COMMUNICATION GROWTH AND RESEARCH NEEDS IN THE FUTURE OF CONSTRUCTION ENGINEERING AND MANAGEMENT

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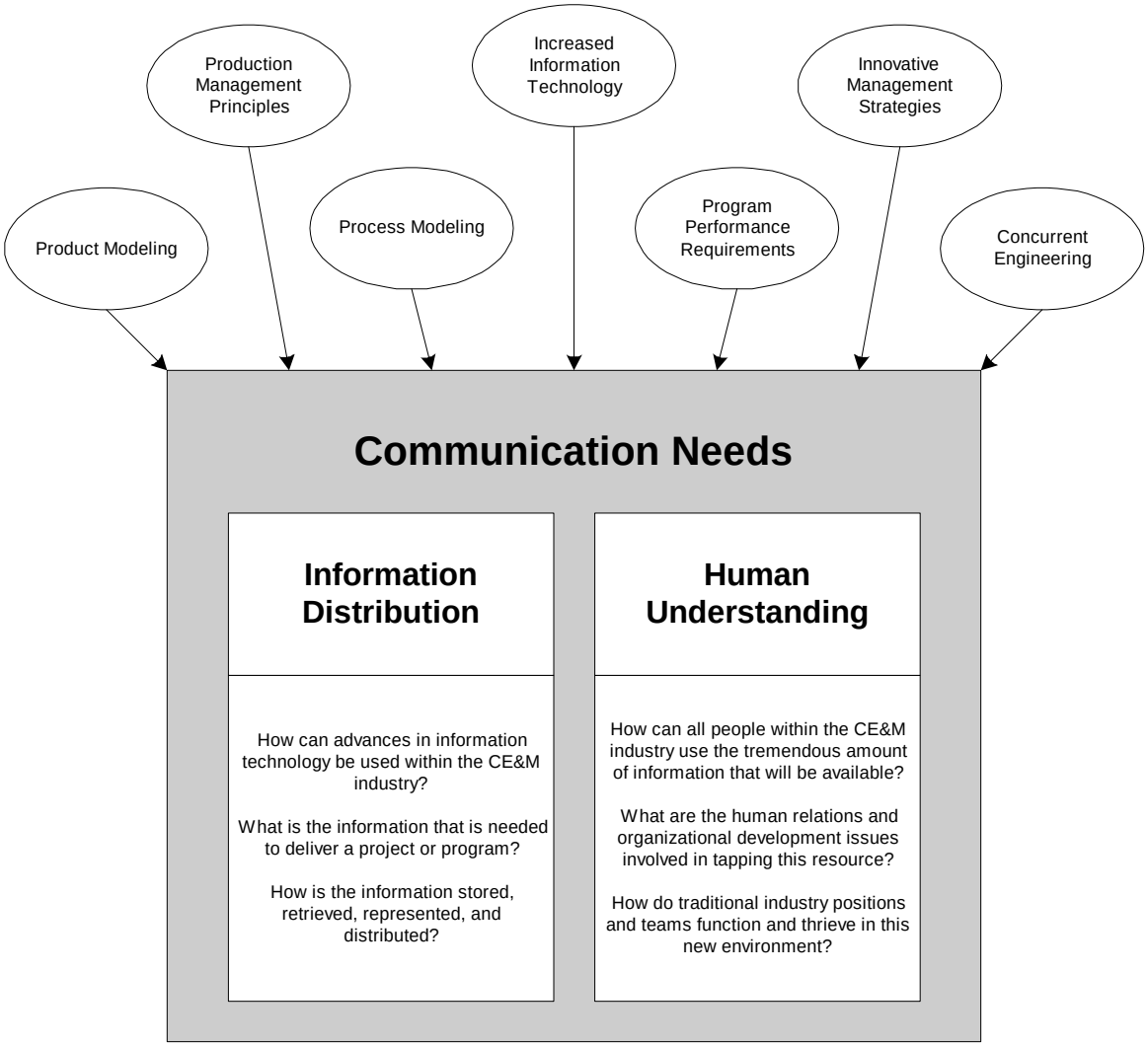
Previously unimaginable increases in information technology and innovative new production techniques present the construction industry with tremendous potential to improve the program and project delivery process. Fundamental to these changes, however, is the need for improved communication (Gushgari et al 1997, Kartam 1997, Liu, et al 1994, Luiten and Tolman 1997, and Thomas et al 1998). As shown in the figure below, this new communication need can be divided into two broad types – information distribution and human understanding. Each element must be considered in future research efforts in order to recognize significant improvements within the industry. Without adequate means to communicate/distribute information it is little value to anyone other than a single person or group. Without a human and organizational framework in which to use the information, it is of no value to anyone.



Vision for the Future

Information and communication are an integral part of any construction effort. The figure below introduces the current practice, current state of the art, and future vision standards for communication on a construction project or program.

Timeframe	Communications Charaterizations
Current Industry Practice	Traditional design-bid-build procurement Information manually managed (within a computer) Limited communication Limited integration Sharp divisions between project participants
Current State of the Art	Alternative project delivery systems Alternative production models Integrated cost and schedule control 4D modeling and constructability Fuzzy divisions between project participants
Future Vision	Integrated development of design by all project parties Immediate access to all project information by all parties in all phases Virtual smart models guide design and construction processes No division between project particpants Shift from project to program emphasis

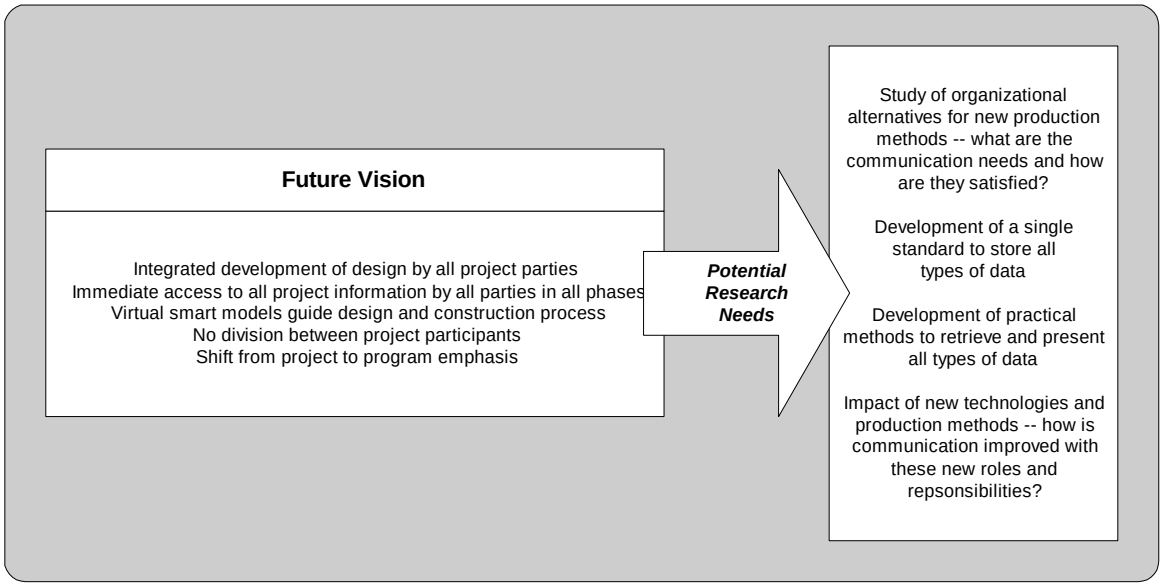
Currently, communication on most projects is person to person either face to face or by telephone. Larger projects and more sophisticated parties do make use of email; however, many small contractors still do not even use a computer in construction management functions (Shash and Al-Amir 1997). Current industry practice does not facilitate sharing of information. Project parties often work in adversarial relationships. Each project is considered a unique with little knowledge communicated from project to project (Kartam 1996).

Engineering News Record presents a good summary of the current communication state and mentions some techniques described above as state of the art ("Connection …" 1999). The current state of the art projects also makes use of alternative delivery systems (design build, multi-prime / trade contracting) and may use alternate production models (lean production, concurrent engineering). Konchar et al documented the importance of communication on the current state of the art delivery systems (1998). These projects often have sophisticated control and planning systems that produce large quantities of valuable information available in a large number of formats disseminated in through variety of mediums. What is lacking is a common methodology to capture and communicate all of this information for all forms of projects (Kang and Paulson 1997). Some research has begun to identify standards (CSI 1988, IAI 1996, ISO/TC184 1993, Tri-service A/E/C CADD Standards 1996), but human communication needs are often ignored in such technical methodologies.

In state of the art applications, information is often shared through web base systems (Blueline-Online, Calypso Technologies PRONTO system – Project Resource Observation and Team Organizer, and many other) (Seesing 1996). Common to these more state of the art projects is a team atmosphere where traditional adversarial relationships become positive and the project becomes mutually beneficial to all parties. Lessons learned from one project are shared within a program and utilized in future maintenance operations. The benefits of the current state of the art come with the requirement for a higher plateau of communication. The reason such systems do fail is because of communication problems at either of the two levels previously introduced. Often times relevant information may not be available when needed

leading to a constant re-inventing of the wheel (Veshosky 1998). Even if information is available and distributed, the meaning of the message may not be correctly interpreted or understood (Pietroforte 1997).

The future for the construction engineering and management industry holds the promise of integrated development of design by all project parties, immediate access to all project information by all parties in all phases, virtual smart models guide design and construction process, no division between project participants, and an emphasis on the program rather than the project. This effort however has a tremendous communication requirement as shown below as potential research needs.



Unless these and other research needs with respect to communication are identified and addressed, the information technology tools and the product and process development tools being developed today will be of significantly less value. Communication is fundamental to our industry – it must not be neglected in our future.

Background and Motivation

I am a Research Assistant Professor in the Department of Civil Engineering at the University of Southern California, and I am also a Project Director for Vanir Construction Management (top 40 ENR CM firm), 3435 Wilshire Boulevard, Suite 2050, Los Angeles, California 90010-2006; (213) 485-2443; fax (213) 847-9680, kuprenas@mizar.usc.edu.

I appreciate the opportunity to present my vision for the future of our industry. My research at USC has been diverse with an emphasis on solutions to field and management problems and a strategic view of projects and problems. In my 15 years of industry experience ranging from field engineer responsible for a single $300,000 project to project director responsible for multiple projects worth hundreds of millions of dollars, I have seen that the vast majority of problems in construction engineering and management result from communication difficulties. As technology increases, information in our industry becomes more fluid – easier to produce and distribute, but much harder to comprehend. Although my firm does have one project successfully testing a web based management system; this fluidity of information comes with the price of excluding many “unsophisticated” project parties. One can argue that profit and competition will force the industry to use these powerful information tools, but I am certain that many organizations will still fail to recognize the tremendous potential of our new tools and process because of communication difficulties stemming from information distribution and human understanding. My vision outlined above sees an increase emphasis on communication at all levels and for all parties in the industry. The time is now to begin the research into these satisfying these communication needs.

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