+v3_88	**eGovernance** eGovance = v2_11 +v3_42 + v3_23 +v3_25 +v3_27 +v3_29 +2*v3_44 +3*v3_46 +4*v3_48 +5*v3_50 +6*v3_52 +7*v3_54 .
ICT Policy	policy = v2_7+v2_8+v2_9+v2_10		
ICT Budget	Budget1=v2_30 Budget2 =v2_31		
Organizational (ICT)	organiza = v2_26+v2_28+v3_10	**eGovernment** eGovern = v3_31+v3_33+v3_35+v3_37+v3_39	
ICT Infrastructure	infrastr = (((v2_1+v2_2+v2_3+v2_4+v2_5+v2_6)/6)+ ((v3_13+v3_14+v3_15+v3_16+v3_17+v3_18+ v3_19+v3_20)/8))/2		
Internet - Web presence	webpres = v2_11		
Web information Update	webinfo = (v3_56+v3_60+v3_64)/3		
eCapture of Staff Competence	eCapture = v4_21+v4_23	**Knowledge Management** Kman = (v4_1+v4_5+v4_9+v4_13+v4_17)/5	
Information / Knowledge Responsibility	info = v4_25		
Rewarding System	reward = v4_32+v4_33+v4_34+v4_35+v4_36		
KM Networking	network = (v3_68+v3_72+v3_76+v3_80)/4		
Organizational initiative	iniciat = v3_1+v3_4+v3_7	**Learning Organization** lear_org = v4_48+v4_49	
Educational Level	educat = v1_12 + v1_13 + v1_14		
Permanent Education	permedu = v4_38		
Training	trainb = v4_43+v4_45		
KM Networking	network = (v3_68+v3_72+v3_76+v3_80)/4		

Table 2: Calculation of compound, endogenous and exogenous variable