Minutes of the meeting of

W102: INFORMATION AND KNOWLEDGE MANAGEMENT IN BUILDING

Meeting held on April 29 and 30, at the Department of Architectural Science, Ryerson University, Toronto, Ontario, Canada

Were present:

Jaime Acevedo-Alvarez, Fraunhofer-Informationszentrum Raum und Bau IRB, Stuttgart, Germany
Luke Bednarek, Ryerson University, Toronto, Canada
Michael Culhane, National Research Council, Ottawa, Canada
Colin Davidson, Université de Montreal, Quebec, Canada
Branka Dimitrijevic, Centre for the Built Environment, Glasgow, United Kingdom
Scott Fernie, University of Reading, United Kingdom
Patrice Godonou, CIB, Rotterdam, Netherlands
George Kapelos, Ryerson University, Toronto, Canada
Constantine J. Katsanis, Ryerson University, Toronto, Canada
Peter K. K. Lee, University of Hong Kong, China
Francisco Loforte Ribeiro, Universidade Técnica de Lisboa, Lisboa, Portugal
Marja Naaranoja, University of Vaasa, Finland
Thomas H. Morszeck, Fraunhofer-Informationszentrum Raum und Bau IRB, Stuttgart, Germany
Thomas Ng, University of Hong Kong, China

Invited guests:

Stal Boctor, Dean, Faculty of Engineering and Applied Sciences, Ryerson University, Toronto, Canada
Mitchell Hall, KPMB Architects, Toronto, Canada
Steven Liss, Associate Dean, Research, Development and New Science Programmes, Faculty of Engineering and Applied Sciences, Ryerson University, Toronto, Canada
Marianne McKenna, KPMB Architects, Toronto, Canada
Zita Murphy, MLS, Faculty of Engineering and Applied Science, Ryerson University, Toronto, Canada

Pertinent documents were distributed at the start of the meeting.

Opening remarks

Prof. George Kapelos, Dr. Stal Bactor and Dr. Steven Liss welcomed the delegates at the start of the meeting. Branka Dimitrijevic then outlined the meeting agenda and invited Zita Murphy to give a presentation on Open access Systems in Journal Publishing, which was the first item on the agenda due to speaker's obligations to travel to other meetings.

Novel approaches to information dissemination

Zita Murphy[1] informed the W102 delegates on *Open Access Publishing: Issues and Implications for Building Sciences*. Zita has kindly provided a summary of her presentation as follows:

As the subscription cost of journals continues to escalate, initiatives and efforts are being made to develop new models of scholarly publishing to counteract the predominant role that currently resides with the commercial publishing industry. The Open Access movement is one that is gradually gathering momentum. In general terms, the ideal of Open Access is free access to scholarly content on the internet to anyone, anywhere. The reality is that there are yet many stages to go through in order to achieve that goal.

To consider the Open Access publishing model in the context of the Building Sciences information and research it may be worthwhile to examine some of the issues related to Open Access and some of initiatives that have been taken to date. From the perspective as an academic librarian, I include an overview with some highlights on Open Access for discussion as an alternative to traditional publishing.

The general concept of open access is that research content be more widely and readily available using the internet as the medium for delivery. With the objective of free distribution on the internet the content would then be accessible to all. The costs of printing production and distribution of commercially published journals, which have normally been covered by the subscription fees paid by the reader (individuals or institutions), would be eliminated. But in the process of getting this research and scholarly content readily to the reader, there are a number of issues to consider.

Open-access literature is not without cost to produce and maintain as even low expenses must be recovered if open access is to be sustainable. Particularly in academic research, some level of the cost of the publishing is covered by the contributor who pays to submit; often of course, those costs may be covered by research grants or similar sources of funding. These processing fees would continue to be applied to, for example, the costs of peer review, manuscript preparation, and hosting and sustaining on webpages.

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[1] Librarian, Electronic Resources (and Architecture librarian), at Ryerson University Library, Ryerson University, Toronto, Canada.

If the Open Access model, as it is developing, can become viable alternative to the traditional, some of the same issues relating to rigor of academic review and availability to future researchers/readers and the costs associated with that must be covered in some way. A number of initiatives have been taken, especially in the some science and medical fields. Some examples of pioneers in Open Access publishing include BioMed Central, who began electronic delivery of content with submission by contributors for a fee, which may have been waived based on availability to pay. Many variants of open access publishing are now emerging with differing levels of "free" and "open".

Issues that are may be considered then in the viability of this model for research content include:
- Academic promotion and tenure and peer review process;
- Copyright and protection of intellectual property;
- Sources of funding or sponsorship to cover costs to ensure that the content is available into the future (infrastructure costs) and to ensure equal access in low economy regions of the world.

The dialog will continue in order to find innovative ways to achieve this goal of more affordable or open access. Some of the initiatives, as begun by BioMed Central, PubMed Central and continued by others including SPARC (Scholarly Publishing and Academic Resources Coalition), will be valuable to apply to disciplines in addition to the medical and sciences.

Commercial publishers, including Oxford University Press are now experimenting with Open Access journals. Institutions, including universities, are building open access institutional repositories of their researchers' intellectual production. The initiatives can be augmented through cooperative efforts, advocacy and further dialogue and exploration. The application of Open Access publishing to Building Sciences is worthy of further research."

Delegates acknowledged the relevance of Open Access in publishing for the work of W102. It was pointed out that since authors have to pay for publishing in Open Access journals, research proposals should include these costs. Delegates expressed a concern that the Third World countries would not be able to pay publishing costs. Zita Murphy pointed out that biomedical journals do not charge for publishing articles from these countries. Another issue is that if the costs of publishing research articles are covered by research grants, who will pay for publishing information which is not related to research. For instance, IRB's data shows that 15-20% of books sold are based on recent research, the rest is non-research information.

Since W102 is concerned with free circulation of knowledge for small and medium size enterprises (SMEs), who need brief information, it was suggested that intermediary mechanism should exist to search for information in Open Access journals and publish succinct summaries which "translate" academic jargon into easily understandable language. It was pointed out that provision of information for construction industry in Germany through SHADIS, which publishes texts on pathology in construction, is

already affordable for SMEs who pay 3 Euros per article. A similar system exists in Finland. The National Research Council of Canada's Institute for Research in Construction (IRC) is funded primarily by the federal government, with some funds obtained via research contracts with industrial partners. IRC has been transferring information to SMEs in the construction industry since it's inception in 1947. The majority of information provided by IRC is free on the web, including the Construction Technology Updates which are practical 4-6 page publications for architects, engineers, specification writers, property managers, builders and building officials. Also on its website is the IRC publications database, which includes references to all IRC publications (approx. 12,000), 2200 of which are available in fulltext, free of charge.

Despite possible easy and free access to information, building legislation is an obstacle for international distribution. However, it was said that it would be useful to have easy and free access to information to learn more. Delegates indicated that the problems and issues relating to Open Access publishing should be addressed. It was suggested that CIB and ICONDA take lead in this area. Since there is a need for an analysis of status quo in publishing and how information is offered, delegates agreed that they would prepare a joint paper on Open Access in publishing in their countries. The paper will be submitted for the W102 conference on Information and Knowledge Management in a Global Economy, which will take place in Lisbon, Portugal, on 19-20 May 2005. The paper will also be published on W102 website. The paper will be a starting point for collecting and updating information on Open Access in publishing for the construction industry worldwide.

Minutes of the 2003 meeting

Delegates were reminded of the minutes of the W102 meeting in Glasgow, and the minutes were then approved.

Connections with other CIB projects and groups

At the meeting in Belgrade in 2002, a connection between PeBBu and W102 was made and then continued through Colin Davidson's contributions and Branka Dimitrijevic's participation at the PeBBu Domain 9 meeting in Budapest in March 2003, and organisation of PeBBu Domain 9 meeting in Glasgow on 22 June 2003. Domain 9 was subsequently closed, but Colin Davidson and Branka Dimitrijevic are developing a research agenda on information and documentation required for performance based building.

Communication between W102, TG47 and CIB has clarified the remit of W102 and TG47 respectively concerning innovation brokerage and dissemination; while TG47 focuses on innovation brokerage in large organisations, W102 is concerned with dissemination of innovation to SMEs.

Publishing papers presented at W102 meetings from 1999 to date

In order to provide an overview of W102 activities from its first meeting in 1999 to date, it was proposed to publish (electronically) a set of the papers, summaries of discussions and other key documents arising from the meetings held in Montreal in 1999, in Helsinki in 2000, in Melbourne and Auckland in 2001, in Belgrade in 2002, in Glasgow in 2003, and in Toronto in 2004.

Matters arising from previous meetings of W102

At the meeting in Glasgow in 2003, delegates suggested that W102 should provide recommendations, and suggest tools and models for providing information on new technologies to SMEs. They agreed that W102 should prepare a paper on providing information on new technologies to SMEs. Following this decision, Branka Dimitrijevic proposed a questionnaire for collecting data on information providers (IPs) and the paper structure, which were approved by delegates and distributed to W102 members. The paper includes contributions from authors from five countries and it was presented at the meeting in Toronto.

Approaches to providing information to SME's in the construction industry

A joint paper on "Technology Watch for SMEs in the construction industry" provided an insight in approaches to providing information to the construction industry in Canada, Germany, New Zealand, Sweden and United Kingdom. Branka Dimitrijevic[2] presented the paper on behalf of all other authors who were as follows: Colin H. Davidson[3], Mike Culhane[4], Guylaine Beaupré[5], Jaime Acevedo-Alvarez[6], Anthony Conder[7], Bengt Eresund[8], Charles Egbu[9], Esra Kurul[8], Cynthia ChinTian Lee[8], Anthony Olomolaiye[8], Subashini Hari[8], Champika Liyanage[8] and Micah Vines[8].

The paper points out that while large enterprises working in the built environment sector have in-house services to collect the information on existing and new technologies, SMEs do not have the resources to provide themselves with this kind of service. Since in most countries the construction industry includes an overwhelming majority of SMEs, advances in design, procurement and construction cannot be achieved if they are not able to embrace technological innovations and be competent participants in the supply chain. The needs of SMEs for information are being met in different ways across the world. The paper aims to give an overview of the approaches in providing the

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[3] Immediate past coordinator of W102, Université de Montréal, Canada
[4] National Research Council of Canada, Institute for Research in Construction, Ottawa, Ontario, Canada
[5] Centre de recherche industrielle du Québec, Sainte-Foy, Québec, Canada
[6] Fraunhofer Information Centre for Regional Planning and Building IRB, Stuttgart, Germany
[7] BRANZ Limited, Auckland, New Zealand
[8] Former managing director of Byggdok, 1985-1996, member of CIB W57, member of the Board of CIB for six years, Eresund PB AB, Järfälla, Sweden
[9] School of the Built and Natural Environment, Glasgow Caledonian University, Glasgow, United Kingdom

information to the construction industry SMEs in a number of countries. An analysis of the data collected by the members of W102 indicates the range of practices, the gaps in the services and the areas which need further research and development.

A questionnaire was developed to assist the members of W102 in collecting the information from information providers (IPs) to answer a series of questions such as:

- Who are the providers of the information on new technologies to SMEs worldwide (e.g. public or private organizations, professional associations, universities, etc.)?
- How do providers know what information the industry actually requires and what methods do they use to identify the needs of the industry?
- How easy is it to obtain in-depth information about new technologies?
- Is the information packaging adequate and do the providers consider the SMEs' capability to access information?
- Who verifies that the information is correct, i.e. given by an authoritative source?
- How is the question of liability dealt with?
- Is the information freely available? How is the provision of free information subsidized?
- What type of information is not freely available?
- Is any further support available for adopting new technologies?
- Are there any on-going or planned research projects related to the provision of information to SMEs? Who is undertaking these projects and what issues do they address?

Although limited in geographical scope, the survey can be a starting point for mapping out the information providers to the construction industry worldwide and providing an insight in features of their services, especially those facilitating the access to information for SMEs. The list of IPs whose services are analyzed is given in Table 1.

Table 1. Information providers

Country	Information provider	Acronym
Canada	National Research Council Canada, Institute for Research in Construction	IRC
	Centre de recherché industrielle du Québec	CRIQ
Germany	Fraunhofer IRB	FIRB
New Zealand	Building Research Association of New Zealand	BRANZ
Sweden	The Swedish Institute of Building Documentation	BYGGDOK
United Kingdom	Construction Best Practice Programme	CBPP
	Information Technology Construction Best Practice	ITCBP
	Construction Industry Research and Information Association	CIRIA
	Building Services Research and Information Association	BSRIA

Construction Industry Trading Electronically	CITE
Small Business Gateway / DTI	SBG-DTI
Royal Institute of British Architects	RIBA
Royal Institution of Chartered Surveyors	RICS
Royal Incorporation of Architects in Scotland	RIAS
Institution of Civil Engineers	ICE
Chartered Institute of Building	CIOB
Confederation of British Industry	CIB
Centre for Innovative Construction Engineering, Loughborough University	CICE
Construct IT, University of Salford	CIT
Centre for the Built Environment, University of Strathclyde and Glasgow Caledonian University	CBE
Concrete Information Limited CIL	CIL
Corus Construction Centre	CCC
Building Research Establishment BRE	BRE

The paper described various methods for providing information such as websites, e-mail, CDs/DVDs, telephone, brochures, best practice guides, newsletters, journals, seminars, workshops, conferences, exhibitions, bespoke advice and other services. Costs and take up by the industry have been indicated by most IPs.

IPs predict that there will be further expansion of electronic services, but the more traditional methods for providing information will be used as well. Distance learning is also being considered using secure web site and secure web membership (BRANZ). Some IPs predict that all information will be provided only electronically (ICE, CITE).

IPs have stated that they plan to or had undertaken research to improve their services, as follows:
- BRANZ indicate the need to match delivery to sector as one area where research would be useful, but this has not yet occurred.
- BYGGDOK undertakes research in development of online Internet services: e-Bookstore at Byggtorget, distribution of digital documents of all kinds, including films, movies, direct automatic link to experts live etc.
- ICE's Engineering & Knowledge Department focuses on research which ensures that appropriate and timely information is available for electronic accessibility. The most important areas are the capture, retention and dissemination of information via the Internet.
- CIOB contribute to steering groups, help with identification and provision of relevant information and contacts, and assist in the dissemination of research findings. Increasing attention is, however, being given to the opportunities for CIOB to take the lead in projects, enabling it to develop its role as an intermediary within the construction industry.
- Contractors of CBPP undertake research on how people have changed their businesses and the benefits that it brings.

- Davis Langdon Consultancy undertake research on behalf of ITCBP on various topics related to the use of IT in the construction industry.
- BISRA & Builders merchant undertake research on online information on building regulations.
- CICE undertakes research on Sustainable Construction; Geographic Information System for Employment Training and Forecasting; Improving the Efficiency and effectiveness of the integration of design and construction, etc.
- Construct IT focus their research on 3D to nD Modelling; Diversity, etc.
- CBE undertakes on-going survey on CPD and lifelong learning needs of SMEs operating in the construction industry in the West of Scotland.
- CRIQ conducts information-related research projects concerning the development of tools to improve decision-making in organizations.
- Industry Liaison and Outreach undertake research on behalf of IRC to determine what information the industry wants, how they want it, and how best it can be delivered. Industry Liaison and Outreach (comprising the Publications, Library/Internet Services, Client Services, and External Communications functions) is specifically tasked with transferring IRC technology and information to industry, using tools such as publications and the Internet.

IPs ensure that professionals who produce and distribute information check its accuracy. Regarding the liability, BYGGDOK uses ordinary company insurance cover against any liability claims. Other IPs provide standard disclaimers.

Conclusions pointed out that each of the five countries participating in the survey on IPs has at least one large IP which provides information related to the construction sector as a whole and uses various methods to fulfill this task. Professional organizations and associations act as IPs and also use a variety of methods, but they mainly focus on the needs of their members. University knowledge brokers focus on one theme of interest to the industry and use only a few methods for providing information, mainly IT. However, one university knowledge broker provides information and knowledge transfer of all the expertise available at the participating universities and uses a range of methods for providing information.

Development of centralized or decentralized structure of IPs is related to several factors such as
- availability of public funding and relevant national policies
- size and economic power of the industry to support private funding of IPs
- research capacity
- level of IT development.

Needs of more developed and diversified construction industry are met by decentralized structure of IPs.

How much of the information available is accessible to SMEs? Although some information is free, it is often available only if SMEs use IT. The fees and subscriptions for obtaining information are a limiting factor for SMEs' access to information. However, the advantages gained by paying high fees for obtaining information cannot be

maintained if the knowledge acquired is not transferred down the supply chain to the enterprises who cannot afford high fees.

The paper will be published on the W102 website and it will be open for updating with data collected by members of W102 in other countries. Coordinator of W102 will send a questionnaire to members of W102 who have not yet contributed to this survey in order to collect more information on IPs worldwide.

Using information for effective project management

Marja Naaranoja[10] presented a paper "The construction team and the challenge of knowledge management" on behalf of the research team which included Heikki Lonka[11] and Päivi Haapalainen[12]. The paper is based on the findings of the PROLAB-project which seeks to find solutions for how the information can effectively be used in project management, specially in construction projects; what kind of procedures help the management of the knowledge and how the obstacles for efficient ways of administrating the information can be removed. These obstacles can be either related to use of new technology or to organization culture. The aim of the research is to show how communication between different parties should be arranged so that the relevant information is passed from one to another and also understood in the right way.
Even a very simple building project contains an enormous amount of information. One reason for failures of projects is certainly the problems with knowledge management. One solution to this could be information systems. However, information systems are not developed enough to be able to understand the information they deal with or create new understanding based on the old one[13]. It is possible that they never will be able to do this. Thus information system can be a helping tool or medium, thinking must be done by humans. Even the project utilizing the most sophisticated information systems have succeeded or failed based on human actions.

Research team have interviewed over 45 construction project participants in Finland. The aim is to find out the key knowledge management challenges and also the information brokers in the project. The themes were: what kind of stages are there in the projects and who has major role in each stage; what kind of successes and failures have they experienced; what kind of media was used in knowledge sharing and the experiences of using the media.

The issues of trust, cultural differences and decision-making are the most important ones based on the interviews in the companies.

The following list explains how the issue of trust can be considered in construction projects:

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[10] University of Vaasa, Finland
[11] Vaasa town, Finland
[12] University of Vaasa, Finland
[13] Naaranoja Marja (2001), Capabilities of Utilisation of Information Systems in Facilities Management. Publications 2001/ 336. Tampere, University of Technology.

- The project manager needs to be aware of the importance of trust. The project team has to build up trust and manage the human issues.
- Especially the end user participation needs to be planned in order to make it clear what is their responsibility and their effect on the decisions
- Open discussions should be encouraged and planned how to gather the knowledge from every party without making them countable of possible mistakes.
- The computer tools have to be built in such a way that one can trust in it and even that the user of the system is allowed to make mistakes and correct his failures without them remaining their as fault that everybody can see.

Some ideas how the issue of culture and language can be considered in construction projects:

- In the beginning of the project the project team should learn to know each other and learn how the others talk. This needs time but the time will be saved during the process as the misunderstanding does not happen and the project group can understand each other.
- One should also aim at creating a shared vision in the beginning about what is the project all about and then take care that the new participants of the project are able to share the same vision.
- There should be a system that helps the newcomer to get information of the culture of the project and people as well: For example a short video where the most important moments of the project can be observed. In that way the new site manager would become familiar to the project and learn about the culture of it.

Some ideas how the issue of trust can be considered in construction projects:

- Decision-making should be made visible. Who makes the decisions – now officially the client makes the decision but in practice client cannot make all the decisions he/she should make.
- Decisions should be made possible to be tracked somehow - what kind of other possibilities had been studied (Now the computer systems can help to organize the information and the files)
- IT tools may help to handle the changes of decisions and also forces the decisions to be made earlier like in simulations or as in 4D when the manufacturing decisions are made during the design stage.

The study described that the main knowledge management challenges concern trust, cultural differences and decision-making. The study also shows that there are different means to manage the knowledge better and we can work to minimize the obstacles. The following list describes how we can improve the knowledge management: the decision making needs to be improved by making it visible who makes the decisions; the communication may be improved by familiarizing the project members with each other; the project manager needs to be aware of the importance of trust and consciously improve the trust between the parties; and there is need to improve the shared understanding of the goal of the project.

Improving information flow by using web services technology

Francisco Loforte Ribiero's[14] paper "Sharing Information Using Web Services Technology in the Construction Organisation" argues that Web services technology is an effective means for capturing and sharing information over the organisation network. Through Web services construction companies can encapsulate existing business processes, publish them as services, search for and subscribe to other services, and exchange information throughout and beyond the enterprise. Construction is a fragmented industry with partners using different systems and platforms for delivering and sharing information. The point is that Web services are very good at solving the interoperability problem across disparate pieces of software. Web services now offer a strong foundation for software interoperability through the core of open standards of XML, SOAP, WSDL, and UDDI[15].

The construction industry has many more buying and selling organizations than other industries such as motor or pharmaceutical industries, where few companies dominate the market. Due to the wide spread of site locations, the industry is geographical dispersed. Therefore, a construction supply chain typically spans over multiple partners such as the client, contractors, house builders, designers, consultants, suppliers, installers and users. In order to optimize the entire supply chain system cross-enterprise coordination and special business relationship must be established among the organizations along the construction supply chain. As part of engineering the business, organization planners capture business processes in models and implement them as enterprise applications.

Traditionally, application or data integration required the use of Enterprise Application integration (EAI) products or Application Servers. The promises offered by moving to XML and Web Services for this class of project include greatly reduced development and deployment costs, as well as an ability to respond much more quickly to changing business requirements. The size and scale of these benefits are dramatic, with customers reporting savings of between 25% and 75% on development times as well as significant reductions of deployment and on-going maintenance costs. Using XML as a common data format across all systems, construction companies can significantly reduce the costs, complexity, project risk and development timescales associated with integration projects. XML and Web Services can provide immediate cost and time benefits when deployed *within* the enterprise to integrate systems and business processes.

One of the main characteristics of Web services is communication over unreliable communication channels such as the Internet employing unreliable (considered unreliable, as they do not offer the reliable messaging services such as guaranteed delivery) data transfer protocols such as HTTP, SMTP and FTP. But, unless the

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[14] Instituto Superior Técnic, Lisboa, Portugal

[15] XML structures the message, SOAP transfers the message, WSDL describes the available services, and UDDI lists them.

message exchanges of Web services are made reliable, organizations will not be able to trust them for deployment in industrial-strength business applications and for mission-critical operations such as complex business-to-business transactions or real-time enterprise integrations. Accordingly reliable messaging becomes one of the first problems that need to be addressed for Web services to become truly enterprise-capable technologies. One of the first to recognize and devise a solution to this problem that is truly transport-independent was RosettaNet via the RosettaNet Implementation Framework. The RosettaNet PIP model is primarily based on an asynchronous message exchange mechanism, where reliable messaging is accomplished by means of separate acknowledgment message exchanges sent by the receiver.

Two case studies describe the Web services activities within the Portuguese construction industry. The first example is the use of E-constroi system. A group of 24 companies, of which 21 were construction companies and three were information technology companies, used Web services technology to develop an e-procurement infrastructure. E-constroi provides an infrastructure for sharing information among contractors, house builders, suppliers and installers. It is a Web-based service, which enables supply chain partners to communicate, negotiate and take part in trading, irrespective of their geographical position. The technology used by E-constroi is based on the Commerce One platform that enables enterprises to communicate and collaborate with each other, irrespective of the system they use, the language they speak, or currency they trade with, via HTTP protocol using XML messages and XML Common Business Library. Four distinct business activities were identified under E-constroi: sharing and management of information (such as bill of quantities, specifications, designs, scheduling documents, tender documents) over the platform; cataloguing; procurement of manpower, construction materials, plant and services; and electronic commerce.

Interviews with the construction organizations involved with the E-constroi, revealed that there was a gap between the benefits achieved and those advocated by the software vendor, particularly in terms of standardization, technical and semantic interoperability, and technical portability of applications. The business benefits that were identified included: ease access to online business opportunities; faster time to market products and services; ease access to business information (tender information, product information, work in progress). Likewise, the technical benefits that were identified included: reduced paper work per transaction; and less internal human resources required. High capital and maintenance costs of the technology used by E-constroi are considered to be a dis-benefit of the system, particularly for SMEs. For example, the subscription for fee for a consumer is 2,500 Euros, and cataloguing costs are 1,000 Euros. Despite these initial high costs, the E-constroi expects to increase its share in construction materials procurement market to 65% over the next years.

The second case study is related to the use of CidadeBCP system in the Real State sector. Individuals seeking information about the purchase of real estate (e.g., obtaining quotation for a home or information about what is available to purchase from the property market or applying for a mortgage) can go on-line by using the Web Services

provided by CidadeBCP. The Web Services provided by CidadeBCP include: access to the on-line property market; dynamic application process for the pre-approval of a loan; listing of Real State Agents; dynamic listing of contractors to provide appraisals, inspections, repairs, and other services.

Interviews with organization involved with CidadeBCP identified several benefits and limitations. Benefits included: faster access to real state services; online access to real state agents; online access to property markets; online selection of the best financial conditions; shorter time for mortgage credit application processing. CidadeBCP does not allow the interaction between the different parts involved in a single real state transaction, such as the buyer, seller, their agents, their mortgage companies, and other various parties such as home inspectors, property appraiser, notaries, etc.

Conclusions point out that the standards and protocols for Web services are still evolving and that construction organisations should see this as an opportunity to develop an expertise and therefore gain an early competitive advantage.

Improving the efficiency of small and medium sized contractors (SMCs) through an information Web portal

Thomas Ng[16] presented the paper "Needs of SMCs in Hong Kong: Information Management and IT" on behalf of the research team whose members were M. Motiar Rahman[15], Mohan M. Kumaraswamy[15], Elaine Lam[15], Eric Ho[15], Selina Lee[15], Ekambaram Palaneeswaran[15] and Onuegbu O. Ugwu[15]. It first briefly discusses information management (IM) and information flow from the perspectives of SMCs in Hong Kong. It then reports on the first stage of a recently launched project that has been formulated to build an effective IM system for SMCs using available IT. Although improved Knowledge Management (KM) is also very important in this project, KM is not specifically discussed in this paper, since it will be dealt with later in the programme.

Project success has been suggested to be measured through some project based Critical Success Factors (CSFs). These project-based CSFs include: adequate communication, communication system, control mechanisms, feedback capabilities of both contractors and subcontractors, effective coordination, effective decision making, monitoring, safety and quality assurance program, site management, supervision, and speed of information flow[17]. These are clearly related to Information Management (IM) and Information Technologies (IT), and their effective use.

Any industry improvement initiative needs collective learning and knowledge transmission/ sharing - to the extent that an organization requires it. This is fostered by cultural, institutional and geographical proximities, often in combination. From the perspectives of SMCs, the areas where effective IM aiming at faster and smoother decision-making can be applied with the help of the Internet and other IT (tools) include:

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[16] University of Hong Kong, China

[17] Chan, A.P.C., Scott, D. and Chan, A.P.L. 2004. Factors affecting the success of a construction project. *ASCE J. Construction Engineering and Management*, Vol. 130, No. 1, pp. 153-155.

- Data and information required by construction site staff from head office: foremen/ supervisors, gang leaders, individual trades people (e.g. plasterers) – in smaller projects without any site office
- Data and information required by construction site staff from site office: foremen/ supervisors, gang leaders, individual trades people (e.g. scaffolders)
- Data and information required by site office from various sources: foremen/ supervisors/ gang leaders working at site, individual trades people working at site (e.g. plasterers), head office, client/ owner/ developer, consultant, subcontractor(s) and supplier(s), other suppliers(s) working on the same project/ site (if any)
- Data and information required by head office from various sources: (1) in smaller projects without any site office – (a) foremen/ supervisors working at construction sites, and (b) individual trades people working at sites (e.g. plasterers and scaffolders); (2) different site offices; (3) clients/ owners/ developers, consultants, main contractors (if any), subcontractor(s) and supplier(s); (4) other subcontractor(s) working on common projects/ sites (if any), other suppliers(s) working on common projects/ sites (if any); and (5) other external organizations, e.g. Labour Department, etc.

In order to meet specific needs of SMCs in Hong Kong and to improve their competitiveness, a research and development (R&D) project was launched in November 2003 at The University of Hong Kong. The project is captioned: 'Strategic Management with Information Leveraged Excellence' for Small and Medium Contractors (SMILE-SMC). The main objective of this project is to provide affordable integrated solutions to the SMCs, aiming at empowering their continuous improvement by providing a user-friendly framework and various generic modules (e.g. for performance evaluation, benchmarking and improvement) to assist in continuous improvement through strategic IM and KM, using available IT tools and through a 'single point' information source/ interface.

The above requires the collection of much diversified information, e.g. multi-project, multi-organisational, and organisation-specific data from SMCs – with sources varying from their day-to-day business activities to strategic decision-making. Therefore, close collaboration and active participation from a motivated set of 'pioneering' SMCs or 'Partner Contractors' (PCs) was felt essential. Consequently 15 (so that around 10 may be available at any given time) such PCs were enlisted with the help of different 'Contractors Associations' and personal contacts. The information collected from the interviews and constructive suggestions at the monthly meetings resulted in identifying some 'needs' areas, where the researchers can concentrate to develop SMILE solutions and assist SMCs for improving their 'processes', and thereby competitiveness.

Potential business/ work processes for improvements include general team interactions, company specific/ business related issues, selection, co-ordination and training, and site inspection/ supervision and monitoring. The PCs also expressed their interest to know, discuss and share their concerns on a common platform. These issues vary from general project management to political issues that affect the construction industry. The

highest concern appeared to centre on supply chain management. It was also revealed that PCs predominantly use, as well as prefer, traditional and already practiced methods for communicating and transferring their information, although the usage of various methods differs considerably among individuals. The most common method of communication is telephone and pager services, since one can directly contact and pass the information to the appropriate person without wasting any time. Some PCs preferred face-to-face discussions for the issues requiring more explanations. They use faxes for transmitting the information that does not require any explanation or immediate feedback. However, PCs preferred to increasingly use email, PDA and Internet based services for communicating from office to work site and vice versa.

Based on the information collected from the 'Pilot Needs Analysis' from 14 PCs, their feedback, further suggestions and discussions in the monthly meetings, the business goals and implementation strategies of SMCs in Hong Kong was conceptualised. This mainly targets cost minimisation and revenue maximization. Following the initial appraisal, it has been proposed that the SMILE-SMC services will be provided in five broad areas: inter-organisational information exchange, inter-organisational discussion forum, intra-organisational information and knowledge flow platform, performance improvement module(s) and a benchmarking club.

SMILE members will be able to seek business opportunities, search for business partners (i.e. subcontractors, suppliers, main contractors), discuss various concerns, exchange information, and organize and manage their most frequently used information flows. They will also be able to use some specific modules and formats in improving their performances and competitiveness, and benchmark among each other. Specific attention will be given to compatibilities while developing the SMILE website, so that SMCs can use commonly available software with add-ins/ plug-ins for utilizing the services. Dissemination of the SMILE project will include periodical newsletters and e-bulletins, seminars and workshops. A 'train-the-trainer' policy will be adopted to familiarize end users with SMILE services, beginning with the PCs. Self-learning packages will also be developed for further dissemination. These services will be made available to the SMCs freely at the beginning, while a nominal subscription fee will be received from the members for the maintenance of both the system and the services after the development period.

Action points

The meeting was concluded by reiterating future tasks of W102 as follows:

- Cataloguing providers of technology watch for SMEs in the construction industry will continue

- A joint paper on open access in publishing for the construction industry will be submitted for the W102 conference in Lisbon, Portugal, in May 2005

- Publishing information on W102 since 1999 to date on W102 website

- Establishing closer links with W92 and other CIB commissions and task groups.

Future meetings

Next meeting of W102 will be held at Instituto Superior Tecnico, Lisbon, Portugal, during the CIB W102 conference Information and Knowledge Management in a Global Economy on 19-20 May 2005. Francisco Loforte Ribeiro, member of W102, will host this meeting. In 2006, W102 will meet in Stuttgart, Germany, following the invitation by Jaime Acevedo-Alvarez and Thomas H. Morszeck of Fraunhofer-Informationszentrum Raum und Bau IRB. Since the next CIB World Congress will take place in South Africa in 2007, W102 will be organized at the same time.

Closing the meeting

Delegates thanked Constantine J. Katsanis and his colleagues at the Ryerson University for a very successful organization of the W102 meeting.