ICT USE IN TURKISH CONSTRUCTION SECTOR: EXISTING LAWS AND REGULATIONS

Yasemin Nielsen, Nihan Kumas and Caglar Ciftci

METU, Civil Engineering Dept., Ankara Turkey

In terms of information and construction technology (ICT) many construction organizations are at a level of maturity enabling them to realize significant business benefits through the deployment of advanced ICT systems. However, the necessity of legal validity in all information, even at project level, has proven to be an impediment for the sectors full embrace of ICT. The contractual relations cause dependency of 'official' paper copies, and this contributes to a slower rate of ICT implementation compared to other sectors. In this study, recent legislative issues of ICT usage in Turkish construction sector are examined and the current legal re-structuring of the existing related laws and regulations to use ICT in a legal and contractually valid environment is discussed.

Keywords: construction, information technology, legality.

INTRODUCTION

International competition has become more dependent on information. To stay competitive in an environment that depends on information, construction companies have to make rapid changes in organizational structures and processes. This transformation, which is set in motion by developments in information and communication technologies (ICT), affects economy and all other aspects of daily life, and also compels countries to find new ways that are beyond traditional approaches and definitions.

In the construction sector, many organizations have realized considerable business benefits through the implementation of ICT systems. At the same time current management thinking is also fostering more collaborative approaches which require a level of communications which can only be achieved by an IT-centered infrastructure (eLEGAL state-of-art[1]- assessment, 2001). However, the full use of ICT is often hampered by poorly defined responsibilities, overlapping communication techniques and mistrust. Additionally, a lack of frameworks which define legal conditions, contracts and tools that provide legal support seems to be one of the impediments for the full use of ICT in construction sector.

Open-ended interviews on the current contractual practices and ICT use in the construction industry were conducted, both in public and private organizations. Existing Turkish laws and regulations related to ICT were researched. The requirements of the industry and barriers faced in legal ICT use, based on the consultations with managers, supervisors from public and private organizations are concluded.

[1]ynielsen @metu.edu.tr

Nielsen, Y, Kumas, N and Ciftci, C (2006) ICT use ın Turkish construction sector: existing laws and regulations. *In:* Boyd, D (Ed) *Procs 22nd Annual ARCOM Conference,* 4-6 September 2006, Birmingham, UK, Association of Researchers in Construction Management, 697-705.

CONSTRUCTION INDUSTRY; EFFECTIVE FACTORS AND BARRIERS IN ICT USE

The construction industry is a project based business bringing together many different organizations to complete a desired goal. The strategic use of Information and Communication Technologies (ICT) has enabled this goal to be completed more effectively (Hassan, Shelbourn, Carter, 2004).

As the impact of technologies such as 3D visualization, animation, virtual reality, e-commerce, and project specific web sites are revolutionizing global markets into an era of the new economy, the engineering and construction industry must re-invent itself to meet the increasing owner demands of high performance. Owner organizations are requiring the engineering/construction industry to perform at extraordinary levels of project delivery (Songer, 2000). Advances in project delivery systems and information technologies provide tremendous potential for enhancing the engineering and construction industry's overall performance. However, the majority of industry participants have been slow to embrace the use of new technologies to enhance project performance to desired levels. Two areas have therefore received much attention by construction management researchers; appropriate implementation of ICT, and impediments for full implementation compared to other industrial sectors.

One reason for the difficulty of implementing ICT is the misalignment of current organizational structures and cultures with ICT models for integrated, collaborative work environments. The construction industry is largely decentralized composed of separate organizations, which must participate together on a project by project basis. The multi-participant, multi-organizational framework is a significant barrier to implementing ICT in the industry. According to the Roadcon project (2003) different barriers have in the past restrained the take up and advanced use of different ICT tools. These barriers need to be overcome for the industry to progress further in the exploitation of ICTs to support its business activities. These barriers can be classified as organizational, people, technology, and legal barriers.

New technologies have not been sufficiently considered by any legal and contractual practices. This is of significant consequence in construction: Electronic information is often, in contrast to hard copy of documents, not considered legally valid. Given the importance of the contract – a document enforceable at law – as basis for the project, electronic communication and documentation is considered much less significant as it will have no or little bearing in a legal dispute. In Turkish construction industry, although the use of ICT has become vital, it is not covered by contractual practice.

In Turkish construction Industry, the most common problems experienced with IT are; lack of training associated with its implementation and systems knowledge, cost of technology, conservative nature of the industry, security of hardware at site, legal support for ICT use, incompatibility/interoperability problems and lack of technical support (Kumas, 2004). The most common problems are lack of training associated with its implementation and system knowledge, and cost of technology. Contractors are unaware of the impact that potential advanced applications of ICT could have on the organization's competitive position. As for legal validity, only %16 of the respondents complained about the lack of legal support for ICT use (Kumaş 2004). The lack of legal validity of e-documents, data exchange, e-contracts were seen as an impediment allowing them to follow the information revolution and again only 16% of the contractors stated that incompatibility and interoperability problems directed

them to continue the traditional methods for their transferred documents to be readable.

This figure may look promising at a glance. But the survey results related to the organizational ICT culture reveals that approximately half of the respondents do not have awareness of an organizational ICT culture and they give conflicting answers during the interviews, showing that the 16 percent who have complaints about the legal and interoperability issues are the ones who have awareness of organizational ICT culture.

EMERGING ICT SUPPORT AND ITS IMPACT ON TURKISH CONSTRUCTION SECTOR

Although construction industry should not be expected to embrace the advancements as quick as other sectors like banking, merchandising or finance, the obligations that have to be fulfilled to survive, urge construction organizations to adopt ICT. The expected improvements related to e-business are illustrated below.

According to the construction industry research by Kumaş; communication in large scale construction projects is still done by traditional means; drawings, faxes, mobiles and meetings. Human involvement is very dominant in the information streams as translation or transformation machines. This is, in terms of Lean Construction, a transformation process without added value (on the contrary it is error prone) that is seen as waste and should be eliminated requiring an Internet-based Communication Technology that is applicable for meaningful electronic communication. Only if the parties involved in a project and computers share a common ontology of construction terms and definitions, then electronic communication becomes feasible.

Among all the organizations interviewed, ICT use is widespread, and electronic intra- and inter-organizational communication via email is common. Relatively few have re-engineered their business processes along with the adoption of ICT, however those that have done so have not experienced significant gains in productivity and commensurate competitive advantage yet since they were generally at a very early stage. In some firms, ICT has enabled expansion into new markets, and positioned them to compete internationally. Among the advanced users, the leaders are creating networks based on IT across organizational, national and international boundaries.

However, some companies have committed to a continuing investment in technological advancement and organizational change. By changing how they are organized and do business, they are planning to achieve far greater benefits than available through automation alone. ICT view of the Turkish construction industry is summarized in table 1.

	All 50 respondents					
Very Low, Low, Medium, High, Very High	VL	L	M	H	VH	
From stand-alone specific engineering applications towards integrated **Total Life Cycle**	0	6	9	11	24	
From physical products and (semi-)automated building services towards **Intelligent**	15	21	5	9	0	
From reinventing and use of personal/departmental experience towards **Re-use and Sharing of Knowledge** at enterprise and industry levels.	0	4	3	18	25	
From information access via company and project intranets and web towards **Ambient Access** to all relevant information anytime, anywhere regardless of physical location.	11	5	0	20	14	
From document (and drawing) based ICT towards **Model Based ICT** (i.e. computer interpretable information).	11	18	10	11	0	
From intrusive ICT ("humans serving computers") towards **Human Centered Environments** ("computers serving humans").	10	24	6	10	0	
From document & paper based contracts and procedures towards **Legal and Contractual Governance** of ICT usage within and between enterprises.	5	21	4	6	14	
From file based data exchange towards **Flexible Interoperability** btw. heterogenous ICT	19	21	10	0	0	
From business processes driven by lowest capital cost towards **Performance Driven Process** driven by customer perceived values.	19	8	9	14	0	
From teamwork using email and project web sites towards **Virtual Teams**, able to collaborate seamlessly across organisational, geo-graph-ical and time boundaries as if they	33	9	8	0	0	
From taylored and configured ICT systems towards **Adaptive Systems** that learn from their own use and user behaviour, and are able to adapt to new situations without manual maintenance, configuration and support.	24	18	8	0	0	
From limited ICT awareness of construction professionals towards the combination of enhanced **ICT skills** (via education, training) and built-in **learning** support within ICT systems.	0	14	11	6	19	

Table 1: Survey Results related with Industry ICT View (Kumaş, 2004)

According to the Public Procurement Authority (PPA) in Turkey, which is administratively and financially autonomous, the main goal is to prevent illegalities, grafts and lawlessness in public procurements. In order to achieve this goal electronic procurement has an important role. After finishing the legal and technical infrastructure modifications, e-procurement will be used in order to regulate and control the public procurement market.

An increasingly popular method for providing online services is the use of an Application Service Provider (ASP). Services provided by an ASP include user management, access control: accounting, billing, software installation and provisioning, maintenance, integration with user IT systems, and hosting of third-party software.

The ASP service may vary from being seen as merely a means of communication between the parties (eg: EDI agreements) to the ASP service being placed at the centre of a contract, setting out the reporting/auditing procedures to be followed by each participant in order that they may comply with their obligations under the contract. This range of services could be

Contract allows parties to communicate/facilitate information flows electronically (by email, no project website);

- Design co-ordination via Project Website
- Design co-ordination and project document management via Project Website

- Design co-ordination and project document management plus financial reporting via Project Website
- All communication/information flows must go via website/be confirmed on website.

It is also possible for Clients/Project Managers to own the software. There would then be no ASP Agreements but End User License Agreements to protect the intellectual property rights in the software. (eLEGAL deliverable D11)

Electronic commerce on an open network will enable global transactions at any time, thus reducing costs and increasing opportunities for trade, but on the other hand, it will also be exposed to errors, tampering and denials. To improve this situation, the introduction of a digital notary has been suggested. A digital (or electronic) notary is the mechanism for electronic commerce that proves who has made an electronic interchange (what), with whom it was made, and when it was made. The simplest example of a digital notary service is one designed to validate the existence of a particular electronic document, such as a contract, at a given point in time. The notary service receives the document with the author's electronic signature attached. It verifies the signature and then returns a copy of the document, complete with the notary service's digital signature, including a guaranteed date and time at which the verification took place. Being equivalent to a "digital postmark" this will be authoritative in cases of conflicting claims regarding, for example, research results or a contract. (eLEGAL deliverable D11)

The electronic or digital notary concept is not new in Turkey. Since 2002, the frameworks and regulations have been prepared to arrange the technical and legal infrastructure of e-notaries in Turkey. Moreover, the related laws and studies should be finalized immediately which are milestones to achieve the aim of e-Turkey.

WHERE TURKEY STANDS IN E-TRANSFORMATION?

In a recent study, World Economic Forum's Global Information Technology Report (2002-2003), different countries were ranked according to their readiness to information society. Among 84 countries, Finland, the US, and Singapore takes the top three, and Turkey is ranked as 50th.

e-Readiness Index

Rank	Country	Point
1	Finland	5.92
2	USA	5.79
3	Singapore	5.74
4	Sweden	5.58
5	Island	5.51
6	Canada	5.44
7	UK	5.35
8	Denmark	5.33
9	Taiwan	5.31
10	Germany	5.29
...	...	...
...	...	...
50	**TURKEY**	**3.57**
...	...	...

Source: World Economic Forum

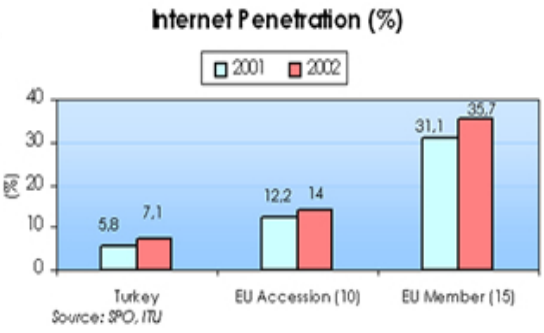

Figure 1: e-Readiness index and Internet penetration %- an important indicator of ICT usage in Turkey. (World Economic Forum's Global Information Technology Report, 2002-2003)

As a part of the government's Urgent Action Plan's Public Management Reform Section, information society issues are declared as one of the most significant projects.

E-Transformation Turkey Project aims to foster the evolution and to coordinate information society activities, which were previously carried out under different topics by different institutions. Responsible institution for this specific project is identified as State Planning Organization (SPO), which is affiliated to the Prime Ministry. SPO is responsible for overall coordination of countrywide economic and social development programs, allocation of funds to public investment projects, and advising to the Government. The time frame set for e-Transformation Turkey Project is 6 months for an Action Plan and continuous for the entire project term. Prime Ministry, NGOs, and all public institutions are identified as affiliated organizations for this project. To clarify the objectives and principles of the project, a Prime Minister's Circular, dated February 27, 2003 has been issued. According to this Circular, the objectives of e-Transformation Project are as follows (e-Transformation Turkey Project, 2005):

- Policies, laws, and regulations regarding ICT will be re-examined and changed if necessary, with respect to the EU acts; eEurope+ Action Plan, initiated for the candidate countries, will be adapted to Turkey.
- Mechanisms that facilitate the participation of citizens to decision-making process in the public domain via using ICT will be developed.
- Transparency and accountability for public management will be enhanced.
- Good governance principles will be put in place in government services through increased usage of ICT.
- ICT diffusion will be promoted.
- Public IT projects will be coordinated, monitored, evaluated and consolidated if necessary in order to avoid duplicating or overlapping investments.
- Private sector will be guided according to the above-mentioned principles.

In order to realize these objectives and to ensure the success of the project, a new coordination unit, Information Society Department, within SPO is established. This Department is responsible for the overall coordination of the project. Before this project was launched, lack of efficient coordination between institutions made the progress slow and ineffective. Actions aiming to establish interoperable and secure online information services have the first priority in STAP. Besides, actions in STAP are in line with actions of Urgent Action Plan that covers restructuring of public management, increasing efficiency in public services, and introducing citizen-oriented services. Also, eEurope 2005's goals and harmonization of Turkish legislation to EU acts have been taken into account.

ICT application should be increased in every sector. It must be one of the most important factors of socio-economic development and must ensure national defense and security. Raising the Turkish software industry into a key economic sector with a high growth rate will lead to significant contribution to the modernization.

ELECTRONIC SIGNATURE AND CERTIFICATION AUTHORITY

In general, two main questions may arise for a computer user who views a digital document: Who is the author of the record, i.e. the originator and when this record was created or last modified? There are good solutions to both of these questions. A

solution for the first question is the well known concept of digital signatures. In principle, a digital signature is an asymmetric procedure involving a pair of corresponding keys. A private key is used for the creation of a digital signature. This key is kept secret. The other corresponding key (known as the public key) is publicly available. The public key will be used to verify the received digital signature.

In order to prevent someone from publishing a public key under a false name, it is necessary for all parties to register themselves with a trusted authority, usually known as the certification authority (CA).

In Turkey, after the electronic signature law came into force on July 2004, the regulations about electronic signatures and certification authorities were prepared by Telecommunication Institution. Telecommunication Institution (TI) hasn't been give license to the electronic certificate service providers yet. Although, TI's regulations finished on 23 January 2005, service providers' preparation period is still continuing to get license. In Turkish construction industry the government plays essentially two roles: regulator and client in the construction processes. Clear government leadership will raise the awareness of the both industry and the clients and encourage a more rapid take up of ICT than would otherwise occur. As a major owner and user of constructed facilities the government has a role to play and perhaps take the lead. A fundamental requirement is that the government as a major industry client provided the leadership for industry improvement. Innovative research and development should be recognized as a critical success factor. A proportion of any research and development budget should be set aside for the purpose of identifying and assuring the continuous transfer of scientific discoveries into business. The government is the only construction client entity to have the motivation and resources to follow these objectives and provide leadership (Lenard, D., Abbott, C., 2001). The government is aware of the opportunities that ICT sector and launch e-transformation of Turkey project in order to accelerate Turkey's transition to information society. It was launched as a part of Turkey's commitment to join the European Union and to leverage Turkey's potential to become an important player in the global arena. The role of public sector in Turkish construction industry should be as a catalyst in introducing new technologies and financing research, and there should be active participation of the private sector improving and increasing productivity with the government.

The main ICT related legislation, which should be considered by the managers in the contract phase of the project to work in a legal and contractually valid environment, is introduced. It is observed that the EU membership process of Turkey (1999) has had a positive effect, as the legislations to support the technology has increased The governments aim of transition to Information Society resulted in enforcement of new laws covering such facets as electronic signature, intellectual property rights (IPR), e-commerce and consumer rights. The law related to protection of personal data is expected to come into force soon. Furthermore, for e-government, regulations have been prepared. In order to enable the successful use of ICT in a legal and contractually valid manner in their projects, managers of ICT need to be aware of these laws and regulations.

According to the survey results about the current contractual practices for gathering the existing clauses and searching for legal cases concerning the application of ICT in Turkish construction industry, the use of ICT seems only to be intended to speed up the transmission process but effectively has no legal validity. Although there is an

increase in ICT related clauses in the recent contracts and laws, no clauses related the legal issues such as IPR, protection of personal data or privacy were observed. Thus, the use of ICT in projects mostly dependent on the unofficial and unwritten transactions resulting in a number of potentially serious implication such as validity of contract notices, ownership of data and intellectual property rights.

CONCLUSION

ICT investment in Turkish construction industry is increasing day by day. However, the issue of 'legal validity' is one of the contributors to a slow adoption compared to other industrial sectors.

Legal barriers such as legal admissibility of emails, CAD drawings, use of ASPs, ownership of information, company vs. project information and legal issues of objects (such as IFCs) should be overcome by specifying an ICT-related contract governing these issues. E-contracting, contract configuration and on-line negotiation tools can be used to develop such ICT-related contracts. The ICT contracts should specify the ICT environment to be used. Different security levels should be imposed on all transactions using digital signatures, third party certification authorities, biometric systems, smart cards and/or digital notaries.

ICT has revolutionized communication and access to information. However, removing barriers to access to information is of little value if undue restrictions are placed on what information may be created, transmitted, stored or used.

Turkish international contracting services undertakes more works in foreign countries, so the effective use of IT becomes important for project communication. However, still the full implementation of the results of eLEGAL project is difficult.

In general, many companies and public organizations in Turkey should use the benefits of ICT before considering the legal and contractual governance. Without a reasonable level of ICT maturity, it is impossible to talk about making an ICT contract. In order to establish an ICT environment, organizational, cultural, educational barriers and barriers related to legal issues should be overcome. The solution general ICT implementation barriers overlaps with the solution of barriers related to legal issues. A majority in the sector share the opinion that despite of the highly increasing investments in the construction sector, traditional systems are still considered more effective. However, if the managers or users are informed and trained, the resistance will be lower.

The use of electronic signatures is widely used in other sectors such as manufacturing or finance. The Turkish State should encourage and lead the construction sector in these issues.

However, typical scenarios which illustrate potential applications of ICTs in various project communications could be implemented by private and public organizations after electronic signature is widely used by the Turkish construction industry. Moreover, although it seems difficult to make a complete ICT contract separate from the traditional contract, as a minimum it can be possible to add more ICT related clauses to the contracts that supports ICT tools and approves electronic documentation and communication as legally valid.

According to the Turkish construction sector's current ICT infrastructure, practices and habits, and Turkey's current attempts on legal and contractual issues, implementation of a legal framework for ICT in the near future use looks promising.

REFERENCES

eLEGAL (2001a) Deliverable D11: State-of-the-art Assessment, eLEGAL: Specifying Legal Terms of Contract in ICT Environment, IST-1999-20570.

Hassan, T.M., Shelbourn, M.A. and Carter, C.D.(2004) Collaboration in Construction: Legal and Contractual Issues in ICT, ., *Proceedings of the 10th International Conference on Computing in Civil and Building Engineering*, Weimar, Germany, June 2004, pp 260, ISBN 3-86068-213-X.

Songer A.D., Young R, Davis K. (2001) Social Architecture for Sustainable IT Implementation in AEC, Paper w78-2001-26: Digital Library of Construction Informatics and Information Technology in Civil Engineering and Construction

ROADCON (2003). Deliverable D3 ICT Requirements of the European Construction Industry: The ROADCON Vision"- IST-2001-37278.

Kumaş, N. (2004) A National IT Strategy for Turkish Construction Industry, Master of Science Thesis, Superised by Yasemin Nielsen, Middle East Technical University.

World Economic Forum's Global Information Technology Report, (2002-2003). http://www.weforum.org

T.R. Prime Ministry State Planning Organization, e-Transformation Turkey Project, (2005). http://www.dpt.gov.tr

Lenard, D., Abbott,C. (2001). The Role of Government in Supporting the Construction Industry in the United Kingdom, Centre for Construction Innovation, UK

Kamu İhale Kanunu (2005) Public Procurement Law, http://www.kik.gov.tr/, Last Accessed Date: June, 2005.